Urban and Small Farms Conference Program

Wednesday, February 17, 2016

7:30 AM	**REGISTRATION OPEN**	
	Utah Berry Growers Sessions *Moderated by: Brent Black /Lori Spears*	**Beginning Farmer - Alternatives I** *Moderated by: Donna Minch/Dave Francis*
8:00 AM	**Welcome and Introductions -** Brent Black, USU **Bramble Nutrition: Rates, Timing, Product, & Placement** Teryl Roper, USU **pg. 1**	**Welcome and Introductions** **Small Flock Chickens** David Frame, USU **pg. 20**
9:00 AM	**Weed Controp in Berry Crops** Ed Peachey, Oregon State University **pg. 14**	**Farms are More than Food: The $Value$ in Selling Farm Experiences** Luke Petersen, Petersen Family Farms **pg. 24**
10:00 AM	**BREAK**	
10:30 AM	**Cane Fruit Disease Survey Results** Claudia Nischwitz, USU **pg. 17**	**Aquaponics in Practice** Terry and Sandy Stapley, Deseret Peak Aquaponics **pg. 25**
11:00 AM	**Berry Eating Insects & Invasive Pest Update** Diane Alston, USU pg. 19	**Aquaponic Laws and Fish Options** Anna Forest, Utah Dept. of Ag Krissy Wilson, Utah Division of Wildlife **pg. 26**
Noon	**LUNCH BREAK**	

Session Target

Beginning Farmer
General for all audiences
Experienced Producers
Limited English Refugee Farmers

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Noon	**LUNCH BREAK**		
	Vegetables *Moderated by: Dan Drost/Britney Hunter*	**Beginning Farmer - Basics** *Moderated by: Matt Palmer/Ron Patterson*	**Basics Sessions targeted to IRC** *Moderated by: Grace Henley*
1:00 PM	**Using Local Biochar for Vegetables** Britney Hunter, USU **pg. 31**	**Evaluating a New Farm Business Opportunity** Brent Black, USU Ruby Ward, USU **pg. 64**	**Welcome and Introductions** Grace Henley
	Vegetable Weed Mgmt (Cucurbits and Solanum Crops) Ed Peachey, Oregon State University **pg. 37**		**USDA-NRCS program basics** Danny McBride, NRCS **pg. 105** **FSA Program basics** Roberta Wheeler, FSA **pg. 116**
2:30 PM	**BREAK**		
3:00 PM	**Farm Transitions** Kelby and Braydon Johnson, Johnson Farms **pg. 42**	**Soil Health & NRCS Cover Crop Programs** Danny Mcbride, NRCS **pg. 76** **Soil Health/Cover Crop Philosophy** Ron Patterson, USU **pg. 87** **Cover Crops in Practice** Dennis Worwood, USU **pg. 92**	**Realities of Small Farms** Luke Peterson, Petersen Family Farms **pg. 120**
	Vegetable Diseases Survey Claudia Nischwitz, USU **pg. 51**		
4:00 PM	**Pumpkins and Tomato Variety Evaluations** Taun Beddes and Mike Caron, USU **pg. 57**	**Protecting your Vegetable Crops from their Wild Relatives: Diversifying selection Pressures and Preventing Weed Shifts** Ed Peachey, Oregon State University **pg. 101**	**Soil Fertility** Katie Wagner, USU **pg. 121**
	Vegetable Mgmt. Guide Updates and Survey Dan Drost, USU **pg. 62**		

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Bramble Nutrition: Rates, Timing, Product, and Placement

Biographical Information:

Teryl R. Roper
Utah State University
Department of Plants, Soils, And Climate

Dr. Roper teaches the fruit production course at USU. He was Extension Fruit Crops Specialist at the University of Wisconsin-Madison for 20 years. He earned BS and MS degrees in Botany from Brigham Young University and a PhD in Horticulture from Washington State University. Teryl's academic career focused on the production of fruits in the upper Midwest, including cranberries, apples, and tart cherries. Much of his research included mineral nutrition of perennial fruit crops.

Session Description:

Mineral nutrition of perennial crops is significantly different than for annual crops. The objective is to ensure that the plant has sufficient mineral nutrients at all times. Growers need to know the correct rates, timing, products, and placement for fertilizer application. Elements of data driven decision making with regards to fertilizing brambles will be presented.

Bramble Nutrition: Rates, timing, product, and placement

Dr. Teryl R. Roper

Department of Plants, Soils, and Climate

Utah State University

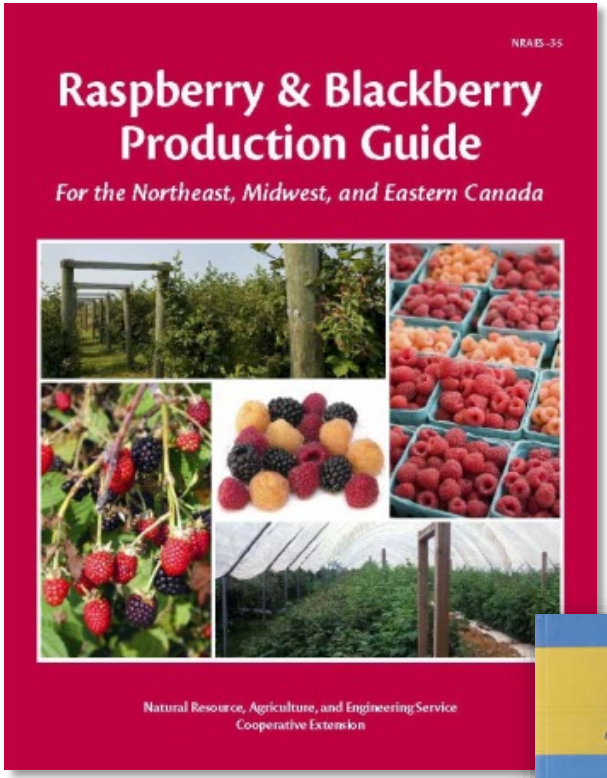
UtahState University

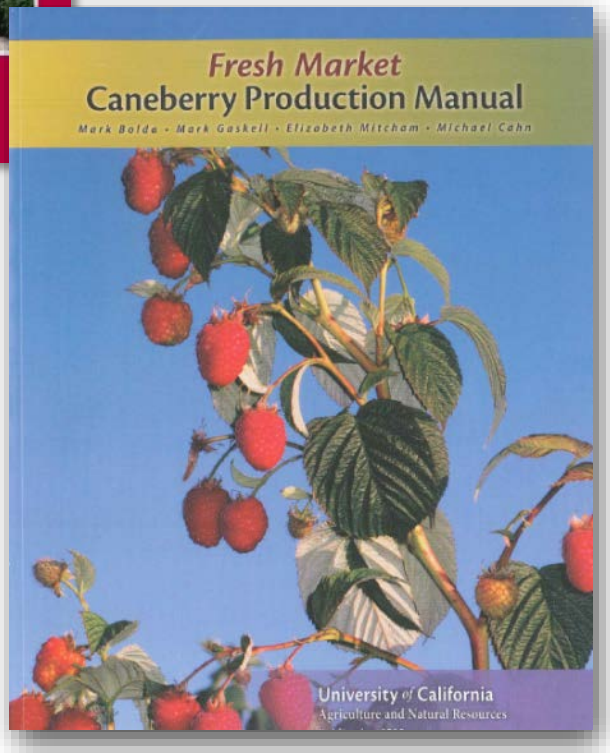
DEPARTMENT OF PLANTS, SOILS, & CLIMATE

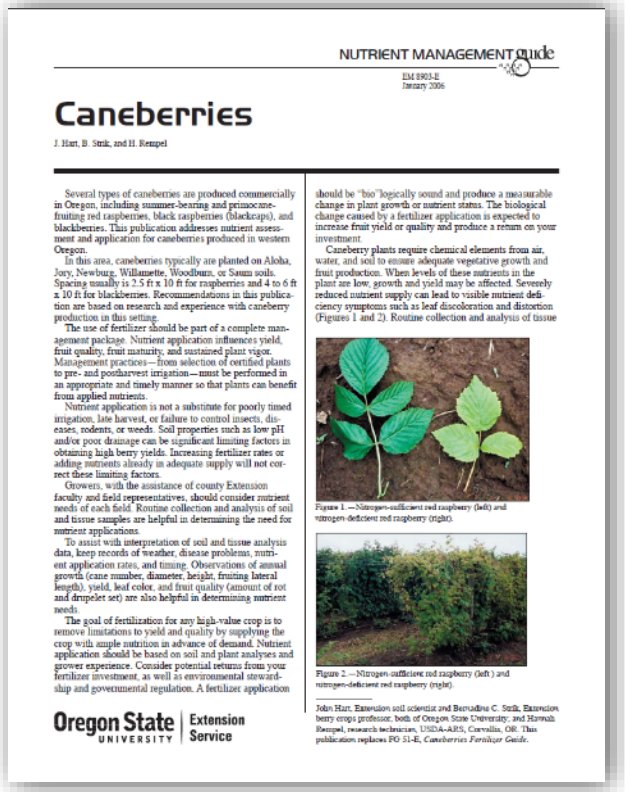
Acknowledgement:

- Bernadine Strik, Oregon State University

Nutrient management guides available







NUTRIENT MANAGEMENT Guide

EM 8903-E
January 2006

Caneberries

J. Hart, B. Strik, and H. Rempel

Several types of caneberries are produced commercially in Oregon, including summer-bearing and primocane-fruiting red raspberries, black raspberries (blackcaps), and blackberries. This publication addresses nutrient assessment and application for caneberries produced in western Oregon.

In this area, caneberries typically are planted on Aloha, Joey, Newburg, Willamette, Woodburn, or Sauvie soils. Spacing usually is 2.5 ft x 10 ft for raspberries and 4 to 6 ft x 10 ft for blackberries. Recommendations in this publication are based on research and experience with caneberry production in this setting.

The use of fertilizer should be part of a complete management package. Nutrient application influences yield, fruit quality, fruit maturity, and sustained plant vigor. Management practices—from selection of certified plants to pre- and postharvest irrigation—must be performed in an appropriate and timely manner so that plants can benefit from applied nutrients.

Nutrient application is not a substitute for poorly timed irrigation, late harvest, or failure to control insects, diseases, rodents, or weeds. Soil properties such as low pH and/or poor drainage can be significant limiting factors in obtaining high berry yields. Increasing fertilizer rates or adding nutrients already in adequate supply will not correct these limiting factors.

Growers, with the assistance of county Extension faculty and field representatives, should consider nutrient needs of each field. Routine collection and analysis of soil and tissue samples are helpful in determining the need for nutrient applications.

To assist with interpretation of soil and tissue analysis data, keep records of weather, disease problems, nutrient application rates, and timing. Observations of annual growth (cane number, diameter, height, fruiting lateral length), yield, leaf color, and fruit quality (amount of rot and drupelet set) are also helpful in determining nutrient needs.

The goal of fertilization for any high-value crop is to remove limitations to yield and quality by supplying the crop with ample nutrition in advance of demand. Nutrient application should be based on soil and plant analyses and grower experience. Consider potential returns from your fertilizer investment, as well as environmental stewardship and governmental regulation. A fertilizer application should be "bio"logically sound and produce a measurable change in plant growth or nutrient status. The biological change caused by a fertilizer application is expected to increase fruit yield or quality and produce a return on your investment.

Caneberry plants require chemical elements from air, water, and soil to ensure adequate vegetative growth and fruit production. When levels of these nutrients in the plant are low, growth and yield may be affected. Severely reduced nutrient supply can lead to visible nutrient deficiency symptoms such as leaf discoloration and distortion (Figures 1 and 2). Routine collection and analysis of tissue

Figure 1.—Nitrogen-sufficient red raspberry (left) and nitrogen-deficient red raspberry (right).

Figure 2.—Nitrogen-sufficient red raspberry (left) and nitrogen-deficient red raspberry (right).

Oregon State University | Extension Service

John Hart, Extension soil scientist and Bernadine C. Strik, Extension berry crops professor, both of Oregon State University, and Hannah Rempel, research technician, USDA-ARS, Corvallis, OR. This publication replaces FG 51-E, *Caneberries Fertilizer Guide*.

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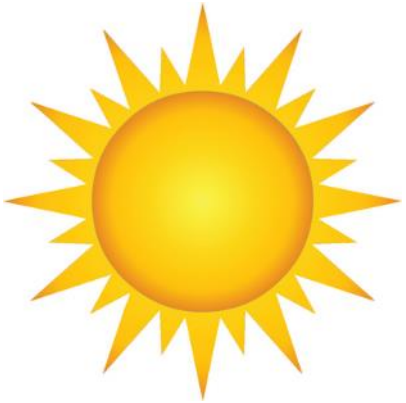
Physiological Context

- Yield in perennial fruit species is highly related to light interception per acre
- Yield in perennial fruit species is **not** highly related to fertilizer application per acre.

Yield components

- Fruits per lateral
- Fruiting laterals per cane
- Canes per row distance
- Row spacing

Cane diameter



"Practically everything we see about us involved photosynthesis at some stage or other. The gardener often talks about 'feeding' plants when he applies fertilizers and the notion that plants derive their nourishment from the soil is one that is commonly held. They do not. Plants take up minerals from the soil, they derive their nourishment from the air."

Edwards and Walker, 1983

Agenda

- Introduction
- Pre-plant preparation
- Soil sampling
- Tissue sampling
- Application
  - Rate
  - Source
  - Timing
  - Method of application

Introduction

- Fertilize for sustainable growth and production
- Fertilizer won't compensate for other management problems
- Supply plants with ample nutrition prior to demand
- Use soil and tissue testing to assess nutrient sufficiency & needs
- Keep records & observe plant growth, yield, weather, and any pest issues
- If fertilizer needed: 1) How much nutrient? 2) When to apply? 3) Best nutrient source? 4) Best method?

Pre-Plant Soil Testing

- Adjust soil nutrients, if required, prior to planting
- Obtain representative soil sample of field – take down to tillage depth ~6 inches
- Test well in advance of planting
- Adjust soil nutrients based on test results
- P & K

Critical levels for soil nutrient content

Soil pH: 5.6 to 6.8 (2:1 v/v in water)

Soil EC: < 2 dS/m

Nutrient	Deficient at less than (ppm)
Phosphorus (P; Bray)	20 to 40
Phosphorus (Olsen)	10 to 20
Potassium (K)	150 to 350
Calcium (Ca)	1000
Magnesium (Mg)	120
Manganese (Mn)	20 to 60
Boron (B)	0.5 to 1.0

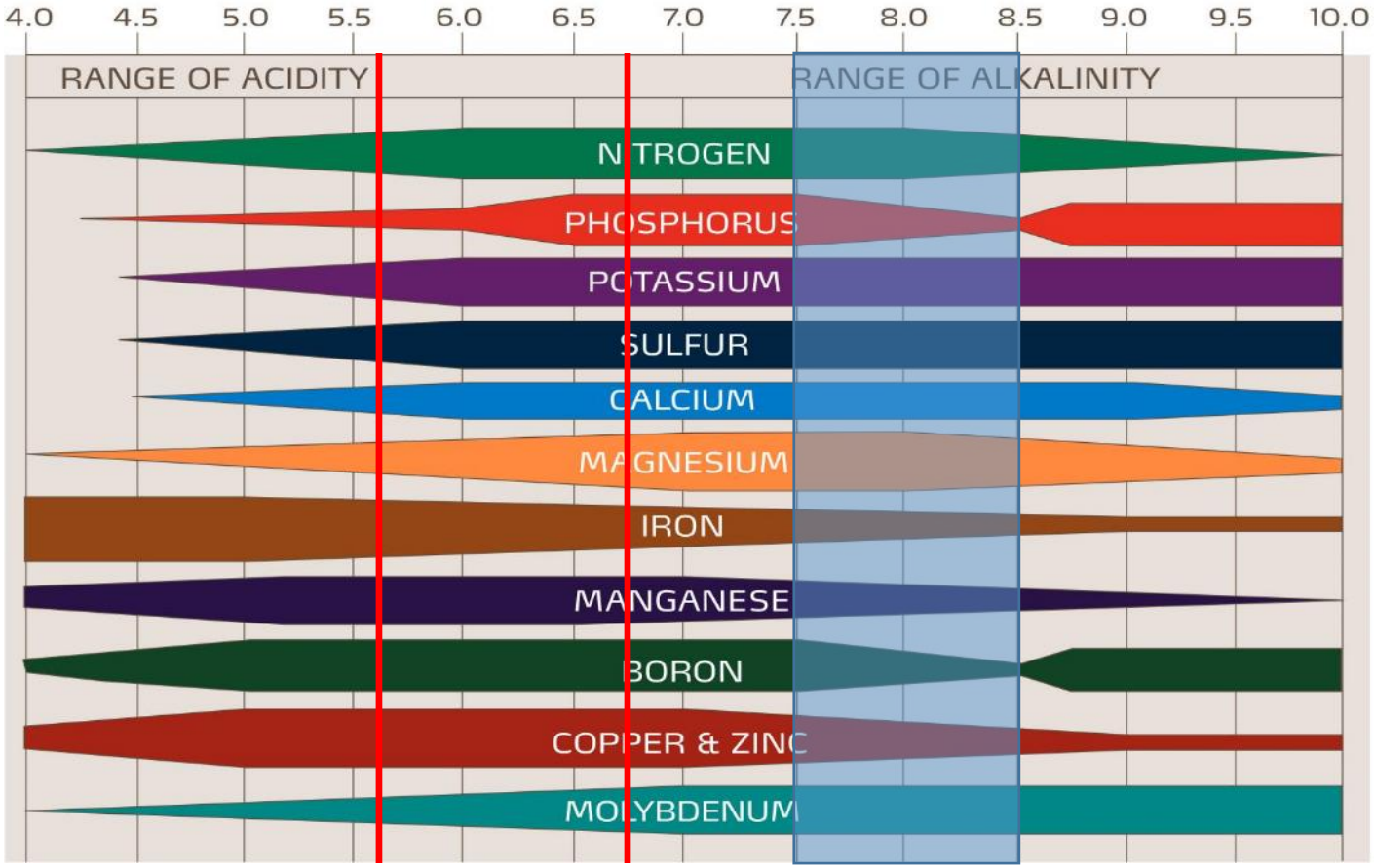
Note: test methods vary by lab which may affect results.

Values in table are from Oregon

Soil pH affects nutrient availability

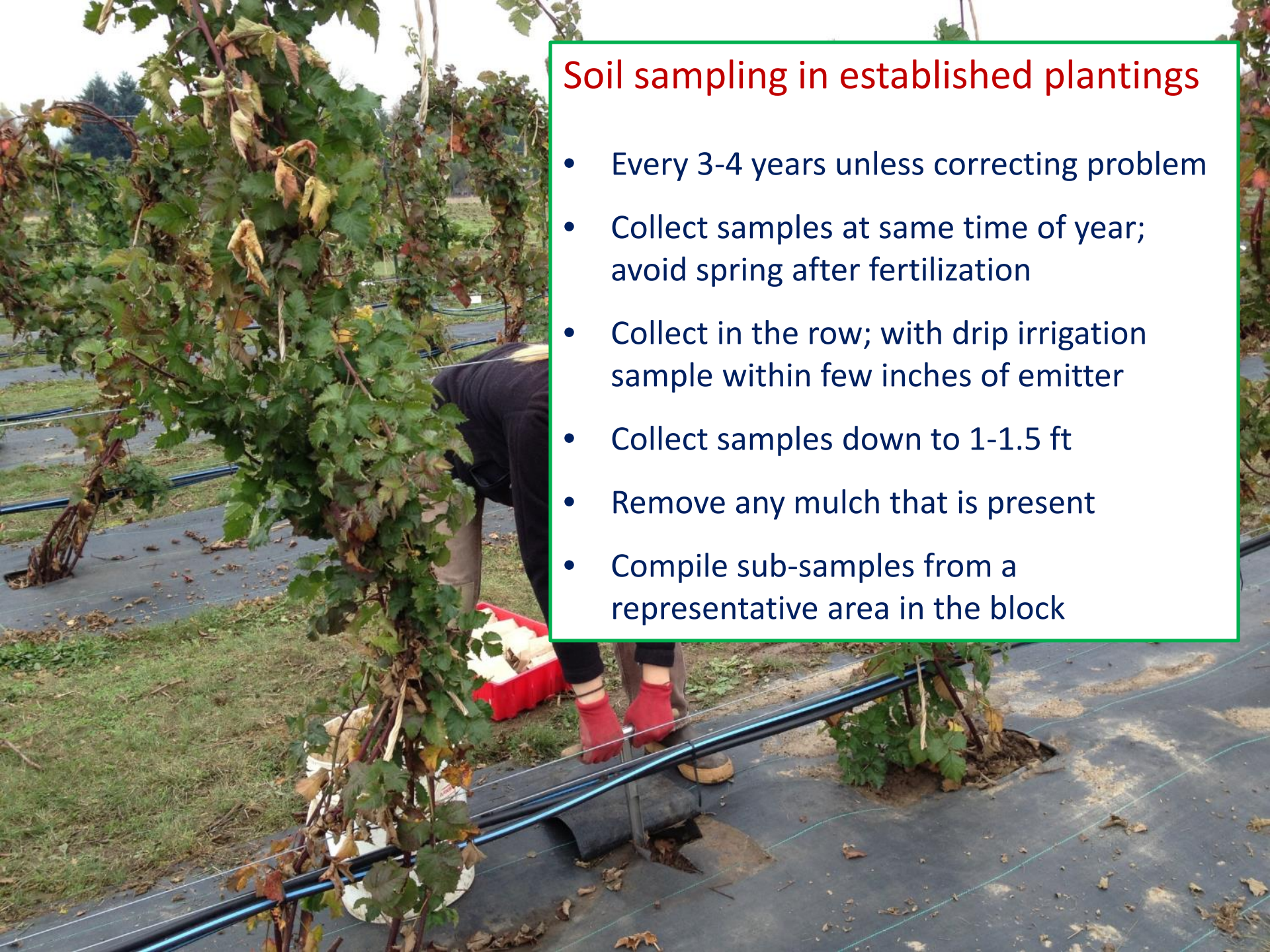
Figure 1

The Influence of Soil pH on Nutrient Availability



Optimum pH for brambles

Utah



Soil sampling in established plantings

- Every 3-4 years unless correcting problem
- Collect samples at same time of year; avoid spring after fertilization
- Collect in the row; with drip irrigation sample within few inches of emitter
- Collect samples down to 1-1.5 ft
- Remove any mulch that is present
- Compile sub-samples from a representative area in the block

Plant tissue analysis

- Provides information on the nutrient status of plants
- Goal is to detect nutrient problems before visual symptoms or yield reductions appear
- Tool to diagnose visual symptoms and evaluate fertilizer programs
- Does not work well for anticipating current season fertilizer needs (except for micronutrients)
- Need to know: 1) What tissue to sample; 2) When to sample; 3) Interpreting results

What tissue to sample

- Sample cultivars separately
- Collect 50 of the most recent fully-expanded primocane leaves
- Collect leaves ~ 1 ft from tip of primocane in floricane-fruiting types
- Published sufficiency levels ("standards") are only for primocane leaves

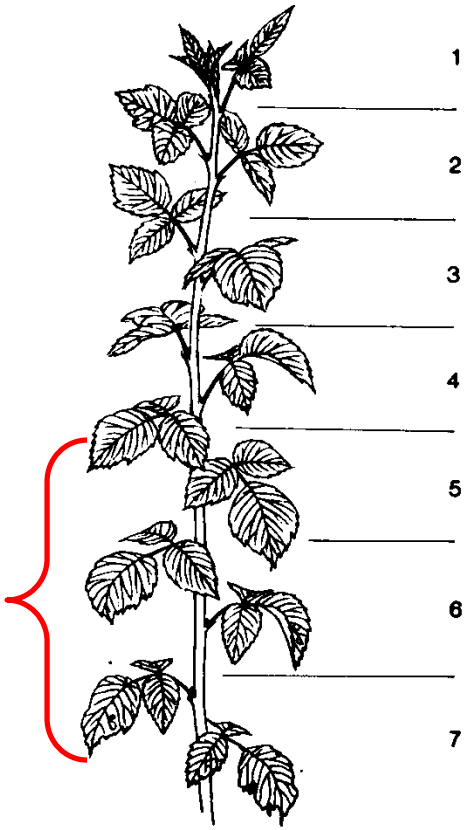


Fig. 1. Schematic drawing of red raspberry cane, showing 7 positions sampled.

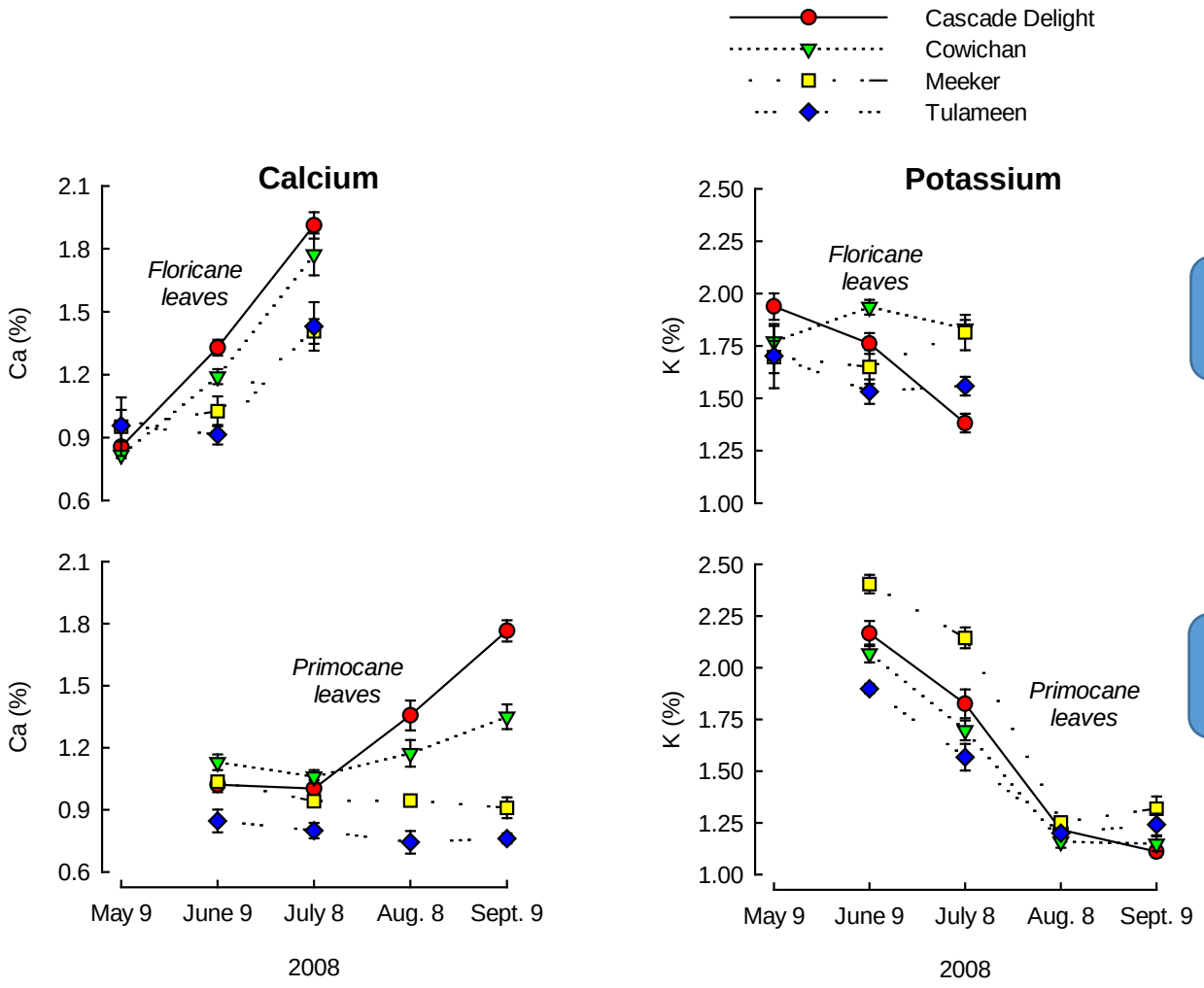
(Hughes et al., 1979)

When to sample

- Tissue nutrient concentrations change over the growing season

Floricane-fruiting raspberry

Leaf calcium and potassium

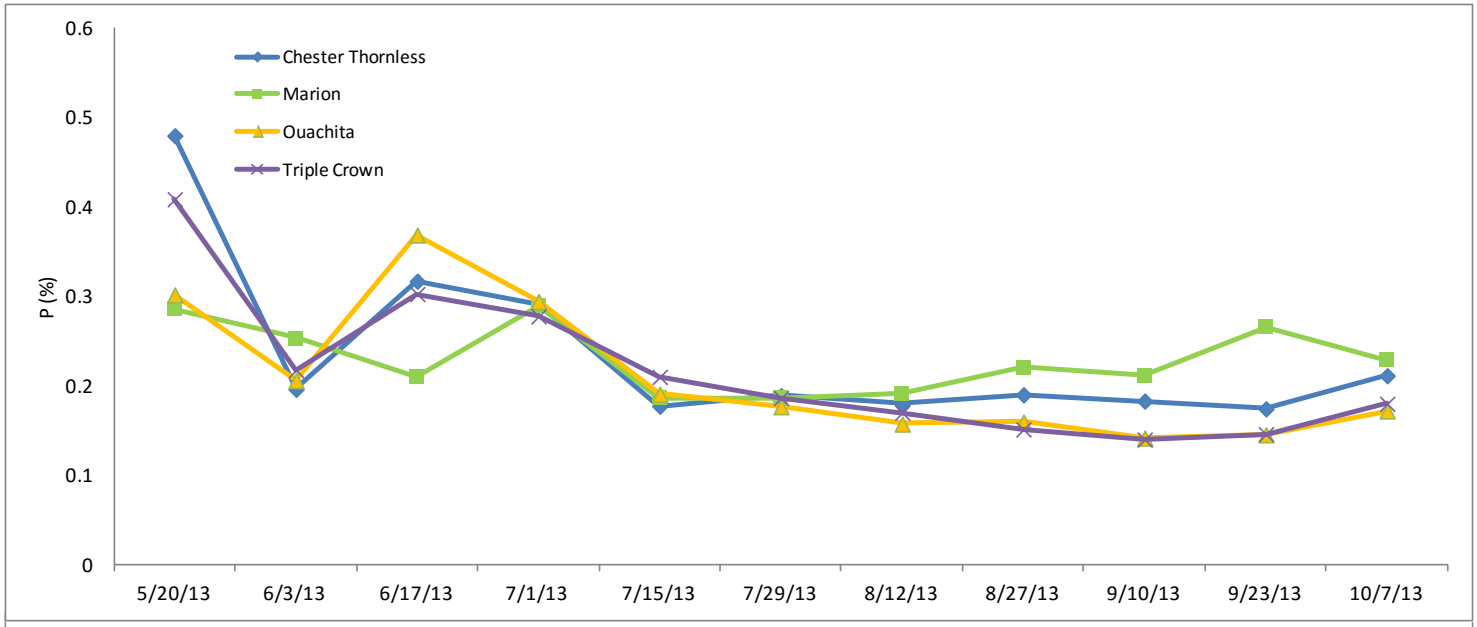


Fruiting lateral leaves

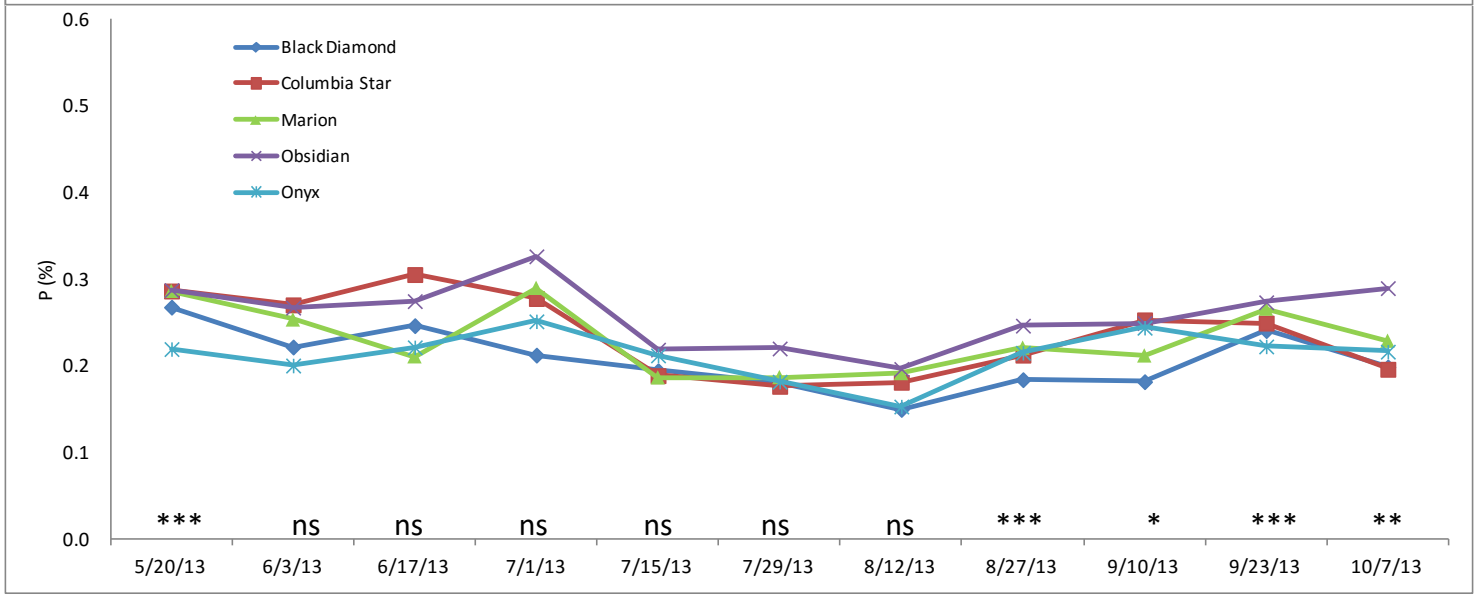
Primocane leaves

Floricane-fruiting blackberry: Primocane leaf %P; cultivar effects

'Marion' vs. Erect & Semi-erect



All trailing cultivars



Interpreting Sample Analysis Results

- Tissue nutrient concentrations are expressed as a percentage (or ppm) of dry weight (concentration)
- Values can only be compared to published sufficiency levels if:
  - Correct leaf samples were
  - Taken at the correct time

Current primocane leaf nutrient sufficiency levels

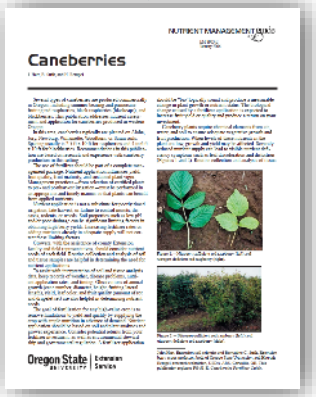
Nutrient	OSU Caneberry Nutrient Mangement Guide	N.E. North America Raspberry & Blackberry Production Guide	California Caneberry Production Manual
Nitrogen (%N)	2.3 to 3.0	2.0 to 3.0	2.0 to 3.0
Phosphorus (%P)	0.19 to 0.45	0.25 to 0.40	0.25 to 0.40
Potassium (%K)	1.3 to 2.0	1.5 to 2.5	1.5 to 2.5
Calcium (%Ca)	0.6 to 2.0	0.6 to 2.0	0.6 to 2.5
Magnesium (%Mg)			
Sulfur (%S)			
Manganese (ppm Mn)			
Boron (ppm B)	30 to 70	30 to 70	30 to 50
Iron (ppm Fe)	60 to 250	60 to 250	50 to 200
Zinc (ppm Zn)	15 to 50	20 to 50	20 to 50
Copper (ppm Cu)	6 to 20	6 to 20	7 to 50

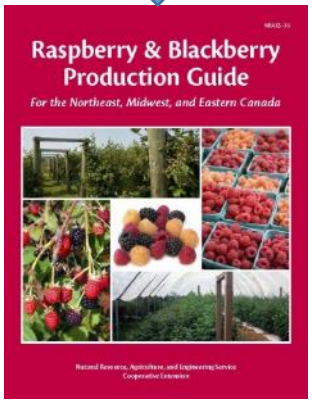
"late-July to early August"

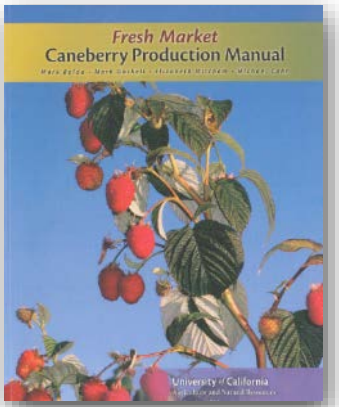
"after fruit harvest"

"May to August"

OSU - Hart et al., 2006; NE North America - Bushway et al. 2008; California - Bolda et al. 2012

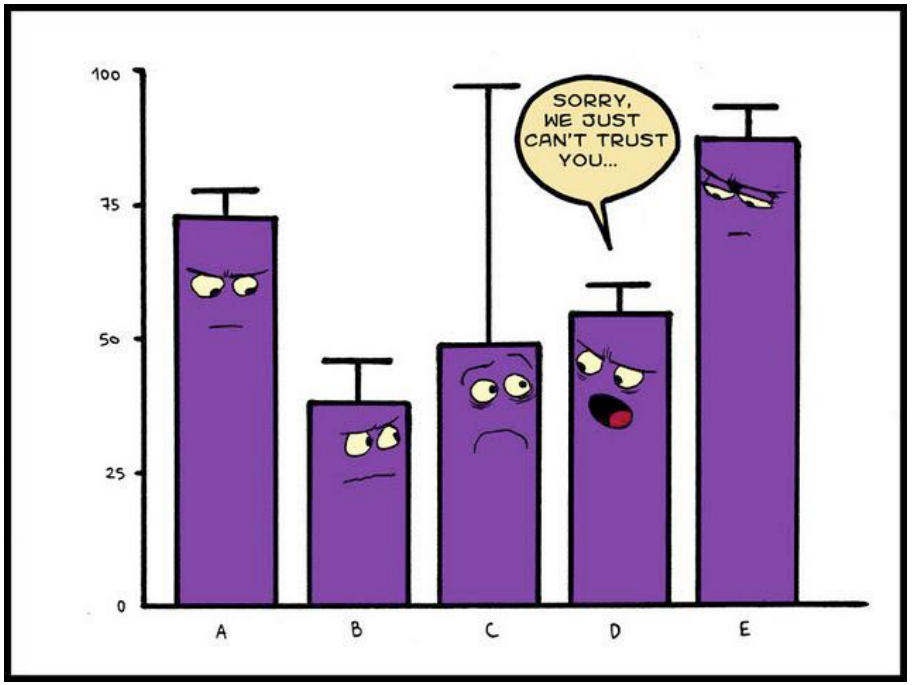






DDDM

- Data Driven Decision Making
- Soil test data
- Tissue test data
- Observational data
  - Yield
  - Soil type
  - Planting vigor
  - Historical applications
  - Cultivar

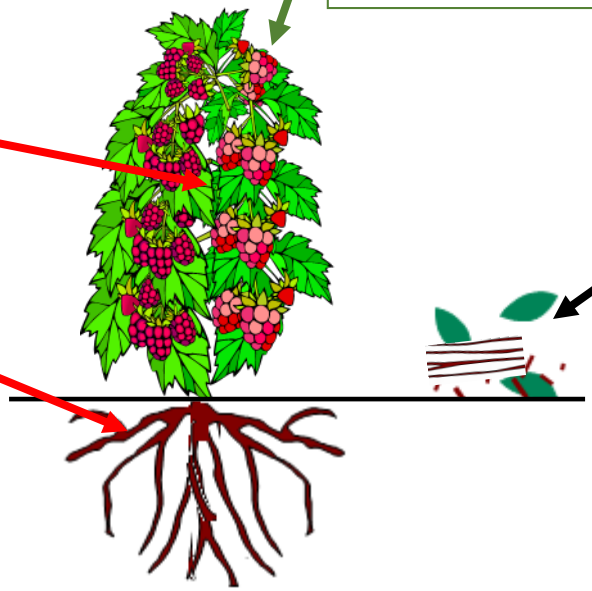


Outline

- Introduction & Horticulture
- Soil sampling
- Plant tissue sampling
- Nutrient rate, source, timing, and method of application

Nutrient Storage & Recycling in Perennial Fruit Crops

Nutrients in harvested fruit are removed from the field



N, P, K, Mg and Mn are retained as reserves in dormant tissues (buds, wood & roots) for remobilization in spring

Nutrients are re-cycled into the soil as dropped flowers & fruit, leaf fall & prunings.

In raspberry and blackberry, new fertilizer N is used for primocanes and fruiting lateral growth. Stored nutrients are preferentially used for floricane growth

What’s available for the plants?

Nitrogen fertilizer rate studies in *Rubus*

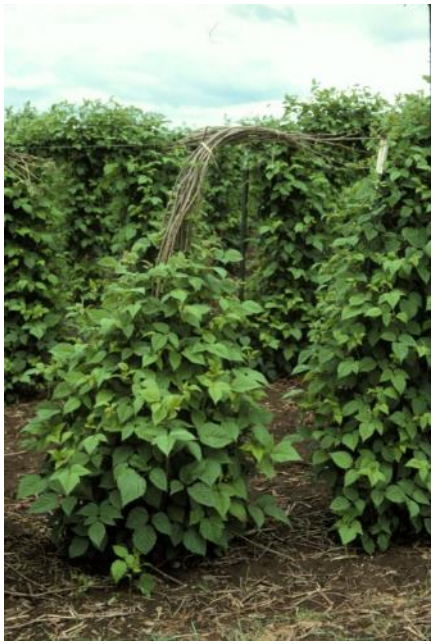
Results from applying various rates of N fertilizer in trials with raspberry & blackberry have been variable throughout world

Variability in results may be partially due to soil fertility and existing plant vigor or age (stored reserves)

Impacts of under-fertilization and changes in fertilization programs often take longer than a year to show

Research on N fertilization rates

- Low N reduce cane numbers, vigor, berry size, and yield
- High N can increase internode length (reducing yield per cane) and fruiting lateral length (harvest & disease issues)
- High N may reduce fruit firmness and shelf life
- High N may increase fruit and cane disease
- Late or high rates of N may increase risk of winter cold injury



Nitrogen

- Mobile in plant and soil
- *Rubus* plants take up nitrate (NO_3^-) form
- N is present in many essential compounds
- Deficiency: general chlorosis in older leaves; poor growth
- Excess: increased vigor, may decrease yield & quality

Manage N fertility by monitoring leaf N concentration and plant growth; base initial rates on recommendations & known plant gains & losses

Nitrogen Rate Recommendations

Blackberry

New plantings:
25 – 50 lb/acre

Established:
50 – 80 lb/acre + additional **20 – 25 lb/a** at bloom of late-fruiting types

Red raspberry

New plantings:
25 – 55 lb/acre

Established:
40 – 80 lb/acre + additional **20 – 25 lb/a** at bloom of primocane-fruiting cultivars

Nutrients removed per TON of harvested fruit ('Meeker') & per ACRE of prunings (adapted from Rempel & Strik, 2004)

	Macronutrients (lb)					
Crop	N	P	K	Ca	Mg	S
Fruit (per ton harvested)						
Red raspberry	3.5	0.5	3.0	0.3	0.4	0.2
Prunings (per acre)						
Red raspberry	17.3	1.2	9.4	15.3	3.1	0.9
	Micronutrients (oz)					
Fruit (per ton harvested)	B	Cu	Mn	Zn		
Red raspberry	0.1	0.03	0.11	0.07		
Prunings (per acre)						
Red raspberry	3.3	0.2	2.1	0.5		

Potassium

- Mobile in plant, but immobile in soil (except sandy)
- Tissue levels related to crop load or time of fruiting as K levels in fruit high
- K deficient plants have older leaves with necrotic lesions
- High rates of K can lead to “salt” injury
- High soil K and low leaf %K often related to production problems

Incorporate prior to planting, if needed. Apply granular K in the fall. Can apply through drip. Muriate of potash (KCl, 0-0-60) or potassium nitrate (13-0-45) if also need N

Phosphorus

- Mobile in plant,
  but immobile in soil
- P deficient plants are stunted and
  often dark green;
- Leaves may have red tinge, accumulation of anthocyanins
- Excess P will increase root to shoot ratio
- Excess P may lead to micro-nutrient deficiencies

Incorporate prior to planting, if needed. Surface applications of granular P not available to roots. Can apply through drip. Ammonium phosphate fertilizers or super or triple superphosphates; ammonium polyphosphate (drip)

Magnesium


Raspberry, Mg Deficiency

- Mobile in plant, but immobile in soil
- Deficient plants have older leaves with inter-veinal necrosis or edges starting red and turning brown
- Deficiencies more common on sandy soil with low pH or if soil K is high

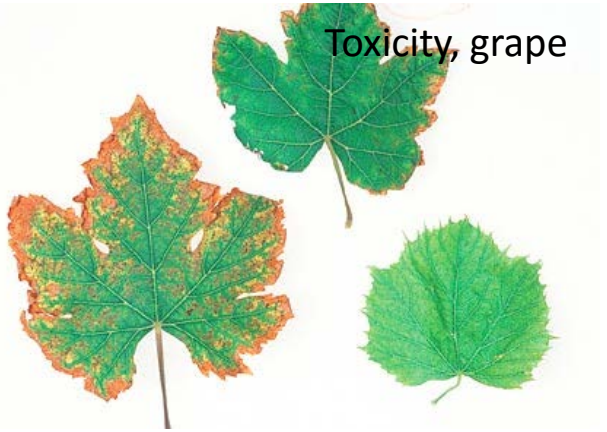
Incorporate prior to planting, if needed. Apply granular Mg in the fall (dolomite lime or magnesium sulfate or gypsum); Can apply through drip (magnesium sulfate).

Boron

Deficiency

- Very immobile in plant; mobile in soil
- Held in organic fraction of soil
- B deficiency reduces percent bud break and increases crumbly fruit
- Toxicity can occur – tip burning of shoots
- Annual applications, without soil or tissue tests not recommended as may reduce yield in raspberry

Incorporate prior to planting, if needed. Apply granular B in the fall (borax). Foliar applications effective (e.g., Solubor)



Toxicity, grape

Calcium

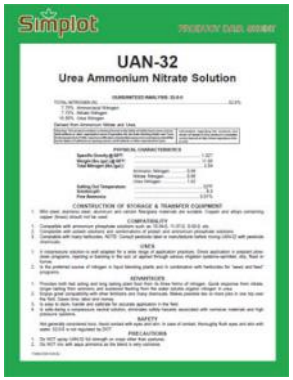
Erect blackberry

- Immobile in plant and soil
- Deficiency symptoms in younger leaves; deformed, twisted tissues; low Ca may reduce fruit firmness
- Low soil moisture & cool, cloudy, humid conditions limit %Ca
- With drip irrigation, soil Ca may leach over time

Incorporate prior to planting, if needed (Ag or dolomite lime). Apply granular Ca in the fall (lime). Can use calcium nitrate if need N. Can apply through drip (calcium nitrate; calcium chloride; calcium sulfate). Foliar Ca (various products)?

Nitrogen form & soil pH

- Bramble plants preferentially take up nitrate-N (NO_3^-)
- Ammonium-N (NH_4^+) is rapidly converted to nitrate-N at the upper end of recommended soil pH range (6.0-6.8)
- Organic sources of N are essentially all ammonium-N (granular and liquid forms)
- Inorganic **granular** sources include calcium nitrate, urea, ammonium phosphates, ammonium sulfate; **fertigation**: urea-ammonium nitrate (UN-32); calcium ammonium nitrate (CAN-17); or ammonium nitrate (AN-20)



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Fertilizer sources (organic)

- **Animal based**
  - Use of fresh manures **not** recommended/OMRI approved
  - Animal meal products (e.g. blood, bone, feather, poultry litter)
  - Liquid products (e.g. fish emulsion) – may be fertigated
- **Composts** (plant or animal based) may be used pre-plant
  - Always test compost analysis prior to use
- **Plant based**
  - Liquid distilled products (e.g. corn steep liquor) – may be fertigated
  - Alfalfa or soybean meal
  - Various “teas”, seaweed, humic acids

http://www.planetnatural.com/

Summary

- Test soil & maintain pH in desirable range (as possible)
- Test tissue annually
  - Test primocane leaves in late July/early Aug. for raspberry and floricane-fruiting blackberry
  - Choose most recent fully-expanded leaf
  - Test cultivars separately
  - Check sufficiency levels

Summary, Cont.

- Apply the right amount of fertilizer
  - Be aware of fertilizer losses
  - Replace losses & add some for growth (adjust as needed using tissue test results)
- Apply the right source of fertilizer
- Apply fertilizer at the right time of year
- Apply to increase accessibility/uptake of the plant

Questions?

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To assist with interpretation of soil and tissue analysis data, keep records of weather, disease problems, nutrient application rates, and timing. Observations of annual growth (cane number, diameter, height, fruiting lateral length), yield, leaf color, and fruit quality (amount of rot and drupelet set) are also helpful in determining nutrient needs.

The goal of fertilization for any high-value crop is to remove limitations to yield and quality by supplying the crop with ample nutrition in advance of demand. Nutrient application should be based on soil and plant analyses and grower experience. Consider potential returns from your fertilizer investment, as well as environmental stewardship and governmental regulation. A fertilizer application should be "bio"logically sound and produce a measurable change in plant growth or nutrient status. The biological change caused by a fertilizer application is expected to increase fruit yield or quality and produce a return on your investment.

Caneberry plants require chemical elements from air, water, and soil to ensure adequate vegetative growth and fruit production. When levels of these nutrients in the plant are low, growth and yield may be affected. Severely reduced nutrient supply can lead to visible nutrient deficiency symptoms such as leaf discoloration and distortion (Figures 1 and 2). Routine collection and analysis of tissue

Figure 1.—Nitrogen-sufficient red raspberry (left) and nitrogen-deficient red raspberry (right).

Figure 2.—Nitrogen-sufficient red raspberry (left) and nitrogen-deficient red raspberry (right).

John Hart, Extension soil scientist and Bernadine C. Strik, Extension berry crops professor, both of Oregon State University; and Hannah Rempel, research technician, USDA-ARS, Corvallis, OR. This publication replaces FG 51-E, *Caneberries Fertilizer Guide*.

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samples can detect low nutrient concentration before visible symptoms or yield reduction occurs.

Plant tissue analyses indicate which elements are accumulated in adequate, deficient, or excessive amounts. Changes in tissue analysis may not occur for 1 to 2 years after nutrient application to a perennial crop such as raspberries or blackberries, especially when immobile materials (phosphorus, potassium, and lime) are applied to the soil surface (topdressed).

Tissue testing is based on a consistent sampling time, selection of the appropriate plant part, and "standards" for comparison. The following sections provide directions for collection of soil and tissue samples.

Tissue testing

Mineral nutrients such as nitrogen (N), phosphorus (P), and potassium (K) are added through fertilizers to supplement the supply from the soil. By analyzing dried plant tissues for their nutrient content (tissue testing), you can evaluate the adequacy of mineral nutrients. This information will help you decide whether fertilizer is needed and, if so, how much and what kind to apply.

Tissue testing can be used for any of the following:

- Predicting fertilizer needs of annual crops
- Diagnosing problems
- Evaluating a fertilizer program for perennial crops

Tissue testing can be used to monitor and adjust fertilizer use during early growth stages of annual crops such as potatoes, sugar beets, or lettuce. Tissue testing can help growers anticipate fertilizer needs for these crops.

In contrast, tissue test results are not very useful for predicting current-season fertilizer needs for perennial crops such as raspberries and blackberries. In part, this is due to the minimal short-term effect of fertilizer on yield in perennial crops. Therefore, tissue testing in producing caneberries is best used for end-of-season evaluation of a fertilizer program for the next year.

If problems such as poor growth or discoloration of canes appear during the growing season, you can use a comparative tissue test to check for possible nutrient deficiencies. You can collect samples to diagnose deficiencies at any time during the season. However, if not sampling during late July or early August (see "When to sample"), you also must collect a sample from an unaffected area for comparison.

Before using tissue testing to predict or evaluate fertilizer needs, you need the following information, which is provided in this publication:

- Sampling time (stage of development)
- Plant part to sample
- Normal or sufficient concentration range for each nutrient so you can interpret results

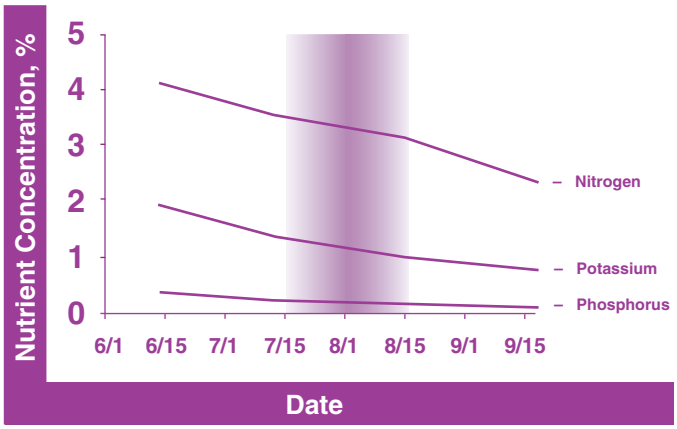

Figure 3.—The change in nitrogen (N), phosphorus (P), and potassium (K) concentration in leaves of 'Meeker' raspberries during the 2001 growing season. Tissue sampling should be done when leaf nutrient concentrations are relatively stable (shaded area).

When to sample

Tissue samples should be collected when nutrient concentration is stable. Samples collected just a few days apart during periods of rapid change in nutrient concentration can give quite different results. Changing N, P, and K concentration in leaves of 'Meeker' red raspberry primocanes is illustrated in Figure 3. Tissue concentration changes rapidly early in the growing season; compare the late-July and early-August tissue concentrations to mid-June tissue concentrations.

Tissue levels of N and K changed substantially during the season but reached a stable level in late July and early August. Samples collected during this period should produce consistent analytical results.

Figure 3 also illustrates the danger in collecting samples in late September. Nitrogen concentrations decrease as plants enter dormancy, so these samples may not give an accurate picture of the situation during the growing season.

Collect raspberry and blackberry tissue test samples during the stable period—late July to early August. Sampling raspberry tissue at any other time is not recommended except when samples are collected for comparative tissue testing to check for possible nutrient deficiencies.

Part of caneberry plant to sample

Do not mix cultivars in a tissue sample. Collect 50 of the newest fully expanded primocane leaves about 12 inches from the tip. Select only one leaf per primocane. A single sample should not represent an area of more than 5 acres or contain leaves from more than 50 primocanes.

Collect leaves that are free of disease or other damage, if possible. Pick leaves so that the petiole (stem) remains with the leaf. Do not wash the leaf samples. Put leaves in a paper bag (not plastic). Air dry them or send them to a laboratory as soon as possible. To avoid spoilage, ship fresh (moist) samples early in the week to ensure delivery before the weekend.

A list of laboratories that perform tissue analyses is available in publication EM 8677, *A List of Analytical Laboratories Serving Oregon.*

Frequency of sampling

Ideally, you should sample caneberry tissue from all fields annually. However, you may feel annual sampling is not necessary or financially feasible. Regardless of whether or not you sample every year, develop a plan for regular sampling.

Begin with fields that are not growing or yielding as desired. Annual sampling from these fields will be necessary until the problem is identified or corrected.

Divide the remainder of your acreage into two or three groups. Sample from a group of fields each year. Thus, you will sample one-half or one-third of the acreage each year.

Interpreting laboratory results

Compare laboratory results to the values in the tables found on pages 5–7 to determine whether sufficient nutrients were supplied by the soil and your fertilizer program.

Review cane growth and yield from last season. Choose the combination of tissue analysis and crop growth listed below that corresponds to your situation. Follow the instructions given for the appropriate category.

- **Low tissue analyses and abundant cane growth.** For summer-bearing red raspberries, canes should be 7 to 9 ft high and ½ inch in diameter. Cane growth of 12 to 15 ft for trailing types ('Boysen,' 'Logan,' 'Marion,' 'Kotata,' and 'Thornless Evergreen') is adequate.

  If cane growth is luxurious, don't apply additional fertilizer. This situation usually is caused by oversupply of N. Below-normal N and high vigor also can occur on canes with little or no crop. Lower-than-normal tissue nutrient concentrations are common with excessive cane growth. In this situation, low tissue nutrient concentration occurs when the tissue nutrient content is diluted by intensive growth. This condition should correct itself when growth returns to normal. Do not apply extra fertilizer, especially N, to correct low tissue concentrations when cane growth is excessive.
- **Low tissue analyses and weak cane growth.** If canes are weak, discolored, or stunted, apply fertilizer at rates recommended by your local office of the OSU Extension Service.
- **Normal tissue analyses and cane growth.** If tissue analyses and cane growth are within the normal range, continue with your current fertilizer program.
- **Above-normal tissue analyses and weak cane growth.** If canes are weak, discolored, or stunted, and the tissue analyses are above normal, look for stress from pests, drainage, drought, frost, or other factors.
- **Above-normal tissue analyses and cane growth.** If tissue analyses are above normal and cane growth is adequate or above normal, reduce the amount of fertilizer you have been applying, especially N.

Other considerations

Tissue analysis results outside the normal range cannot always be attributed to your fertilizer program. Insufficient mineral nutrient concentration can be caused by saturated or dry soils; high temperatures; frost; shade; weed, insect, or disease pressure; or herbicide injury.

Several fungicides contain plant nutrients. Because tissue samples are not washed before analysis, high copper (Cu), manganese (Mn), or zinc (Zn) might be the result of fungicide residue. High boron (B) and Zn also can occur if liquid or foliar fertilizer is used.

Collecting soil samples

Soil analysis is more useful before planting than after planting. Obtain soil samples in the summer or fall before planting to estimate amounts of nutrients and lime needed. After planting, soil analyses can be helpful in diagnosing problems, such as low soil pH or presence of excessive salts.

Fertilizer is commonly applied in a wide band centered on the caneberry rows. The band application concentrates nutrients, complicating soil sampling. Growers are well aware of the concentration of nutrients that occurs horizontally or between rows when fertilizer is placed in a band on the soil surface. However, they often neglect to think about vertical stratification. Repeated applications of N, P, and K in a band will depress soil pH and increase soil test P and K in the surface layer of soil. Neither P nor K is mobile in the soil; they will remain where placed, resulting in decreasing soil test P and K with depth.

Additional information about soil sampling is available in EC 628, *Soil Sampling for Home Gardens and Small Acreages*, and PNW 570-E, *Monitoring Soil Nutrients Using a Management Unit Approach*.

Nitrogen (N)

N requirement varies with yield, cane growth, plant age, soil type, irrigation, rainfall, and cultivar. Cane growth is an initial indicator of N sufficiency. Some caneberries are more vigorous than others and may require less N to give the desired amount of cane growth. Less N is required in the planting year than in subsequent years.

Excess N adversely affects yield and can promote vigorous vegetative growth. Excessive vegetative growth leads to longer, thinner primocanes with longer-than-normal internodes (distance between buds), thus reducing yield per cane. Excess N also can produce longer laterals on floricanes, increasing the risk of breakage during machine harvest as well as the risk of fruit diseases. When excess N is applied in late winter or early spring, fruit firmness may be reduced because a considerable portion of this fertilizer N goes to the fruit.

N fertilization should be based on tissue N concentration, cane vigor, yield, and irrigation practices. Tissue N concentration from sampling in late July or early August should be between 2.3 and 3.0 percent. See "Interpreting laboratory results" for more information.

Raspberries

In summer-bearing red raspberries, fertilizer N that is applied early (before new primocane emergence or when primocanes are less than 6 inches tall) is taken up by the

new primocanes and by the fruiting laterals and fruit on the floricanes. When fertilizer N is applied when green fruit are present (approximately 1 month before first harvest), most of the fertilizer N is taken up by the primocanes and little goes to the fruit.

Research suggests that a split application of fertilizer N is best for maintaining current-season yield and good primocane growth for next season's yield. Apply half of the N about a week before primocane emergence and half about a month before first harvest.

Summer-bearing red raspberries have been shown to use about 40 percent of their stored N per year; thus, good stored reserves of N (in primocanes, crown, and roots) are important for sustaining yields.

Research suggests that delaying removal of spent floricanes after harvest can allow more time for N in the dying canes to be moved to the crown and roots, thus conserving N in the plant. In some cases, however, early "caning out" is best for disease management. Floricane prunings that are flailed and left in the field have been shown to contribute to the organic N available to the plants in subsequent years.

In general, summer-bearing red raspberries (e.g., 'Meeker,' 'Cascade Delight,' 'Coho,' 'Willamette') need 30 to 50 lb fertilizer N/acre in the establishment year and 50 to 80 lb fertilizer N/acre in subsequent years. For primocane-fruiting or fall-bearing red raspberries (e.g., 'Amity,' 'Heritage,' 'Summit'), add an additional 20 lb N/acre at bloom. For black raspberries (e.g., 'Munger'), apply 20 to 40 lb N/acre in the establishment year and 40 to 60 lb N/acre in subsequent years.

Blackberries

Trailing blackberries are produced in either an every-year (EY) or an alternate-year (AY) system. In the EY system, fruit is produced every year, with the primocanes (next year's fruiting canes) trained under the row during fruiting and trained on the wire either in late August or, more commonly, in February. In AY production, only primocanes are produced in the nonfruiting or "off year"; they are trained as they grow and fruit the following "on year" as floricanes. The primocanes are not managed in the "on year," and all canes are cut to just above crown height in October of the on-year to repeat the cycle.

Research has shown that trailing blackberries ('Kotata') allocate current-season fertilizer N to primocanes, fruiting laterals, and fruit. The following year, roots, the crown, and floricanes are a source of stored fertilizer N for growth of fruiting laterals and fruit.

Little stored N is used for early-season primocane growth. Thus, it is important to fertilize EY and AY trailing blackberries with N every year to sustain good growth and yield. A split application of fertilizer N is recommended. Apply half of the N about a week before primocane emergence and half about a month before first harvest.

In EY production, with February training, it is best to remove the spent floricanes in late fall or winter rather than immediately after harvest to conserve plant N. In the on-year of AY production, do not cut the plants to crown height before October; otherwise, regrowth of primocanes will deplete N reserves.

As a general rule for trailing blackberries, apply 30 to 50 lb N/acre in the establishment year and 50 to 70 lb N/acre in subsequent years. In 'Thornless Evergreen,' experience suggests mature plants can respond well to rates of 60 to 80 lb N/acre.

Little N research has been done on erect (e.g., 'Navaho,' 'Kiowa') or semierect (e.g., 'Chester Thornless,' 'Triple Crown') blackberries. However, we do know that these types of blackberries respond similarly to trailing blackberries in their use of new fertilizer N and reserves. These varieties are grown only in EY systems. As a general rule, apply 30 to 50 lb N/acre in the establishment year(s) and 50 to 80 lb N/acre in subsequent years. Use the higher rates for semierect types.

Other considerations

Nitrogen can be efficiently applied with P and K. Apply fertilizer in a wide band, about 2 feet wide and centered on the row. Nitrogen can be lost from surface-band applications if soils have been limed recently and the fertilizer is not washed into the soil by rain or irrigation within 1 or 2 days after application.

Caneberries use the nitrate form of nitrogen more readily than the ammonium form. Nitrate nitrogen is soluble in water and moves into soil or the plant rapidly, but it's also leached easily from soil.

Because nitrate nitrogen generally is more expensive than ammonium forms, many growers apply urea or other ammoniacal sources of nitrogen. Ammonium nitrogen is less easily leached because it binds to soil particles. However, it is converted into the nitrate form through a process called nitrification.

Soil pH is one factor controlling nitrification. Figure 4 illustrates relative nitrification of ammonium nitrate, ammonium sulfate, and urea. Urea and ammonium nitrate act similarly when the soil pH is 6.0 but differently at

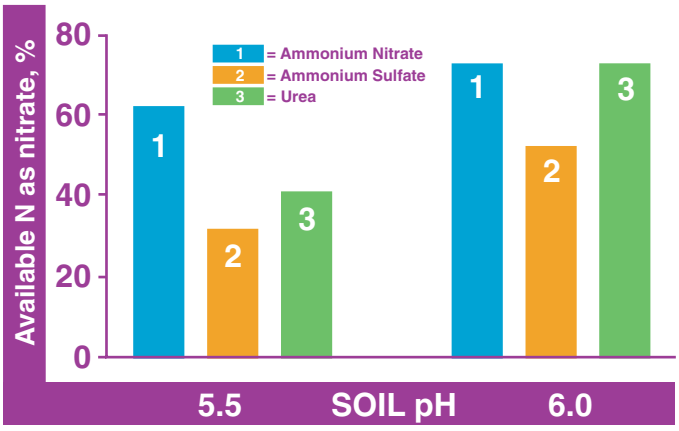

Figure 4.—Relative nitrification of N fertilizers at two levels of soil pH (Hyslop Farm, spring 1985, 140 lb N/acre applied March 7, sampled April 23).

pH 5.5. All N sources nitrify faster at pH 6.0 than 5.5. Ammoniacal N is rapidly converted to nitrate in warm, moist soil with a pH above 6.0. In the Willamette Valley, this conversion can be 50 percent complete 3 to 10 weeks after an early spring application.

Use of most common nitrogen fertilizers increases soil acidity and lime need. Table 1 shows the effect of increasing N rate on soil pH in four southern Willamette Valley soils. Urea or other ammoniacal N sources acidify the top 3 inches of soil approximately 0.1 pH unit for each 100 lb N/acre. For example, when nitrogen is applied at the rate of 140 lb/acre, the soil pH decreases by approximately 0.14 pH unit. If 140 lb N/acre is used for 3 years, soil pH will decline approximately 0.4 pH unit.

Thus, the use of nitrogen fertilizer beyond crop need has a double cost. The first cost—the N fertilizer itself—is not offset by increased yield or economic return. Second, the additional nitrogen acidifies soil, which then requires additional lime to raise the soil pH. Application of 50 lb N/acre above crop need will require an additional 0.3 to 0.6 ton lime/acre in 3 years.

Of the commonly available N sources, ammonium sulfate is the most acidifying. Urea, the most common solid or dry N source, is less acidifying than ammonium sulfate because the N in urea undergoes a different process to become plant-available. As the urea initially reacts with enzymes in the soil, the soil pH rises slightly, partially offsetting acidification produced by subsequent reactions.

Although foliar applications have been shown to be an efficient way to apply micronutrients such as zinc and boron, they have not been shown to be a very effective way of applying nitrogen. Thus, broadcast granular applications or liquid applications through drip irrigation systems are recommended .

Phosphorus (P)

Most soils in the Willamette Valley contain adequate P for caneberry production. Definitive research showing yield or growth response from P is not available for caneberries. Trial applications can be helpful in determining P need for individual fields when tissue P is below normal. See Table 2 for guidance.

Table 2.—Phosphorus recommendations for caneberries based on late-July to early-August tissue test (producing berries) or Bray soil test (preplant).

If the soil test for P is (ppm):	If tissue P is (%):	Apply this amount of phosphate (P_2O_5) (lb/a):
0–20	<0.16	60–80
21–40	0.16–0.18	0–60
>40	>0.19	0

Although we speak and write about P, or phosphorus, the analysis on a fertilizer bag is expressed as P_2O_5. For example, the "20" in 16-20-0 represents 20 percent P_2O_5. The expression is a tradition used in the fertilizer industry. Fertilizer rates are given as P_2O_5, since this is the industry standard.

Surface application of P is less effective than subsurface banding due to lack of P mobility in soil. Rates in Table 2 are for subsurface bands. For the fastest and most efficient movement of P to caneberry roots, place bands adjacent to hills on each side of the row and 4 to 6 inches deep. Testing for 3 to 5 years may be necessary before changes are seen. Double or triple the P rate in Table 2 for a preplant, broadcast, incorporated application.

Rock phosphate can be used by growers practicing organic production. Rock phosphate material has approximately 30 percent P_2O_5 and a solubility above 50 percent. Not all rock phosphates react or release P at the same rate. Finely ground rock phosphate mined in North Carolina applied to a P-deficient soil produced wheat yields comparable to those produced by superphosphates when applied at double the rate of superphosphates.

Potassium (K)

K is essential for caneberry production. However, the amount of K fertilizer (expressed as K_2O) required is not well defined. Good fruit firmness sometimes is attributed to adequate tissue K levels. No documentation exists to support the idea that higher-than-adequate tissue concentration increases cold hardiness.

Use soil tests to determine preplant K fertilization. Plant analysis is the best indicator of K need after

Table 1.—Soil pH and lime rates required to raise the soil pH in grass seed fields after 3 years of nitrogen applications at three application rates.[a]

	Dayton silt loam		Concord silt loam		Bashaw silty clay loam			Amity silt loam	
N rate	Soil pH	Lime (ton/a)[b]	Soil pH	Lime (ton/a)[b]	Soil pH	Lime (ton/a)		Soil pH	Lime (ton/a)[b]
0	5.9	0	6.2	0	5.4	4.3[c]	6.0[b]	7.1	0
135	5.5	1	5.8	1.1	4.9	4.7	6.4	6.6	0
270	5.2	2	5.6	1.5	4.8	5.0	6.9	6.0	1

[a] Sampled November 2000

[b] Lime to pH 6.0

[c] Lime to pH 5.6

crop establishment. Generally, no relationship exists between soil and tissue K levels. High surface soil K and low tissue K may indicate a gravelly subsoil low in K, inadequate irrigation, diseases, or other production problems.

In fields 2 years old or older, K can be banded or broadcast, alone or in combination with N, P, and possibly other fertilizers. Table 3 indicates K fertilizer rates based on soil and tissue testing.

Table 3.—Potassium recommendations for caneberries based on late-July to early-August tissue test (producing berries) or ammonium acetate soil test (preplant).

If the soil test for K is (ppm):	If tissue K is (%):	Apply this amount of potash (K_2O) (lb/a):
<150	<1.0	60–100
151–350	1.0–1.25	40–60
>350	>2.0	0

In new plantings, broadcast and incorporate one-half to two-thirds of the K requirement before planting and band the remaining one-half to one-third with N and P after planting. Do not include more than 40 to 60 lb K_2O/acre in N-P-K mixtures banded after planting. Excessive amounts of banded K may burn new roots, particularly in sandy soils.

Potassium is commonly supplied by potassium chloride (0-0-60, also called muriate of potash), potassium sulfate (0-0-50-18), potassium-magnesium sulfate (0-0-22-22), and potassium nitrate (14-0-45). Potassium chloride usually is less expensive than the other sources.

When using potassium chloride to supply high rates of K (more than 75 lb K_2O/a), you also apply a substantial amount of chloride. Much is said about detrimental effects of chloride on caneberry production, but no documentation exists to substantiate the comments. Even without data to support damage to caneberry production or canes from chloride, be cautious when applying more than 75 lb K_2O/acre.

One way to keep costs manageable and reduce chloride application is to mix K sources or use potassium chloride as a primary source mixed with some potassium sulfate. Potassium sulfate and potassium-magnesium sulfate also provide nutrients other than K and are most useful when sulfur and/or magnesium are needed in addition to K.

Sulfur (S)

Sulfur deficiencies in caneberry crops are not common in the Pacific Northwest. Soil S concentrations usually are adequate because S often is added with other nutrients. Fertilizer materials such as ammonium sulfate (21-0-0), potassium sulfate (0-0-50), potassium-magnesium sulfate, and gypsum contain sulfur. Use of a physical mix of urea and ammonium sulfate, urea-sul, is a common way to supply S in western Oregon.

Like nitrogen, S is a key component of proteins. Tissue S concentrations between 0.11 percent and 0.20 percent generally are adequate. The N:S ratio typically is 15:1. Sulfur is likely to be deficient if the ratio is greater than 20:1.

For example, when tissue N is 3 percent, a 15:1 N:S ratio would represent 3 percent N and 0.2 percent S. For this tissue N concentration, a tissue S concentration of 0.1 percent would be low, creating an N:S ratio of 30:1. When using the ratio approach, be sure tissue N and S are not both low.

Sulfur soil tests are difficult to use in western Oregon and Washington. Sulfur in the sulfate form, SO_4, is moderately mobile in soil; therefore, preplant application is not as critical as for lime, P, and K. A preplant application usually is not needed. If sulfur deficiency is suspected or documented, you can add S preplant, but also will need to add it regularly thereafter.

When S applications are needed, 30 to 40 lb S/acre is adequate. Sulfur can be added with N fertilizer. Gypsum is a common source of S and has little impact on soil pH.

Micronutrients

Boron (B)

Small amounts of boron are critical for bud break and fruit set of caneberries Boron deficiency results in small fruit, decreased yields, and, in severe situations, cane dieback. Table 4 provides B fertilizer recommendations based on soil or tissue tests. Note, however, that soil tests are less effective at predicting B needs for fruit crops than are tissue tests.

Boron applications without soil or tissue tests are not recommended. In an Oregon trial, continued application of B reduced yields 2 years in 5 when tissue B was adequate.

Boron should be broadcast or applied as a foliar spray. It can be added to most sprays, particularly Bordeaux mixture. Foliar boron applications in fall or spring prior to bloom are effective. Do not band apply boron.

If an analysis of a mid-July to mid-August tissue sampling is below 30 ppm B, spray sodium pentaborate (20 percent B) in fall at a concentration of 2 lb sodium pentaborate in 100 gal water. If you use dry B formulations, apply in spring before bud break.

Table 4.—Boron recommendations for caneberries based on late-July to early-August tissue test (producing berries) or hot water extractable soil test (preplant).

If the soil test for B is (ppm):	If tissue B is (%):	Apply this amount of boron (lb/a):
<0.5	<25	2–2.5
0.5–1.5	26–30	1–2
>1.5	>30	0

Other micronutrients

No increase in growth or yield of caneberries resulting from the application of other micronutrients has been documented in western Oregon.

Lime

Acidity, or pH, is the most commonly determined chemical characteristic of soil. Acidity is a measure of the hydrogen ion concentration in soil solution. Soil solution is water held by the soil particles. Soil pH determines a soil's general suitability for root growth.

Soil acidity or alkalinity is measured and expressed as soil pH. Soil pH is measured on a scale from 0 to 14. Soil pH values below 7 indicate acidic soil, and numbers above 7 indicate basic or alkaline soil. As pH numbers decrease, soil acidity (the hydrogen ion concentration) increases. Lime is added to acidic soil to raise the pH. Amendments such as elemental sulfur are added to basic soil to reduce the pH.

Soil pH tells us the chemical condition roots will experience. As soil pH decreases, the solubility of iron, zinc, manganese, and aluminum increases. The concentration of manganese and aluminum can reach levels that are toxic or at least inhibit root growth. Crop sensitivity to manganese and aluminum varies. Caneberries are moderately sensitive.

As soil pH increases, the solubility of iron, zinc, and manganese decreases. The concentration of manganese and iron can reach levels that are deficient, causing yellowing of leaves.

For optimum caneberry production, maintain soil pH between 5.6 and 6.5. A test for soil pH determines whether lime is required. A second soil test, the lime requirement (or buffer) test (sometimes called SMP) estimates the amount of lime needed. SMP are the initials of Shoemaker, McClean, and Pratt, the creators of the test.

Lime is most effective when mixed with the soil. Therefore, lime should be applied before planting caneberries.

Lime is recommended when the soil pH is 5.6 or below, or when calcium (Ca) levels are below 5 meq Ca/100 g of soil. However, if total bases exceed 20 meq/100 g on fine-textured (clayey) soils, lime probably is not needed unless the pH is below 5.2. Estimate the rate of lime application from Table 5.

Table 5.—Preplant lime recommendations for caneberries (tons/acre of 100-score lime needed to raise pH of surface 6 inches of soil).

If the SMP is:	Apply this amount of lime (ton/a):[a]
<5.2	5
5.2–5.6	4–3[b]
5.7–5.9	3–2
6.0–6.2	2–1

[a] Rates based on 100-score lime.

[b] The higher lime rate is required for the lower SMP buffer value.

Increase the lime rates in Table 5 by 1 to 2 tons/acre before establishment of a new field. Mix lime into the soil at least several weeks before planting. A lime application is effective over several years.

Sandy soils to which fertilizers have not been recently applied sometimes record low pH and high SMP buffer values. In such cases, a light application of 1 to 2 tons lime/acre should suffice to neutralize soil acidity.

For acid soils low in magnesium (Mg) (less than 1.0 meq Mg/100 g of soil), 1 ton dolomitic lime/acre can be used as a source of Mg. Dolomite and ground limestone have about the same ability to neutralize soil acidity.

For existing plantings, monitor raspberry and blackberry leaf manganese (Mn) concentration as an indicator of declining soil pH. As soil pH declines, Mn availability increases, and leaf Mn concentration rises. If leaf Mn during late July and early August is above 300 ppm, check soil pH.

Topdressing is the logical method for lime application to established plantings. A topdress lime application should not exceed 2 tons/acre. Topdressed lime moves downward ½ to 1 inch a year until reaching a depth of 2 to 3 inches. Low soil pH below the 3-inch depth will not be corrected by topdressing lime.

Fertilizer Guide 52, *Fertilizer and Lime Materials,* available from the OSU Extension Service, provides additional information on lime, including a definition of lime score and an explanation of SMP buffer.

Manure

Manure is an excellent source of plant nutrients and serves as a soil conditioner. However, because of its variable nutrient content, increased handling requirement, and nutrient release characteristics, manure requires greater skill on the part of the grower than do commercial fertilizers. Table 6 provides average nutrient contents of manures.

Table 6.—Nutrient and water content of fresh manures.

Kind of manure	Nutrient and water content (%)			
	Water	N[a]	P_2O_5	K_2O
Dairy	87	0.50	0.16	0.44
Beef	82	0.65	0.43	0.53
Poultry	73	1.30	1.02	0.50
Hog	84	0.45	0.27	0.40
Sheep	73	1.00	0.36	1.00
Horse	60	0.70	0.25	0.60

[a] About 25 percent of the N is available the first year.

Using manure to supply plant nutrients requires handling more material compared to commercial fertilizers. Consider an application of 70 lb N/acre. For this N rate, 152 lb urea (46 percent N)/acre would be required. The same amount of N from manure, assuming 1 percent N, requires 7,000 lb/acre. Also, additional manure (5,000 to 7,000 lb/acre) would be required for the first year, as not all of the N is initially available.

The conversion of unavailable N to the available form occurs throughout the growing season. If plant demands exceed the rate of conversion, a deficiency occurs. Conversely, if conversion to available forms is high late in the season, unwanted late-season growth may result.

Losses of nitrogen exceeding 50 percent can occur during manure storage or after application to the surface of the soil. Nitrogen loss is least when fresh manure is spread and worked into the soil immediately.

Manure can serve as a source of weeds and pests. Unless livestock have been fed on weed-free feed, use aged manure that has been composted at temperatures high enough to kill seeds. Aged and composted manures contain lower nitrogen concentrations than fresh manure.

Growers report that centipede-like organisms called symphylans are introduced to western Oregon caneberry fields with manure application. This association is a puzzle since symphylans feed on germinating seeds and young roots. Therefore, weed-free or plant-free free manure should not contain symphylans. High-temperature composting should reduce problems associated with manure-introduced symphylans. If you use manure, check for symphylans before application.

For more information

OSU Extension publications

A List of Analytical Laboratories Serving Oregon, EM 8677, by J. Hart (revised 2002).

Fertilizer and Lime Materials, FG 52, by J. Hart (reprinted 1997).

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Published January 2006.

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Weed Control in Berry Crops

Biographical Information:

Ed Peachey
Oregon State University
Department of Horticulture

Ed is an associate professor in the OSU department of horticulture with an extension and research assignment. I have been working in weed management (veggies and berries) and vegetable production at OSU for about 25 years. Prior to that I worked as an ag extension agent for 3 years in Bangladesh. Vegetable crops that get most of my attention now are irrigated crops grown for processing, vegetable seed crops, and some fresh market vegetables in the Willamette Valley of OR with a Mediterranean type climate and very dry summers. I also do applied research in berry and nut crops. Currently we are evaluating interseeding as a way to improve establishment and survival of cover crops in crops such as sweet corn.

Session Description:

This session will focus on integrated strategies, including herbicides, to control weeds cost effectively in berry crops. Perennial weeds are often the most difficult to control in perennial crops. Herbicides discussed will be both old and new, and will include information on modes of action, strategies to avoid resistance, and how to decontaminate spray tanks.

Conventional Weed Management in Cane Fruit

Ed.Peachey@oregonstate.edu

Horticulture Department

Road map

Integrated management

Identification, sanitation

Useful herbicide now and later

Perennial weeds: your choice

- Bindweed, C. thistle, Quackgrass, Nutsedge,

Blackberries (Marionberries and others)

Raspberries
(Red and Black caps)

7300 Acres in Oregon

Blueberries

9600 Acres in Oregon

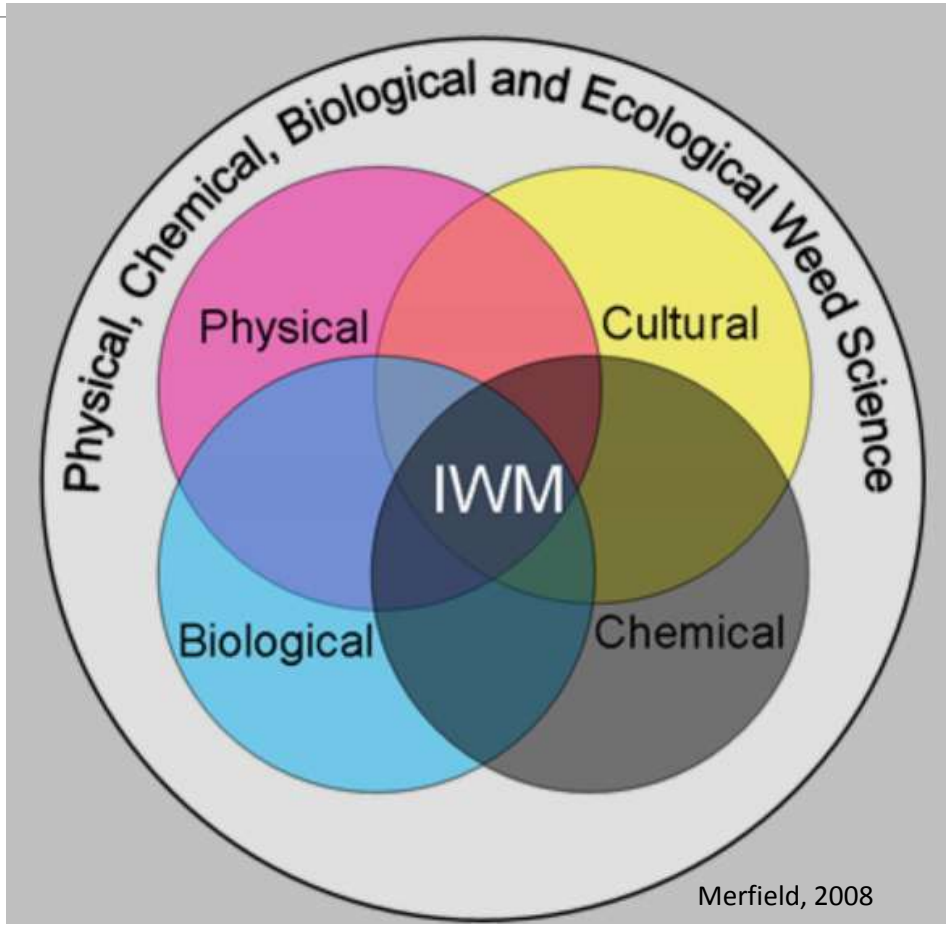
Machine harvest for processed


Hazelnuts
30,0000 A, +3000/yr

Guiding principles for weed management in perennial crops

Integrated strategies

1. Clean up
2. Prevent



Step 1. Clean up before planting

Perennial Horror Picture Show

2. Prevent

Willamette valley sites

Puncturevine

Know your weeds

- Is seed production important?
- How long seed will survive?
- How weed seeds move/introduced

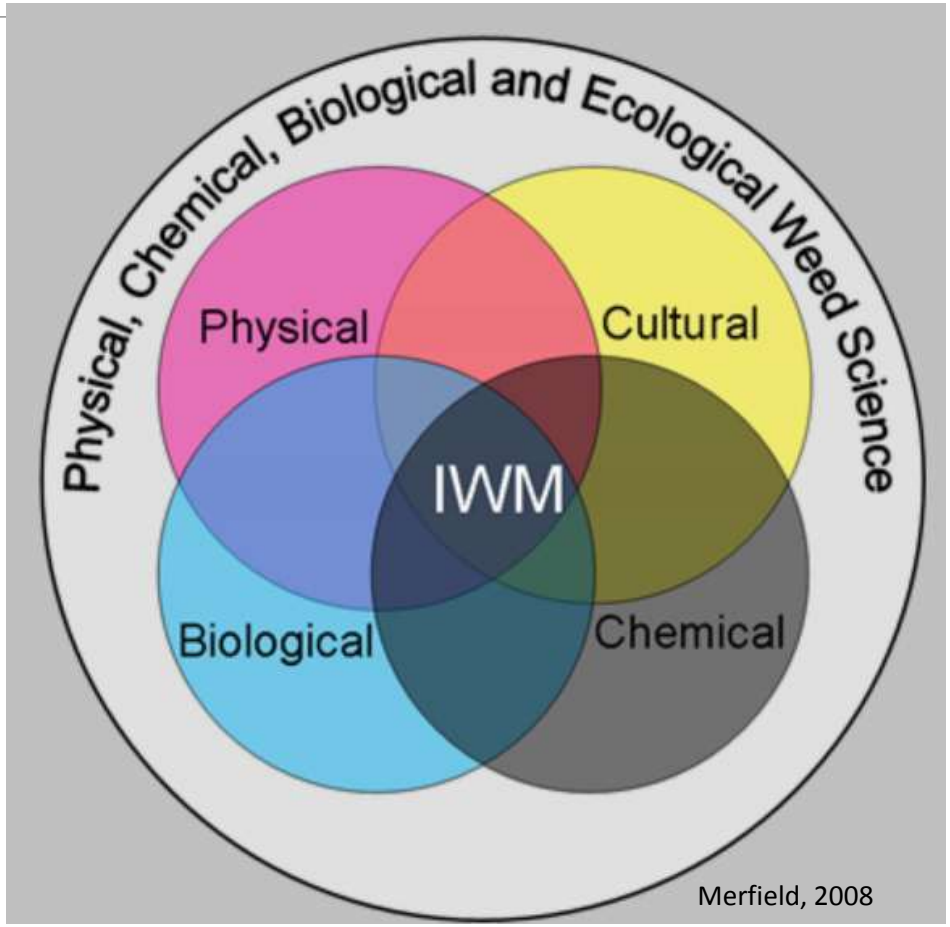
Conventional Weed Control in Caneberries

KINDS OF HERBICIDES

Guiding principles for weed management in perennial crops

Chemical control to complement other strategies

Herbicides as helpers



Newly planted*/Non-bearing

**Devrinol (grass+broadleag)*

**Surflan (both)*

**Trellis (broad)*

Select (grass)

Fusilade (grass)

Basagran (Canada Thistle)

non-bearing = 365 day PHI
*** Softer herbicides**

Soft herbicides for ‘soft’ plants

In early spring, to dormant plants

Devrinol/Surflan plus **Gallery**

after soil has settled and before annual weeds germinate.

- **Snapshot** (Gallery + Treflan granular)
- **Poast, Fusilade,** or **Select** for grasses.

For Bearing Crops

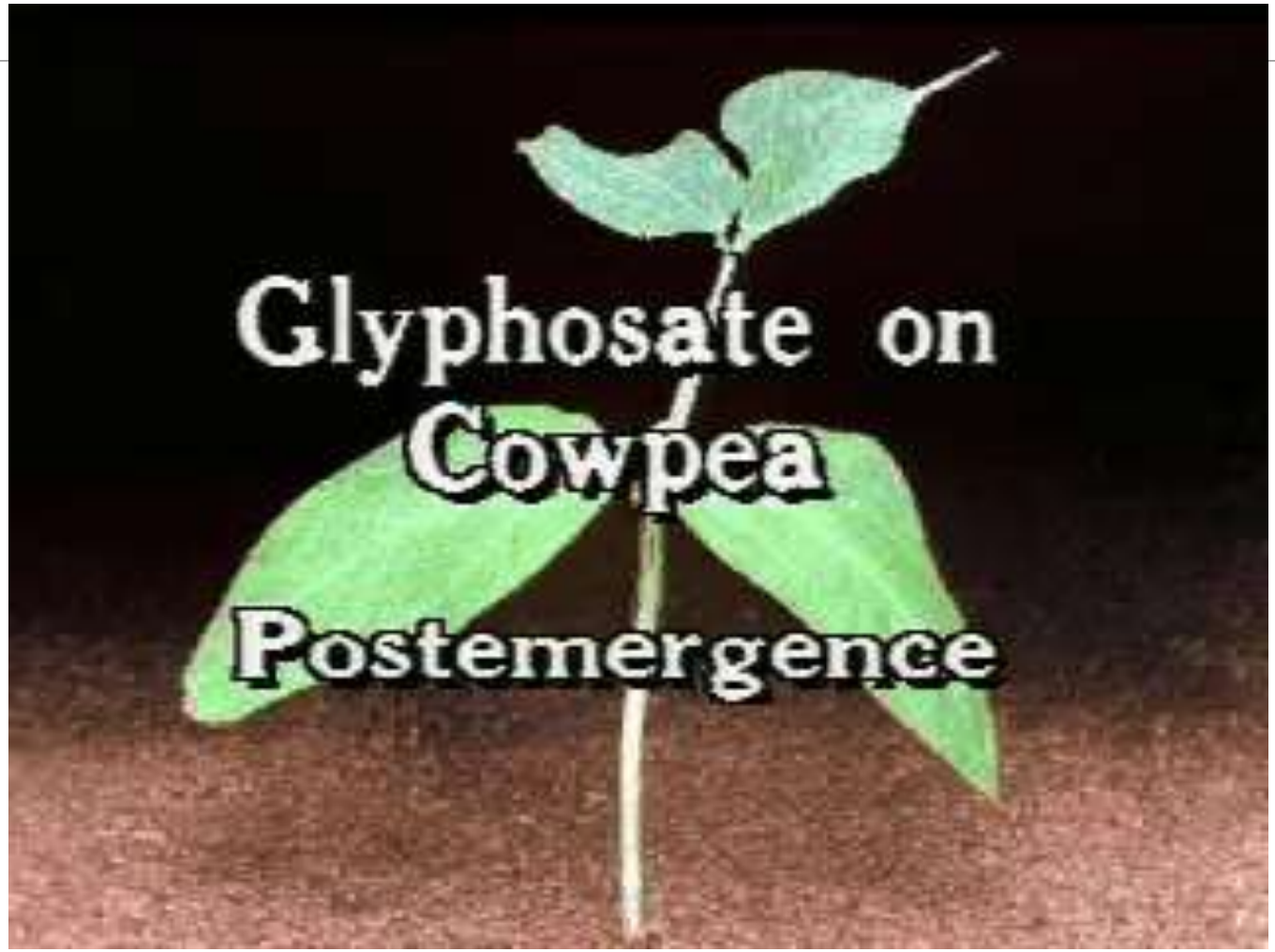
Aim
Callisto
Casoron
Devrinol
Diuron
Kerb
Paraquat
Simazine
Sinbar
Solicam
Surflan

Matrix
Poast

I. Soil (preemergence)
II. Foliar Contact (post)
III. Foliar Translocated

Foliar applied, contact

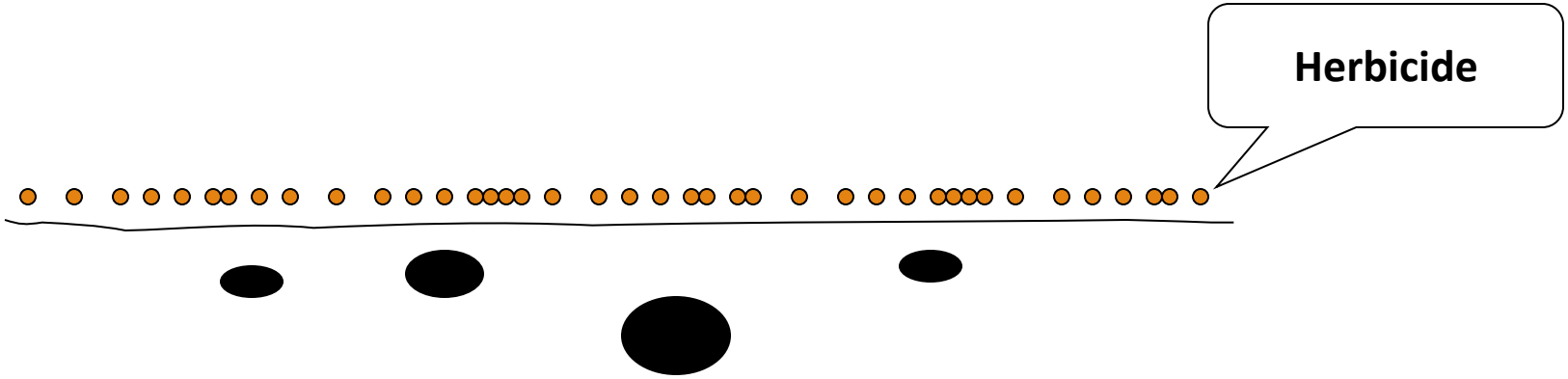
Roundup, Foliar translocated



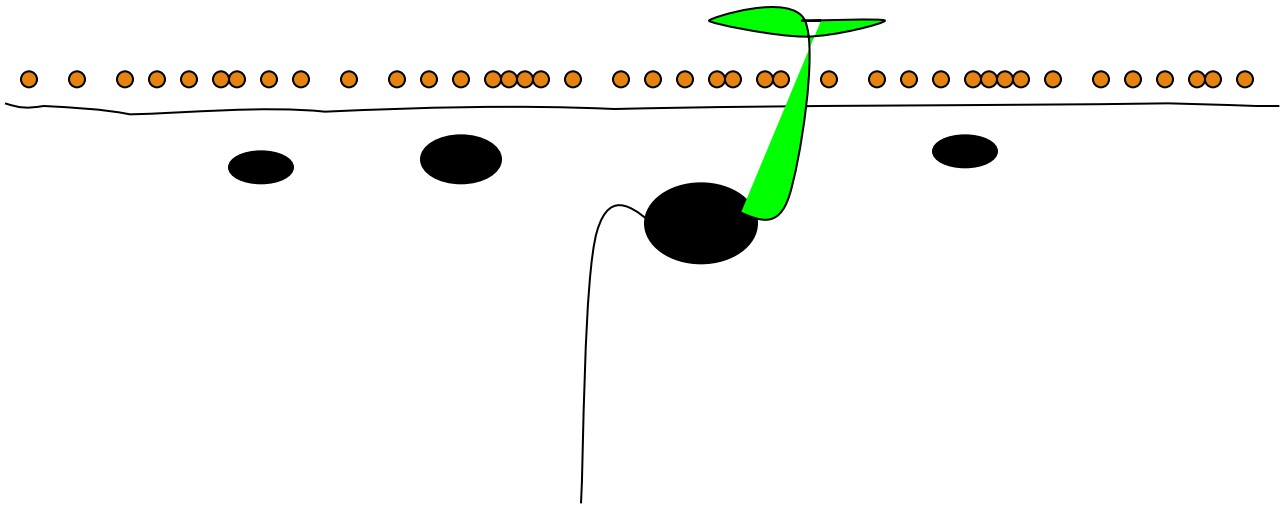
Soil active herbicides

Using PRE Herbicides Effectively

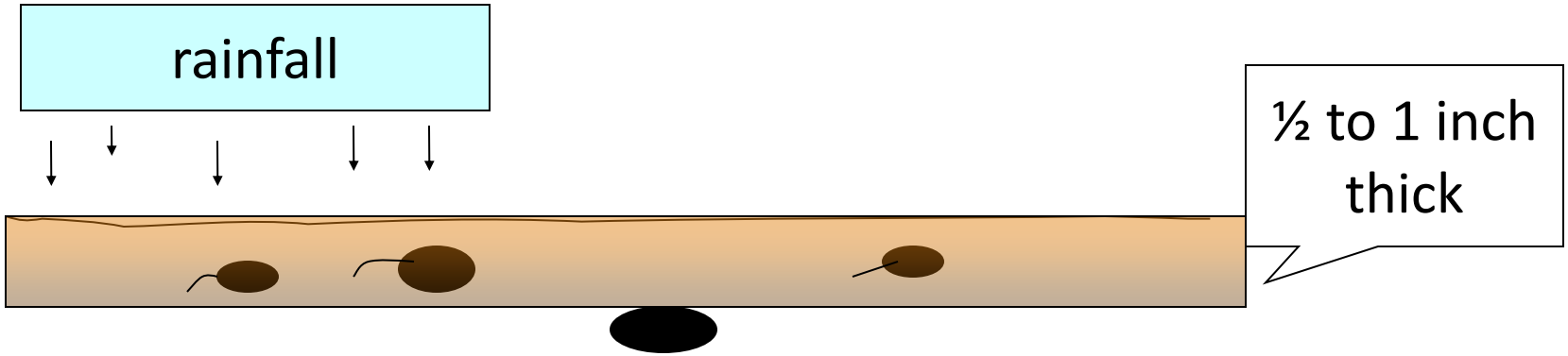
Establishing an herbicide barrier



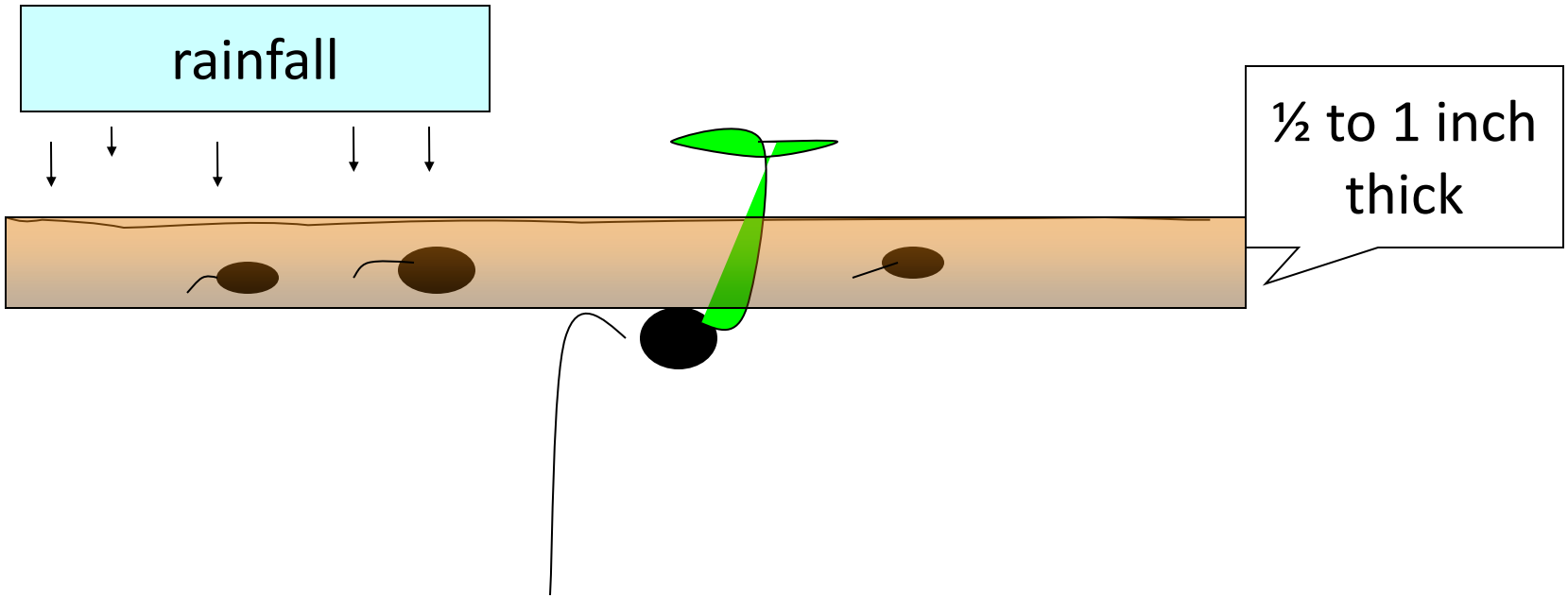
Establishing an herbicide barrier



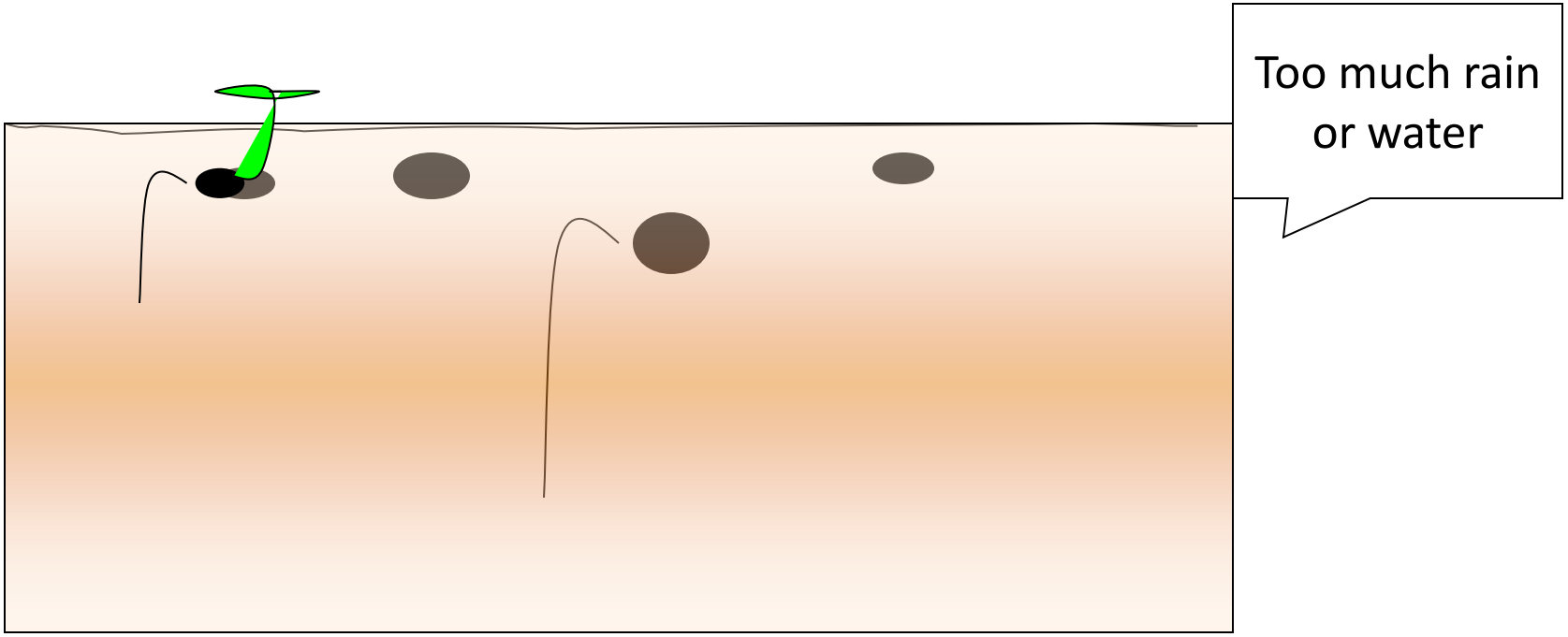
Establishing an herbicide barrier



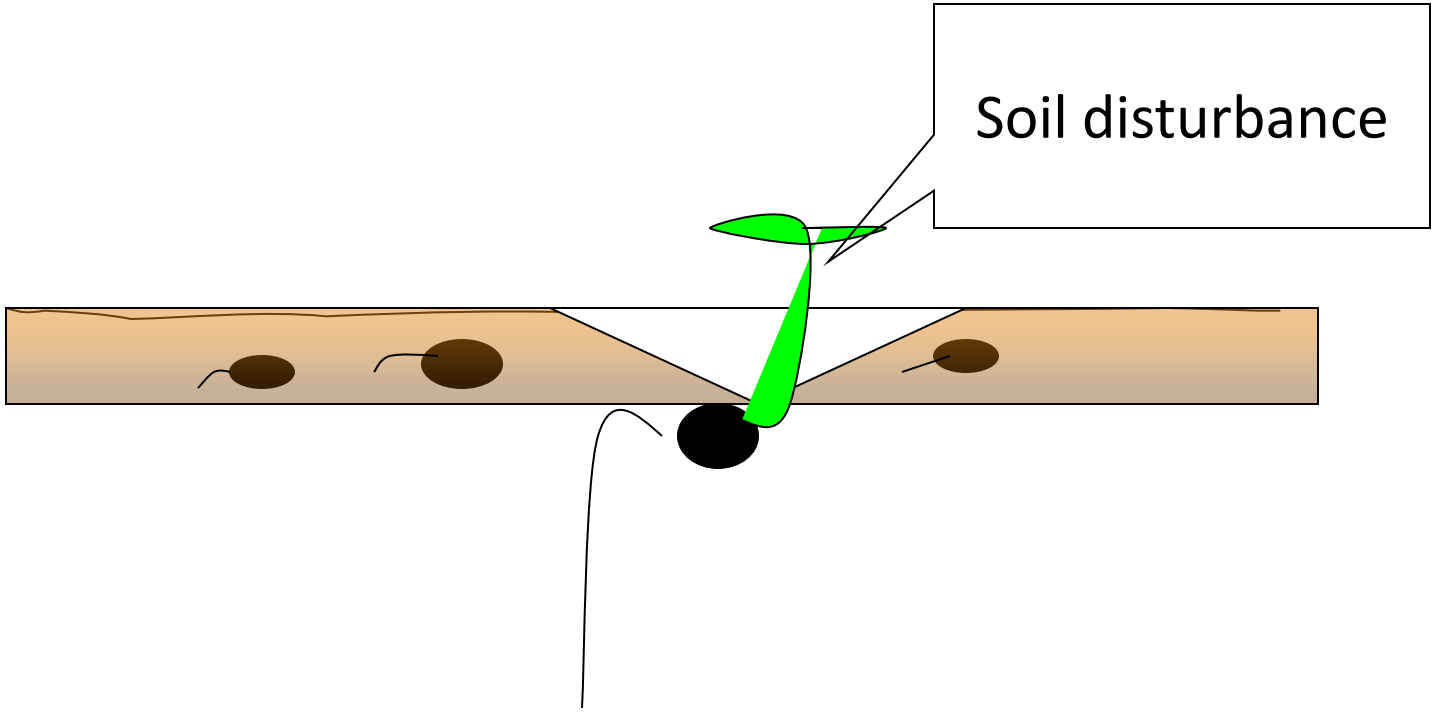
Establishing an herbicide barrier



Establishing an herbicide barrier



Preserving an herbicide barrier



Effective use of foliar herbicides

Usually need an adjuvant

- Crop oils
- Non ionic surfactant
- Nitrogen

Actively growing plant

- Not stressed for water

Timing of application

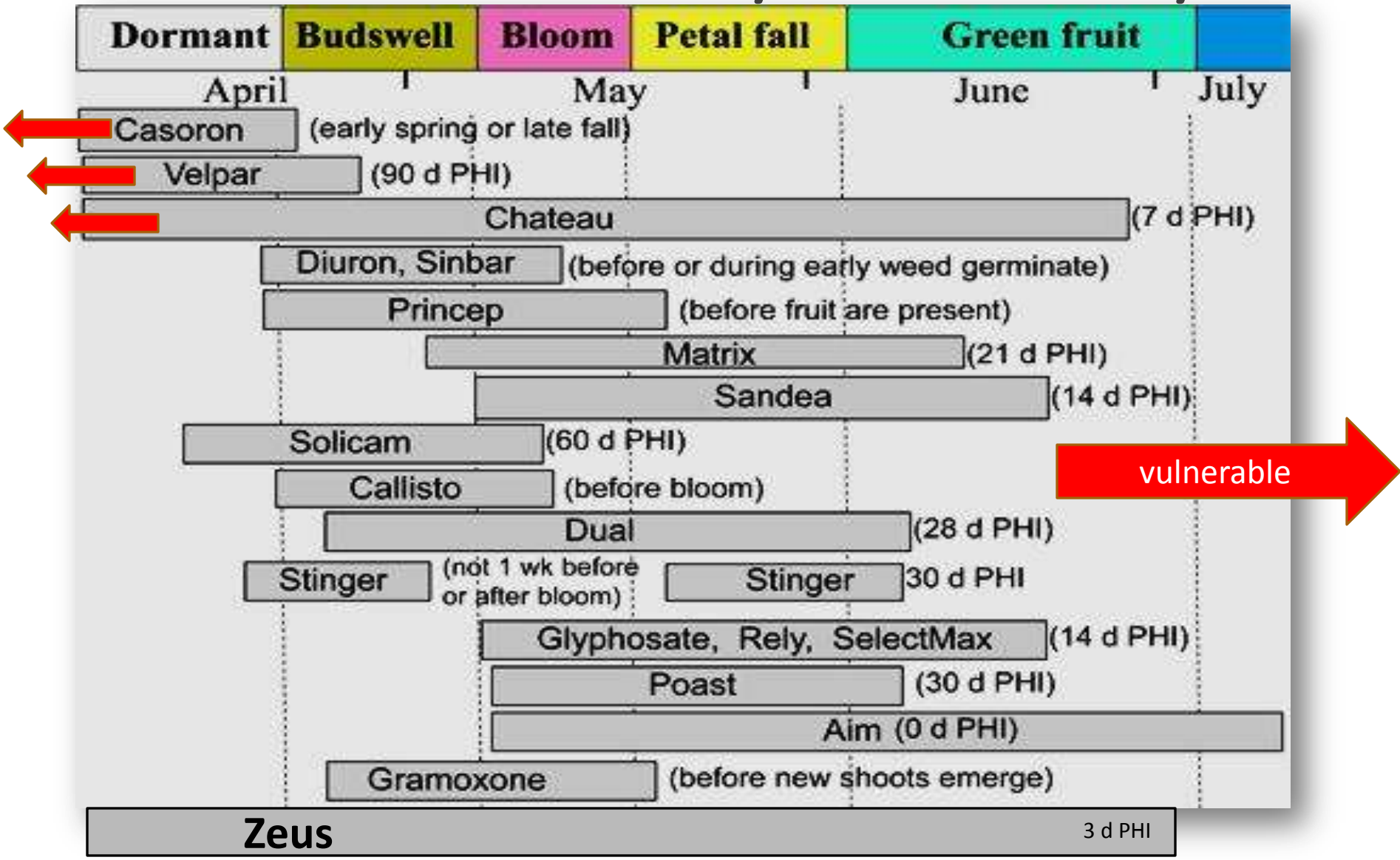
PHI and MRLs

PHI= preharvest interval

MRL=Maximum Residue Limits

- International tolerances
- Country specific
- No MRL for you product means you will not be shipping to that country

Herbicide Summary in Blueberry



Timing of herbicide

Also determined by when water is available to incorporate the herbicide.

When tillage is possible

Trading partner MRLS

Chemical Name (a.i.)	Product Name*	USA	Canada	Codex	EU/UK	Japan	Korea	Taiwan
~ ~ ~ ~ *Herbicides* ~ ~ ~ ~ ~								
2,4-D	Saber	0.2	0.01	0.1	0.1	0.1	0.05	0.02
Carfentrazone-ethyl	Aim	0.1	0.1	NT	0.01	0.1	0.1	NT
Clethodim	Select	0.2	0.2	NT	0.1	NT	0.1	NT
Clopyralid	Stinger	0.5	0.1	NT	0.5	NT	NT	NT
Dichlobenil	Casoron	0.15	NT	NT	0.01	0.2	0.15	NT
Diuron	Karmex	0.1	NT	NT	0.01	0.05	1.0	NT
Flumioxazin	Chateau	0.02	0.02	NT	0.02	0.1	0.1	NT
Glufosinate	Rely	0.15	0.1	0.1	0.5	0.1	0.1	0.1
Glyphosate	Roundup, etc	0.2	NT	NT	0.1	0.2	0.2	0.2
Halosulfuron	Sandea	0.05	0.05	NT	0.01	0.05	0.05	NT
Hexazinone	Velpar	0.6	NT	NT	NT	0.2	0.5	0.01
Mesotrione	Callisto	0.01	0.01	NT	0.05	0.01	0.2	NT
Napropamide	Devrinol	0.1	0.1	NT	0.1	0.1	0.1	0.01
Norflurazon	Solicam	0.2	NT	NT	NT	0.2	0.1	0.1
Oryzalin	Surflan	0.05	NT	NT	0.01	0.08	0.05	NT
Paraquat	Gramoxone	0.05	0.05	0.01	0.02	0.05	0.05	NT
Pelargonic acid	Scythe	Ex	--	--	--	--	--	--
Pronamide (propyzamide)	Kerb	0.05	NT	NT	0.02	0.04	NT	NT
Rimsulfuron	Matrix SG	0.01	0.05	NT	0.01	0.05	NT	NT
S-metolachlor	Dual Magnum	0.15	0.15	NT	0.05	NT	0.1	NT
Sethoxydim	Poast	4.0	4.0	NT	0.1	4.0	1.0	NT
Simazine	Simazine, Princep	0.2	NT	NT	0.01	0.2	0.25	0.2
Sulfentrazone	Spartan	0.15	NT	NT	NT	0.05	NT	NT
Terbacil	Sinbar	0.2	NT	NT	NT	0.1	NT	NT

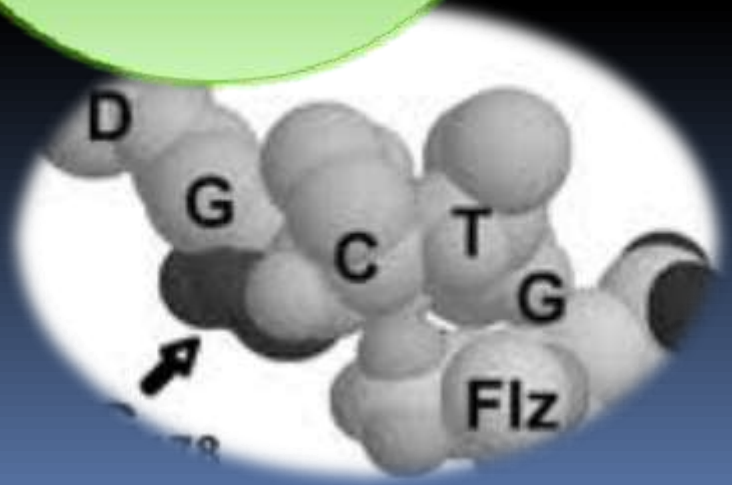
Modes of Action

1 Poast
2 Matrix
3 Kerb
3 Surflan
5 Diuron
5 Simazine
5 Sinbar
12 Solicam
14 Aim
15 Devrinol
20 Casoron
22 Paraquat
28 Callisto

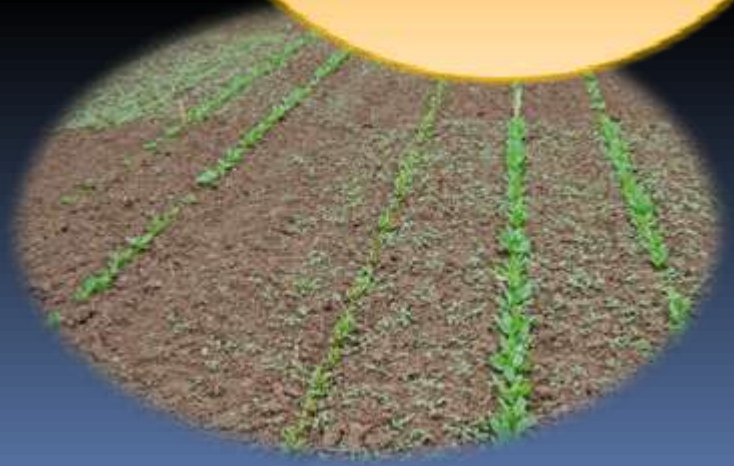
29 unique sites in plants that herbicides attack

Two herbicides
Same mode of action
Different spectrum of action

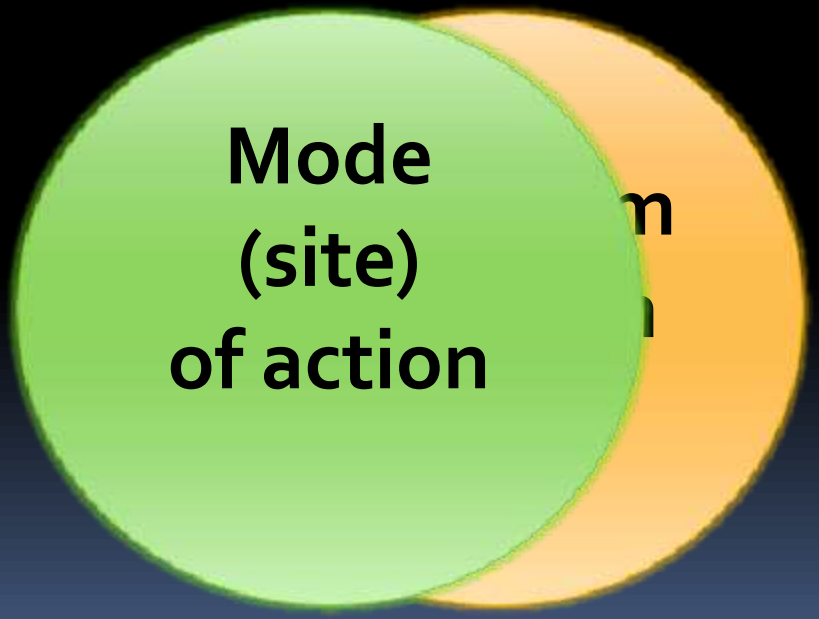
Mode of action (site in plant)



Spectrum of action (weeds controlled)



Two herbicides
Same mode of action
Same spectrum of action



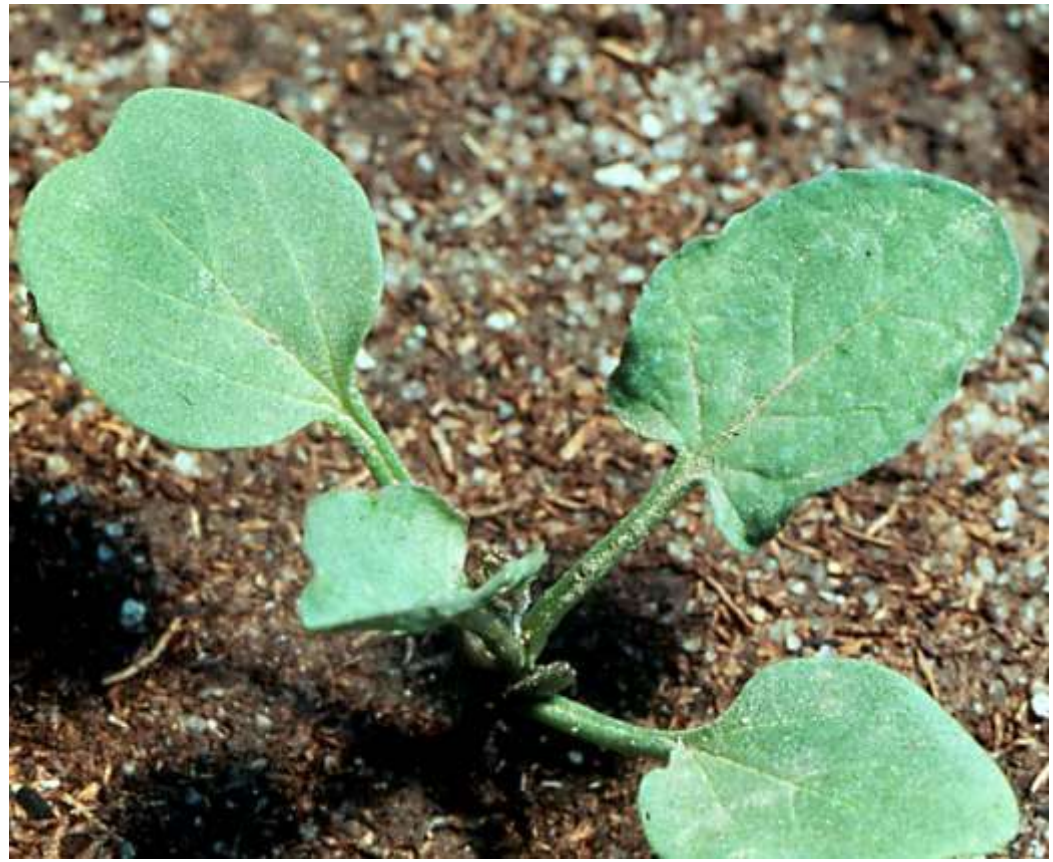
Roundup resistant weeds

Perennial Weed Control

YOUR CHOICE

Field Bindweed

Bindweed: Shoots vs Seedlings



Stopping Bindweed in berries

Stop seed production

Carbohydrate exhaustion?

- Rule of thumb (cultivation only)
  - Every 3 weeks for 2 years
  - Before shoots turn green
- Aim, Rely, Gramoxone: will cause lateral buds to break dormancy
- Carbo exhaustion + herbicide

Herbicides: Casoron (listed as high on label)

Bindweed in check plot
(May 14, 2014)

Grower practice to control bindweed

Blueberries, 2014

Band spray 3 times with Rely until 15 days before harvest (15 d phi).

Spot spray 1 time with Aim up to 3 days before harvest.

Grower practice to control bindweed

After harvest until the first killing frost:

- **Handweeding** at least once to pull out bindweed.
- Occasionally apply **Gramoxone** to kill the base of large bindweed plants.
- Apply **Callisto** to slow growth of emerging shoots at least once.
- Band spray with **Aim** as needed, 3 to 5 times.
- May spot spray with glyphosate if they can avoid getting it on blueberry plants.

>$400/A


Aim 3x
Picture July 23

Bindweed and Canada thistle

Alternate year Marionberries

Aim/Paraquat burndown

Alternate year Marionberries

TYTA LUCTUOSA

the bindweed moth

Lep.: Noctuidae

1-2 generations / year

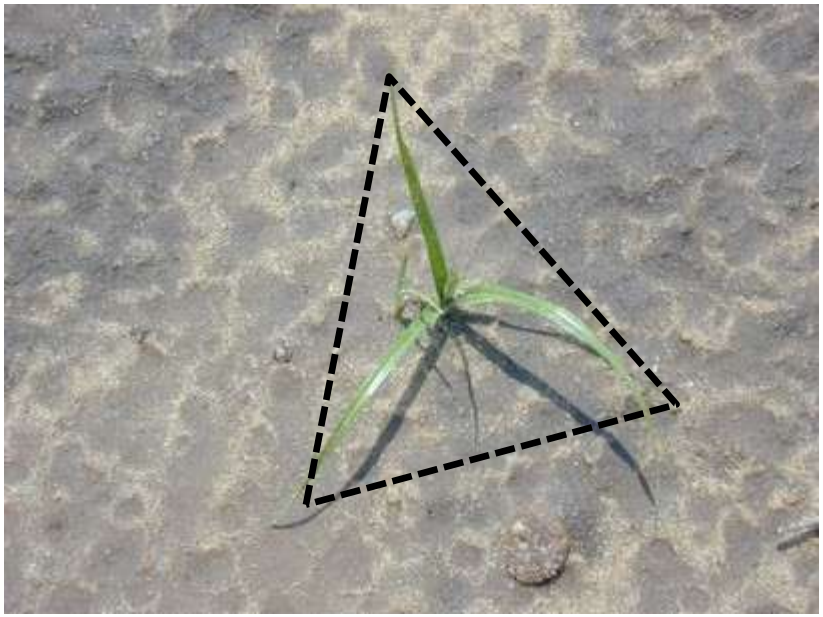
- Pupal diapause
- Daylength, temp cues

Adults are diurnal

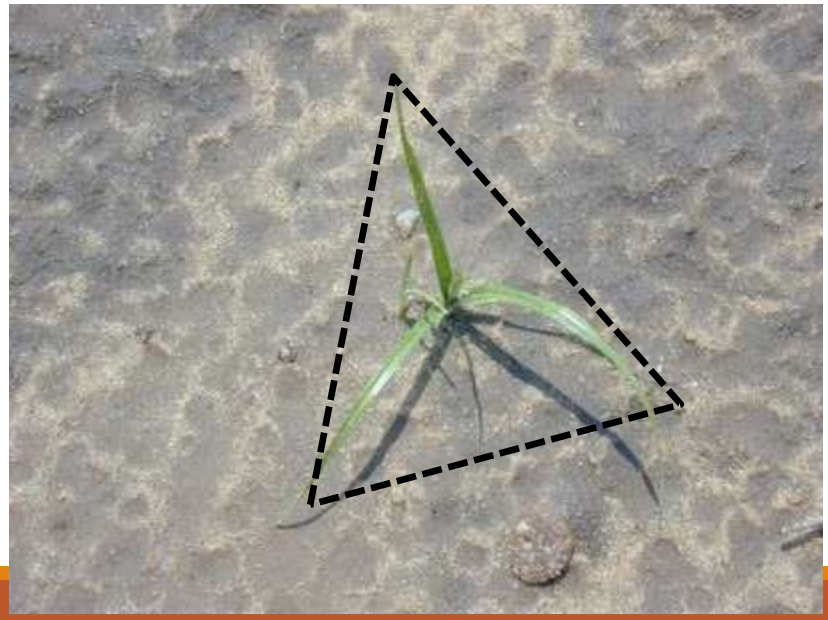
Tyta luctuosa

Bindweed moth

Nutsedge

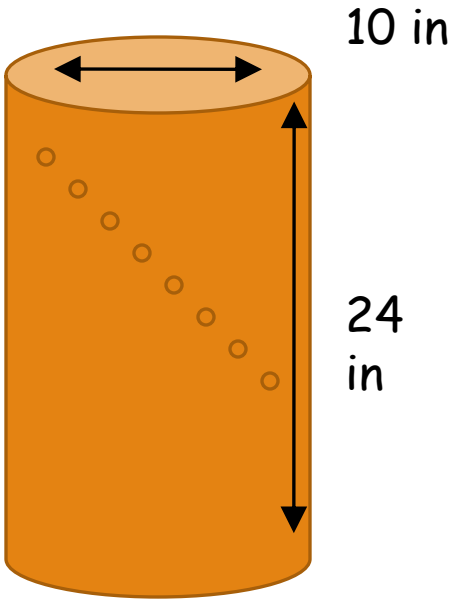


Nutsedge ID



NUTSEDGE TUBER PRODUCTION

JOEL FELIX, MALHEUR STATION, ONTARIO, OR



- Whether buried at 2 or 18 inches
- > 1000 tubers were produced per 1 ft sq

Herbicides labeled for nutsedge Control in berries

	Nutsedge
Aim	
Casoron	X
Diuron	
Glyphosate	X
Paraquat	
Solicam	S
Kerb	
Simazine	
Sinbar	
Sulfentrazone	S (PRE)
Poast	
Basagran (nb)	S (POST)
Fusilade (nb)	

Canada thistle

Canada thistle

Casoron

Basagran

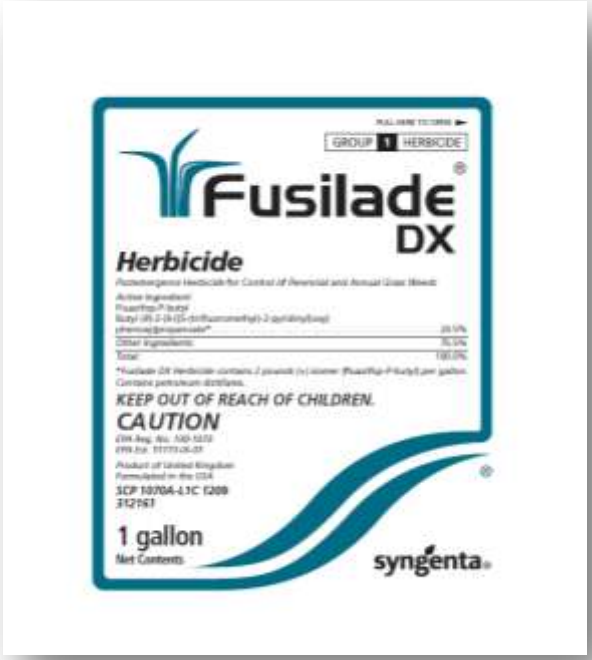
Quack grass

Quackgrass ID

Select Max

Group 1 ACCase

POSTEMERGENCE



Select Max (clethodim)

Post-emergence herbicide

- Controls most annual and perennial grasses
- Annual bluegrass
- Moderately effective on quackgrass,
  - *but better than Poast*
- PHI 14 days

Quackgrass control

- Fusilade 90-95% 365 d PHI
- Select Max 80-85% (PHI 14 d)
- Poast 70-75% (PHI 30 d)

- Apply to actively growing weeds
- Not stressed by drought

Select MAX herbicide now in caneberries

Supplemental Label

VALENT

SELECTMAX HERBICIDE WITH INSIDE TECHNOLOGY™

Crops[1]	Minimum Time From Application to Harvest (PHI)	Annual Grass Use Rate Per Acre[2]	Perennial Grass Use Rate Per Acre[2]	Adjuvant Recommendation[3]	Ammonium Sulfate Recommendation[4]	Special Use Instructions And Restrictions
Caneberry including: Blackberry Loganberry Raspberry, Black Raspberry, Red Raspberry, Wild Cultivars, varieties and/or hybrids of these.	7 days	9 to 16 fl oz	12 to 16 fl oz	NIS at 0.25% v/v	None	Do not apply more than 16 fl oz/A in a single application. Do not apply more than 64 fl oz/A (0.5 lb ai/A) per season. For repeat applications make on a minimum of a 14 day interval.

Summary

Integrated management

Identification, sanitation

Useful herbicides now and later

The big four

- Bindweed, Nutsedge, C. thistle, Quackgrass

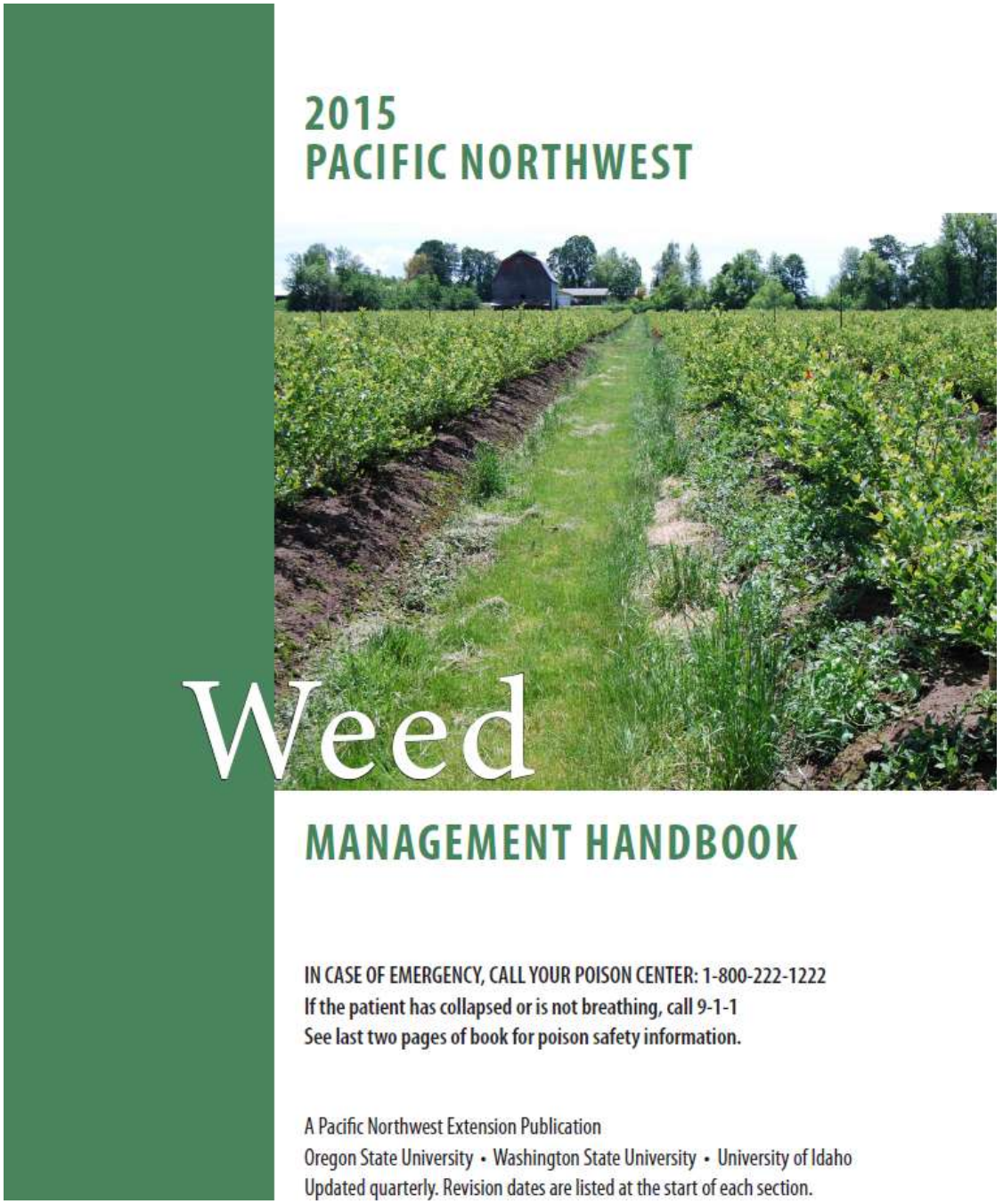
Resources

Agrian website

CDMS website

PNW Weed Handbook

Resources


2015
PACIFIC NORTHWEST
Weed
MANAGEMENT HANDBOOK
IN CASE OF EMERGENCY, CALL YOUR POISON CENTER: 1-800-222-1222
If the patient has collapsed or is not breathing, call 9-1-1
See last two pages of book for poison safety information.
A Pacific Northwest Extension Publication
Oregon State University • Washington State University • University of Idaho
Updated quarterly. Revision dates are listed at the start of each section.

Questions and comments?

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Cane Fruit Disease Survey Results

Biographical Information:
Claudia Nischwitz
Utah State University

Claudia is an Assistant Professor and extension Specialist at USU since August 2010. She works on diseases of plants with focus on vegetable and fruit tree diseases. In addition, she also does diagnostics for the UPPDL lab.

Session Description:

She will talk about the diseases we found in a raspberry survey last year.

Raspberry disease and pest survey

Claudia Nischwitz

Assistant Professor and Extension Specialist

Email: claudia.nischwitz@usu.edu

UtahStateUniversity
COOPERATIVE EXTENSION

Introduction

- In 2015 we surveyed 17 raspberry patches for diseases (viruses, nematodes, fungi), nutrient deficiencies and insect pests across the state

Results

- 76% of raspberry patches had raspberry bushy dwarf virus; no other virus was observed
- 24% had dagger nematodes that could spread Tomato ringspot virus; no other nematode species of concern were found
- 24% had crown borer and spider mites
- 6% had horntail
- No Tomato ringspot virus was found
- No berry rot or cane blight

Results

- Most common nutrient deficiency was manganese, followed by zinc
- Frequently high levels of nitrogen and iron
- Herbicide damage

Raspberry bushy dwarf virus

- Up to 100% yield loss
- Introduction and spread:
  - Introduced on infected planting material
  - Pollen and seed transmitted
- Symptoms (name misleading):
  - Interveinal chlorosis or leaves turn yellow; some varieties show no foliar symptoms
  - Crumbly fruit
  - Yield loss
  - Some varieties like “Meeker” have shorter canes

Raspberry bushy dwarf virus

http://www.omafra.gov.on.ca/english/crops/hort/news/hortmatt/2013/05hrt13a1.htm

http://www.fruit.cornell.edu/tfabp/Dom/may11.htm

Raspberry bushy dwarf virus

http://www.apsnet.org/publications/imageresources/Pages/march_87-3-3.aspx

Blackberry

Raspberry bushy dwarf - management

- Planting certified disease-free plants
- Resistant varieties:
  - ‘Haida’, ‘Chilcotin’, ‘Willamette’
- Remove infected plants

Nutrient deficiencies

Manganese or zinc deficiency

Iron deficiency

http://www.ext.colostate.edu/mg/Gardennotes/223.html

Magnesium deficiency

- Soil sterilants can cause similar symptoms

Thank you!

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Berry Eating Insects and Invasive Pests Update

Biographical Information:

Diane Alston
USU Extenstion
Department of Biology, Utah State University

She has over 30 years' experience in integrated pest management, or IPM, the approach to using multiple pest suppression methods in combination to lower pest populations below economically damaging levels. Diane works with the horticultural industries and gardeners in Utah. She conducts research and education outreach on fruit, vegetable, and ornamental insect and mite pest management.

Session Description:

Diane will introduce the primary insects that directly attack berry crops in Utah, and share insights into IPM insect management strategies. She will also provide updates on the status of recent invasive insects in Utah that may affect berry crops, such as the spotted wing drosophila and brown marmorated stink bug

Berry-Eating Insects & Invasive Pest Update

Diane Alston, Entomologist
Utah State University
Urban & Small Farms Conference
February 17, 2016
Viridian Center, West Jordan, UT

UTAH PESTS

UtahState University

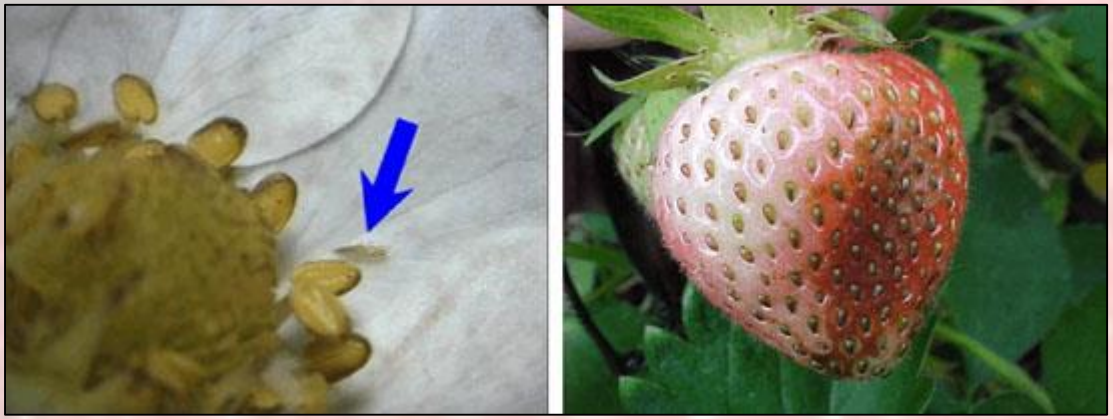
Berry-Feeding Insects

- Early Season – bloom to fruitlet
  - Thrips
  - Lygus bug
- Late Season – mature fruit
  - Stink bugs
  - European earwig
  - European paper wasp
  - Grasshoppers

European paper wasp eating raspberry

Western Flower Thrips

Thrips larva (left) & adults
~1/20 inch long



Thrips feed on flowers & fruit with punch-and-suck mouthparts

Scouting for thrips in blackberry

Thrips blossom blast
on sweet pea

Distorted fruit with
pronounced seeds

Thrips Insecticides - Bloom

- Commercial
  - acetamiprid (Assail; 1 d PHI)
  - Imidacloprid (Admire Pro; 3 d)
  - diazinon – prebloom only to prevent bee kill (7 d)
  - spinetoram (Delegate; 1 d)
  - spinosad (Success, Entrust^{Org}; 1 d)
    - allow to dry $\geq$ 3 hr before bee activity
- Home use
  - acetamiprid (Ortho Max), azadirachtin^{Org}, bifenthrin, carbaryl, insecticidal soap^{Org}, malathion, permethrin, pyrethrin^{Org}, spinosad^{Org}

Wild bee pollinating raspberry flowers

Read and follow label directions carefully!

Lygus Bug
Western Tarnished Plant Bug

Lygus hesperus
~1/4 inch long, yellow V on back
Piercing-sucking mouthparts

Early feeding causes fruit distortion: “cat-facing”, due to damaged seeds - piercing

Lygus bug nymphs

Cultural & biological management:

- Alfalfa hay cutting
- Weed suppression & removal
- Flowering trap crop (careful monitoring)
- Natural predators & parasitic wasps
- Bug-vac

Lygus Bug Insecticides - Bloom

- Commercial
  - *Beauveria bassiana* (Mycotrol[some Org])
  - fenpropathrin (Danitol; 2-3 d PHI)
  - malathion (1 d)
  - thiamethoxam (Actara; 3 d) – post-bloom only
- Home use
  - azadirachtin[Org], bifenthrin, carbaryl, esfenvalerate, kaolin[Org], malathion, permethrin, zeta-cypermethrin

"Cat-faced" strawberry fruits caused by lygus bug

Read and follow label directions carefully!

Stink Bugs

~1/2 inch shield-shaped

Green stink bug, *Acrosternum hilare,* adult (left) and nymph

Mating consperse stink bugs, *Euschistus conspersus*

Barrel-shaped eggs, laid in masses

Deformed, dry berries; Piercing-sucking mouthparts

Release a foul odor that contaminates berries; Use similar cultural mgmt. practices as for lygus bug

Stink Bug Insecticides – Before Harvest

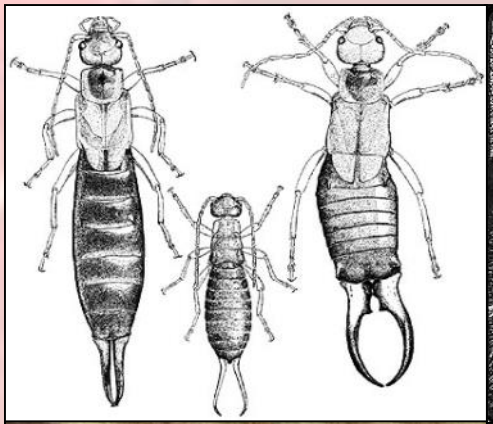
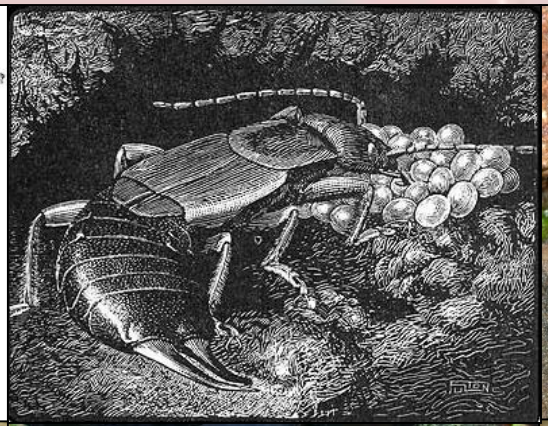
- Knock-down, contact chemicals & repellents
- Commercial
  - bifenthrin, esfenvalerate, fenpropathrin, malathion, zeta-cypermethrin
- Home use
  - acetamiprid, azadirachtin[Org], carbaryl, esfenvalerate, permethrin (raspberry only), insecticidal soap[Org], pyrethrin[Org]
- Adjust air-blast or vacuum-suction cleaner systems on mechanical harvester to reduce insect contamination in berries

European Earwig

Female European earwig (straight cerci)

Nocturnal – feed on fruits & leaves with chewing mouthparts

European Earwig






Earwig Management – Before Harvest

- Same insecticides as for stink bugs
- Insecticidal soap + pyrethrin[Org]
  - reapply every 3-5 days
  - suppressive
  - combine with trapping & habitat management
- Predation by fowl
  - chicken, turkey, duck

Dense & moist ground covers, such as birdsfoot trefoil, can provide attractive daytime refuge for earwigs (not as much for wheat straw & paper mulch)

Earwigs prefer dense, moist refuge

European Paper Wasp

Polistes dominula

European paper wasp (left) has a more slender waist than a yellow jacket (right)

E. paper wasp likes to feed on ripe fruit, but is also a predator

Deformed wing disease

EPW in Utah since 1990s

European Paper Wasp Management

Spring and early summer: beneficial predator of caterpillars

Treat nests with aerosol wasp sprays & remove nests to eliminate larvae developing in cells

Mid summer to early fall: feed on ripe fruit
Trap: fruit juice/yeast bait in pop bottle
Protect fruit with insecticide sprays (same as earwig & SB)

Yellow jacket traps ineffective

USU Extension video fact sheet

utahpests.usu.edu slideshows

Grasshoppers on Berries

Strip the foliage

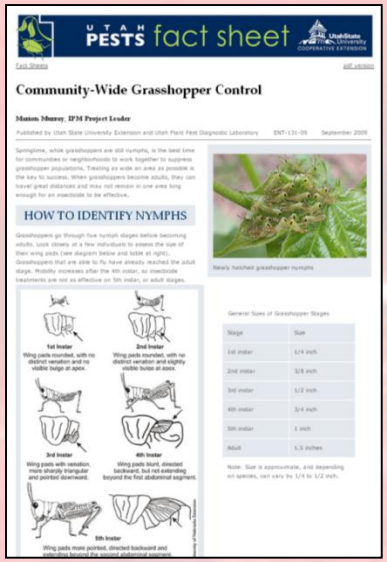
Some eat fruit: e.g., Differential grasshopper, *Melanoplus differentialis*

Late summer to early fall

Hot, dry conditions

Grasshopper Management

- Floating row cover fabric
- Cultivate around plants in fall and/or spring to disrupt overwintering eggs in soil
- Predation by fowl
- Insecticides
  - similar products as for earwigs, wasps, and stink bugs
  - treat a larger area around farm/garden
    - insecticides and baits
      - – *Nosema locustae*, carbaryl


UTAH PESTS fact sheet

Community-Wide Grasshopper Control

Marion Murray, IPM Project Leader

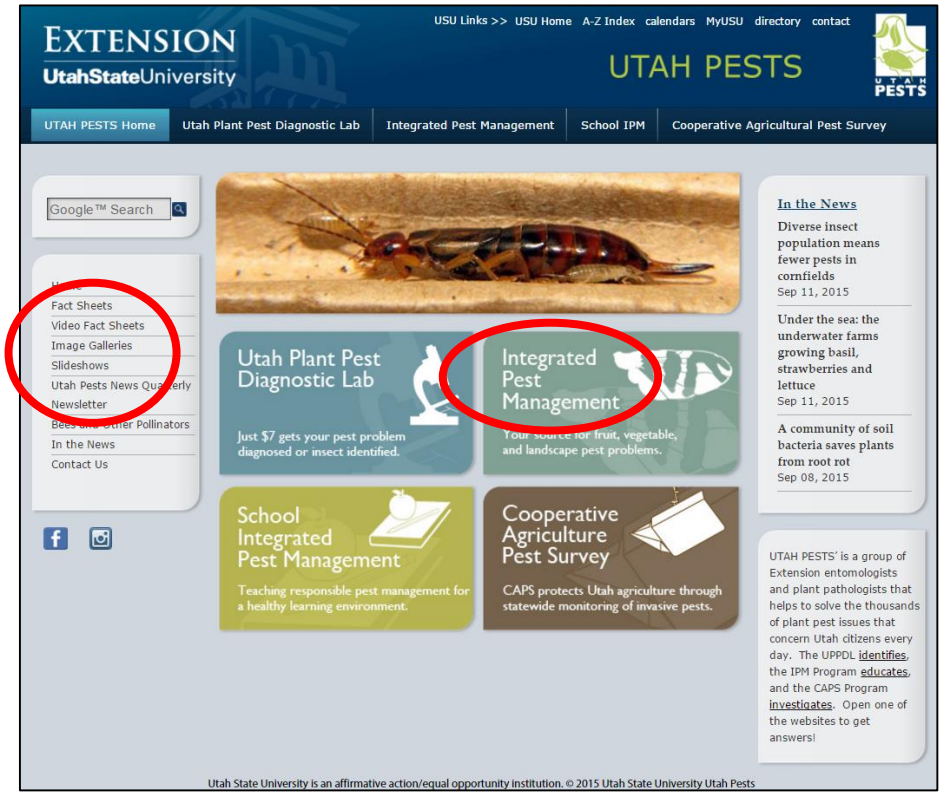
HOW TO IDENTIFY NYMPHS

Community-Wide Grasshopper Control Fact Sheet

utahpests.usu.edu Fact sheets

Utah Pests Online Resources

www.utahpests.usu.edu



Berry Insect Fact Sheets

UTAH PESTS fact sheet — EXTENSION — UtahStateUniversity

Published by Utah State University Extension and Utah Plant Pest Diagnostic Laboratory ENT-179-15 December 2015

Raspberry Crown Borer
[*Pennisetia marginata*]

Diane Alston, Entomologist

Quick Facts

- The raspberry crown borer attacks raspberry plants in northern Utah, causing cane-wilt and death.
- Crown borer has a 2-year life cycle; it spends much of it as a grub (larva) tunneling in the lower cane, crown and roots of raspberry plants.
- To prevent infestation, use only clean planting stock, don't transplant canes between fields, and maintain healthy, non-stressed plants.
- Once a raspberry planting is infested with crown borer: 1) dig and destroy infested crowns and roots, and 2) apply an insecticide as a heavy drench/soak to the lower cane and crown for at least 2 consecutive years in mid-October to target first year larvae, and in the spring before bud break to target overwintered larvae before they tunnel deeply into crowns.

The raspberry crown borer is a stout-bodied clear-winged moth (Lepidoptera: Sesiidae) that resembles a yellow jacket wasp (Fig. 1). It is native to North America, and was first reported from New England states in the mid-1800s. Today, it is a common cane-boring insect pest of raspberry in northern Utah. Although its host range includes all brambles in the genus *Rubus*, it is only known to cause damage to raspberry in Utah. Larvae tunnel in the lower cane, crown, and upper roots of raspberry causing entire canes to wilt and break off at the crown (Fig. 2). Raspberry crown borer infestations are usually not severe, but populations build up slowly over several years, reducing vigor and yield of plantings by as much as 30% (Raine 1962). In a recent survey of raspberry plantings in northern Utah, crown borer was found in 36% of sites; however, plant infestation levels were low, ~1% (Claudia Nischwitz, unpublished data).

Fig. 1. Adult female raspberry crown borer. Black and yellow bands on the body mimic a paper wasp to ward off predators. Females have smooth antennae[1].

HOST PLANTS

Raspberry (red and black) is the primary host infested in Utah; however, all *Rubus* spp. are potential hosts, including blackberry, loganberry, boysenberry, thimbleberry, and salmonberry.

Fig. 2. Raspberry plant crowns damaged by raspberry crown borer larval tunneling. Note hollowed-out crowns and sawdust-like frass from larva[2].

UTAH PESTS fact sheet — UtahState University COOPERATIVE EXTENSION

Published by Utah State University Extension and Utah Plant Pest Diagnostic Laboratory ENT-132-09 September 2009

Raspberry Horntail
(*Hartigia cressonii*)

Diane Alston, Entomologist • Brent Black, Fruit Specialist • Marion Murray, IPM Project Leader

Do You Know?

- The raspberry horntail is a caneboring wasp that can cause crop loss to raspberries in northern Utah.
- Apply insecticides in the spring targeting adults, to prevent egg-laying in the new canes.
- Infested canes often become evident during summer when tips wilt and die back.
- Frequent pruning of infested cane tips during summer can lower horntail populations in a field.
- Several species of parasitic wasps attack horntail larvae within canes and can provide biological control.

Fig. 1. The raspberry horntail larva bears a spine on the tail end[3]

Fig. 2. Raspberry horntail adult[3]

The most injurious insects to caneberries are those that bore within the canes resulting in cane dieback, reduced fruit yields, and even cane death. The most common of the borers attacking caneberries in northern Utah is the raspberry horntail [*Hartigia cressonii* (Kirby)], a type of wasp (Hymenoptera: Cephidae). It was first documented in Utah in the 1980s, and is known to occur in other western states. Horntails spend the winter as mature larvae in the previous year's canes, pupate in the early spring, and emerge as adults to mate and lay eggs in primocanes (first year canes) just after cane growth begins. Early-season egg-laying and protection of the eggs and larvae within canes create challenges for horntail management and potential for high infestation levels in raspberry fields. Recent research to evaluate the susceptibility of raspberry varieties and observations of high parasitism levels of horntail larvae in some fields, provide new insights into raspberry horntail management.

HOST PLANTS

raspberry, other brambles, rose

LIFE HISTORY

There appears to be only one generation per year in northern Utah. Egg-laying extends from early spring to early summer, so larvae of all sizes can be found in canes during the summer.

Mature Larva – Overwintering Stage

- **Size, shape, and color:** cylindrical, white body about 1 inch (25 mm) long; hardened, brown head; short spine on the tail end (Fig. 1).
- **When and where:** spends the winter in a silk-lined cavity in the lower cane.

Pupa

- **Size and color:** tan and about ¾ inch (18 mm) long.
- **When and where:** pupation occurs within the cane in the early spring.

UTAH PESTS fact sheet — EXTENSION — UtahStateUniversity

Published by Utah State University Extension and Utah Plant Pest Diagnostic Laboratory ENT-178-15 October 2015

Rose Stem Girdler
[*Agrilus cuprescens*]

Diane Alston, Entomologist

Quick Facts

- Rose stem girdler is a common cane-boring beetle of raspberry and blackberry in central and northern Utah.
- Larval feeding in the cambium under the cane bark causes spiral grooves and gall-like swellings; injured canes may wilt and break off.
- Severe infestations in ever-bearing and first-year canes of vigorous summer-bearing cultivars can kill out plant stands.
- Avoid planting raspberries and blackberries near infested roses (wild and cultivated), prune and destroy infested canes, use proper fertility and water management to minimize stress to berry plantings, and apply insecticides during adult beetle activity in May and June.

Fig. 1. The rose stem girdler adult is a small, metallic-copper flatheaded beetle. Note the chewing injury to edges of the raspberry leaf[1].

Fig. 2. A raspberry cane with damage from tunneling by a rose stem girdler larva. The cane broke at the girdling site[2].

The rose stem girdler is a small flat-headed, metallic beetle (*Coleoptera*) in the Family *Buprestidae* (Fig. 1). It was first introduced into the eastern U.S. from Europe in the early 1900s in infested roses. It was first reported in Utah in American Fork in 1955. Today, it is a common cane-boring pest of raspberry, blackberry, and wild rose in central and northern regions of the state. It has been observed in Rich, Cache, Box Elder, Weber, Davis, Salt Lake, Utah, Wasatch, and Sanpete counties. Larvae tunnel in the canes causing gall-like swellings and cane breakage (Fig. 2). The rose stem girdler can dramatically reduce stands of red raspberry canes, and even kill out a planting.

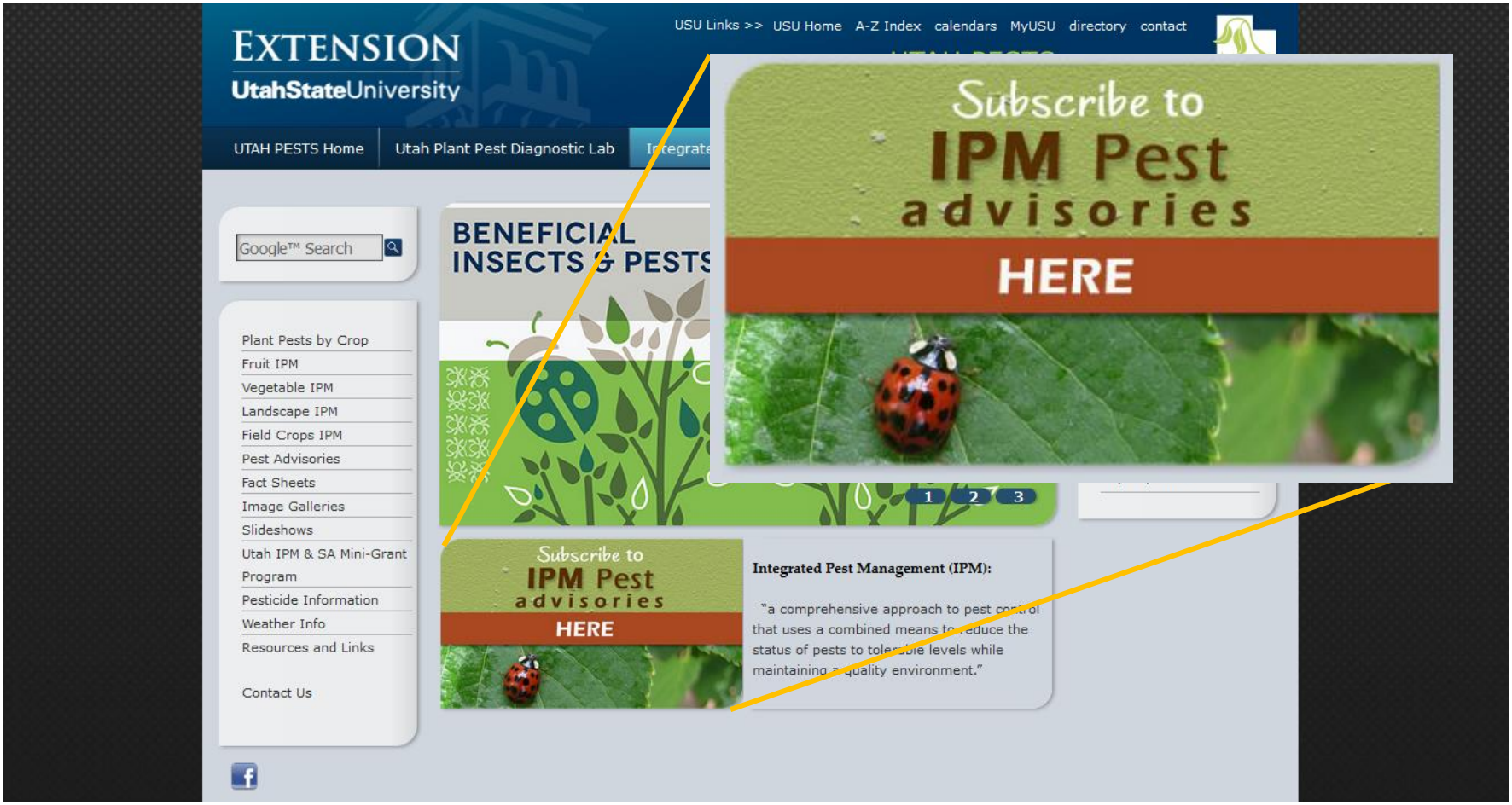
HOST PLANTS

Raspberry (red and black), blackberry, related brambles (*Rubus* spp.), and wild and cultivated roses (*Rosa* spp.) are host plants.

LIFE HISTORY

The rose stem girdler has a single generation per year in Utah. The winter is spent as a 4th instar (4th molt) larva within the pith of canes (Fig. 3). Pupation occurs in the spring when daytime temperatures average 55°F, and adult beetles emerge from infested canes in May to June. Adults rest on plant foliage at night and become active during mid-morning hours as temperatures warm. Eggs

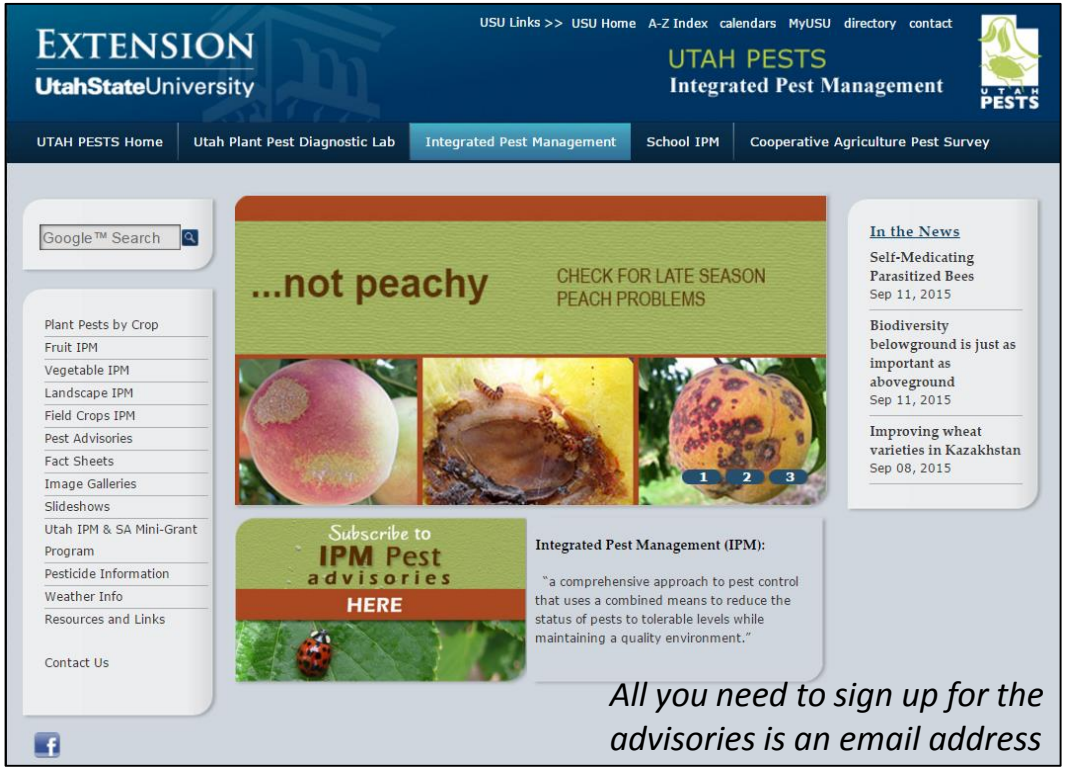
Integrated Pest Management
utahpests.usu.edu/ipm



IPM Advisories:

ornamentals, turf, fruits, vegetables

www.utahpests.usu.edu/ipm



All you need to sign up for the advisories is an email address

Free subscription

Timely info on pest activity

- -insects
- -mites
- -diseases
- -nutrient deficiencies
- -environmental stress

Lots of images!

IPM recommendations

Effective pesticides

IPM Advisories (2015 Examples)

EXTENSION
UtahStateUniversity

Landscape IPM Advisory

UTAH PESTS

Weekly Pest Update for Woody Ornamentals, Utah State University Extension, **April 29, 2015**

What's In Bloom

(Salt Lake City area)

Blackhaw viburnum: first bloom
Crabapple: end bloom
Lilac: bloom - end bloom
Redbud: end bloom
Redtwig dogwood: first bloom
Japanese flowering cherry: bloom
Kwanzan cherry: full to end bloom
Quince: end bloom
Serviceberry: full bloom

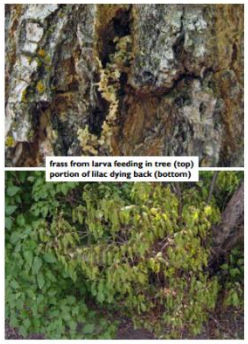
Insect/Disease Information

DECIDUOUS TREES

Lilac-Ash Borer

Hosts: lilac and ash; occasionally privet and mountain-ash

- *treat susceptible trunks now until mid-July*



frass from larva feeding in tree (top)
portion of lilac dying back (bottom)

Lilac-ash borer adults have just started to emerge and females are laying eggs on the bark of ash trees and lilac. Green and white ash (*Fraxinus*) are the most susceptible. Sometimes, mountain-ash (*Sorbus*) and privet are attacked.

Lilac-ash borer does not directly kill trees, but repeated infestations can cause branch dieback and can leave trees susceptible to breakage in storms. Infested trees will have round exit holes on the bark, sawdust-like frass near the holes or at the base of the tree, and rough, swollen, cracked bark, mostly near branch crotches.

This insect overwinters as a larva inside the host plant and pupates in spring, emerging as an adult moth, usually in early to mid May. Emergence and egg-laying continues for about 6 to 8 weeks.

Treatment:

Healthy plants are able to withstand minor infestations, while stressed plants are more susceptible to attack and failure, so give trees optimal water and fertilizer, and prune properly.

Insecticides target the adults. Small trees can be treated by the home gardener, but in order to get thorough coverage on large trees, treatments should be made by a licensed pesticide applicator.

Residential options: Hi-Yield Permethrin, Spectracide Triazicide (lambda-cyhalothrin)

Commercial options: Aceleprym (chlorantraniliprole), permethrin (Astro, Covert, Waylay), or Onyx (bifenthrin)

UtahState UNIVERSITY extension

Turfgrass IPM Advisory

UTAH PESTS

Seasonal Turfgrass Pest Update, Utah State University Extension, Winter 2014

Turfgrass Management

At this time of year, your thoughts may be turning to the potential effects of winter conditions on your turf. "Winterkill" is the general term describing turf loss that may occur as a result of winter conditions. This issue will discuss the actual causes of winterkill and how they may be prevented.

News/What to Watch For

During winter, most turfgrass diseases and insects are relatively inactive. However, one disease complex, the snow molds, may be at work despite recent low temperatures.

Focus on: Winterkill

When turfgrasses die over the winter months, it may generally be described as "winterkill" (Figs. 1 and 2). The term covers a multitude of actual causes of turfgrass death in the winter, which may include snow mold, low temperatures, ice sheets, dessication and crown hydration.

Crown Hydration

Crown hydration is of most concern during the warmer days of late winter or early spring when there is the potential for a day or two of warm daytime temperatures followed by a hard freeze. Turfgrass plants may start to take up water as temperatures warm and then re-freeze rapidly. As a result, ice crystals may form in the crown of the plant, rupturing cells and causing death.

Of the commonly-used cool-season turfgrass species, annual bluegrass and creeping bentgrass are most susceptible to crown hydration problems, though annual bluegrass is the more susceptible of the two because it emerges from dormancy earlier.

Dessication

During the winter when turfgrass plants are dormant or semi-dormant, drying of the leaves or plants (dessication) may cause death. Dessication is typically only a factor on elevated or extremely exposed or windy sites, and areas where surface runoff is rapid.

Figure 1. Winterkill symptoms in turfgrass.

EXTENSION
UtahStateUniversity

Tree Fruit IPM Advisory

UTAH PESTS

Orchard Pest Update, Utah State University Extension, **October 5, 2015**

JUST THE BASICS: Current Treatments

GENERAL

- Clean up fallen fruit to reduce pest pressure for next year.
- Mow tall weeds around trees/install barrier or wire to reduce rodent problems and deer rubbing.
- Make sure all new plantings get white tree paint or tree wrap (base of tree to scaffold limbs) from December through early April, to prevent sun scald.
- Give trees a good watering before the ground freezes.
- Do not do any pruning now; wait until winter (apples) or early spring (peaches).

APPLE & PEAR

- Apply lime-sulfur when the first leaves start turning color to control *blister mites*.
- To reduce *codling moth* for next year, remove bins and debris from the orchard after harvest and remove fruit on the ground or left on the tree.

PEACH/NECTARINE

- Prevent new *coryneum blight* (shothole) infections this fall by applying copper to trees when 50% of leaves have fallen.

Insect and Disease Information

: *information for residential settings* : *information for commercial orchards*

APPLE & PEAR

Blister Mites

Hosts: apple, pear

Blister mite spots cause early fall color change and leaf drop (shown here on apple).

Blister mites and other eriophyid mites can be treated now, and no later than just before leaf drop. They are more of an aesthetic problem, and do not harm the health of the tree. In fact, they serve as a food source for early emerging predatory mites in the spring. In turn, the predatory mites will take care of the harmful spider mites that are active during summer.

Blister mite spots on pear turn black by mid to late season.

If treatment is desired, options include:

- 1.5-2% oil, thoroughly covering the bottoms of the leaves
- Sevin (carbaryl), alone or with 1% oil
- lime-sulfur (only at this time of year, you can mix with oil, but not on drought-stressed trees)

Blister mites belong to a group of mites called eriophyid mites (air-ee-oh-FYE-id). They are so small that they are invisible to the naked eye, but their feeding can cause visible symptoms.

continued on next page

Utah Pests News

Quarterly newsletter on all things “insects and plant diseases” in Utah

UTAH PESTS News

Utah Plant Pest Diagnostic Laboratory and USU Extension — Vol. X, Winter 2016

What's Inside

News Highlights

NEW PUBLICATIONS

Raspberry Crown Borer

Rose Stem Girdler

utahpests.usu.edu

Utah Orchard Leafroller Survey

Leafrollers are a type of moth-caterpillar (Lepidoptera: Tortricidae) that may roll or tie leaves together to form a protective shelter, from which they feed on the leaves and fruits of plants. This group contains many economically important pests that attack fruits, vegetables, and ornamentals. The need for an orchard leafroller survey was prompted by an outbreak of leafroller caterpillars in Utah County tart cherry orchards just before harvest in July 2012.

We surveyed for five species that commonly occur in western U.S. orchards. The survey included five counties of northern Utah from late spring through early fall in 2014 (21 orchards) and 2015 (20 orchards). We used pheromone traps for moths, and feeding injury inspections and beating tray sampling for larvae. In 2014, 11 of the orchards received minimal management, such as limited insecticides, pruning, and irrigation. The remaining orchards were commercially managed.

Our objectives were to determine the species of leafrollers present, types of orchards at greatest risk for infestation, leafroller phenology (timing of moth flight and caterpillar activity), and validate an existing temperature-based (degree-day) model that predicts timing of leafroller treatments.

Obliquebanded leafroller (OBLR) was the primary species caught in the pheromone traps, followed distantly by fruittree leafroller (FTLR), as shown in the graph above. We detected very few European leafroller (ELR) moths, and no omnivorous or pandemis leafrollers. In more limited surveys in 2012 and 2013, OBLR numbers were very high in 2012, the season of the larval outbreak in tart cherries. OBLR moth capture in 2015 increased over those in 2013 and 2014, and although several orchards had high trap captures, the overall catch in 20 orchards was not as high as the total catch in 2012 (6 orchards). Growers were notified when OBLR numbers were high, and populations will be monitored in 2016 to prevent another outbreak.

The survey showed that OBLR is the most common leafroller species in Utah, followed by FTLR.

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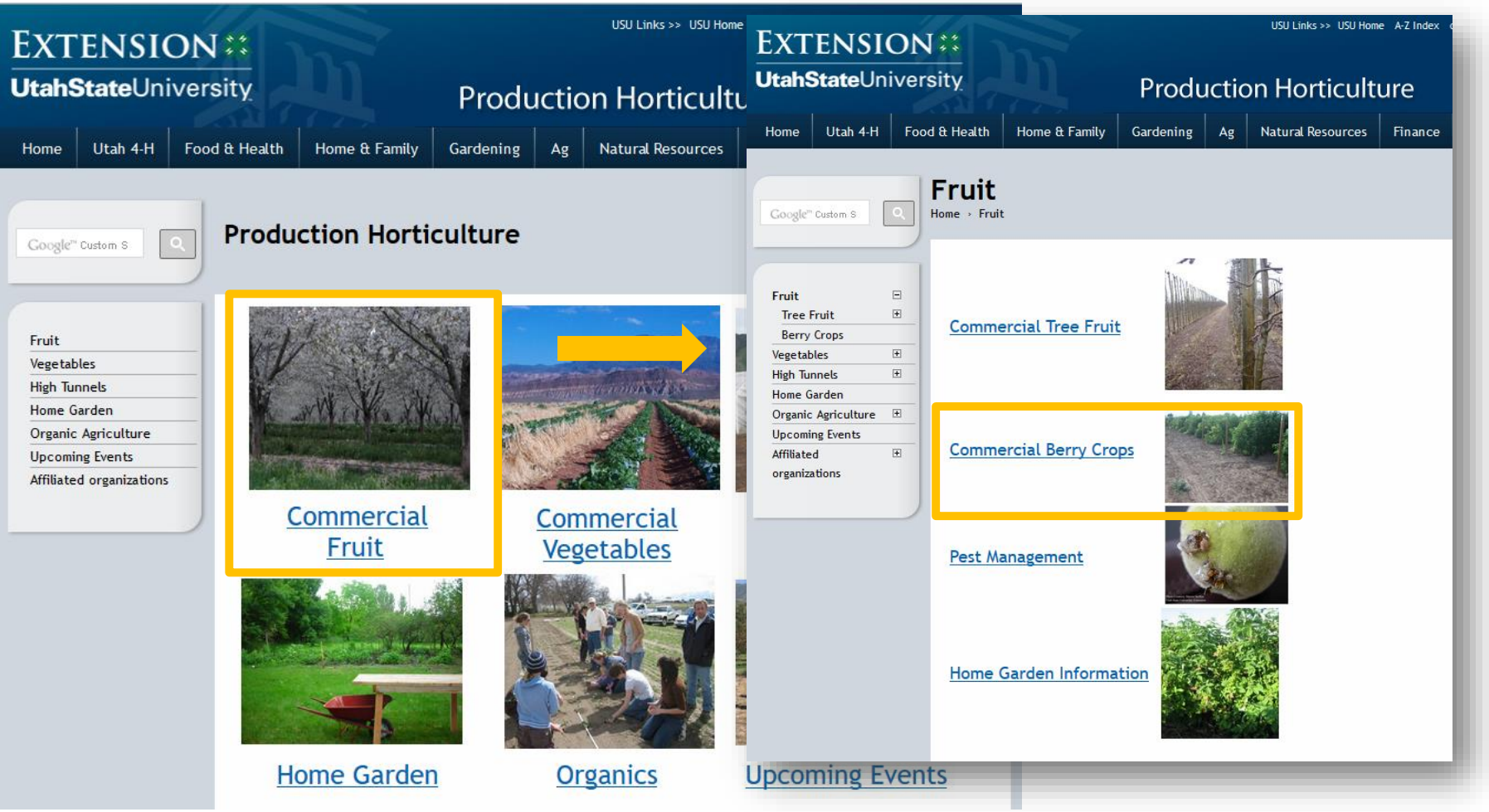
fruit.usu.edu



Raspberry IPM Manual (WSU)

A-Z Index Campuses myWSU WSU Home Search Web/People GO

WASHINGTON STATE UNIVERSITY
World Class. Face to Face.

WSU Whatcom County Extension

Integrated Pest Management

Raspberry IPM Manual
Introduction

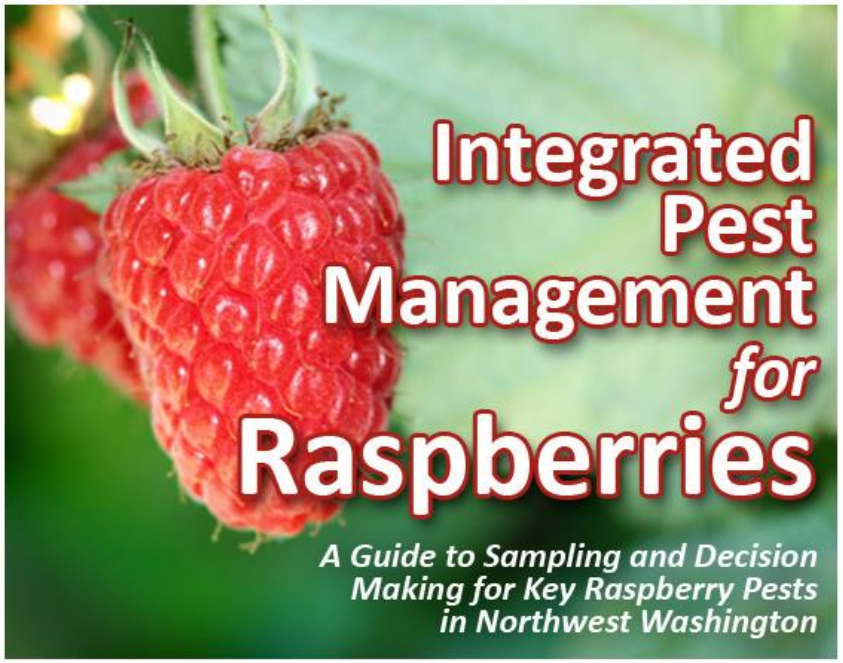
Dormant/Pre-Bloom
Bloom/Pre-Harvest
Harvest
Post Harvest

Scouting Sheets
Decision Making Matrices
Pest Profiles
Weed Management
Pesticide Selection
Pesticides and Water
IPM Field Guide *(pdf)*
Give Feedback

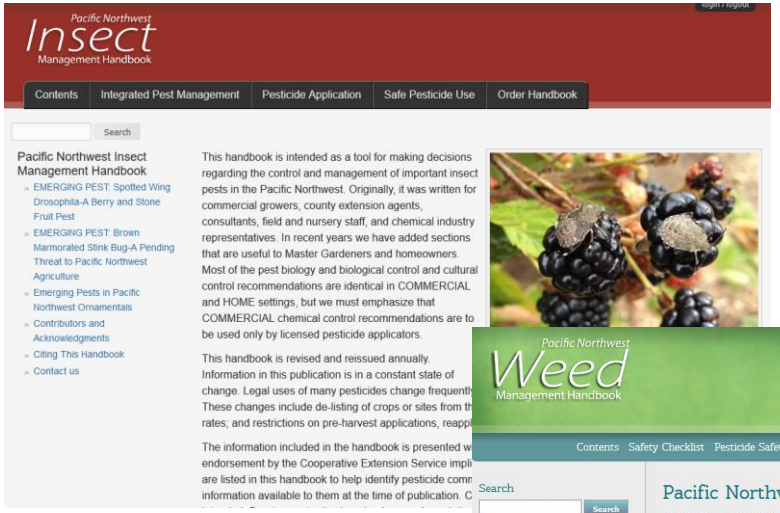
WSU Whatcom County Extension

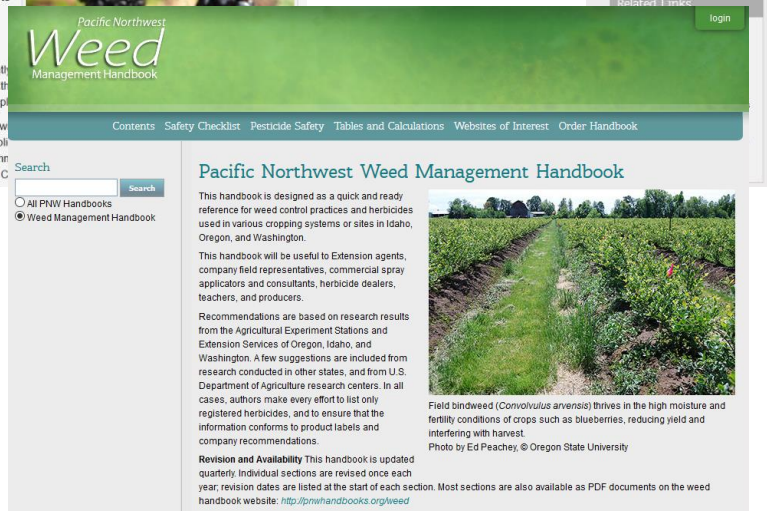
Integrated Pest Management for Raspberries

A Guide to Sampling and Decision Making for Key Raspberry Pests in Northwest Washington.

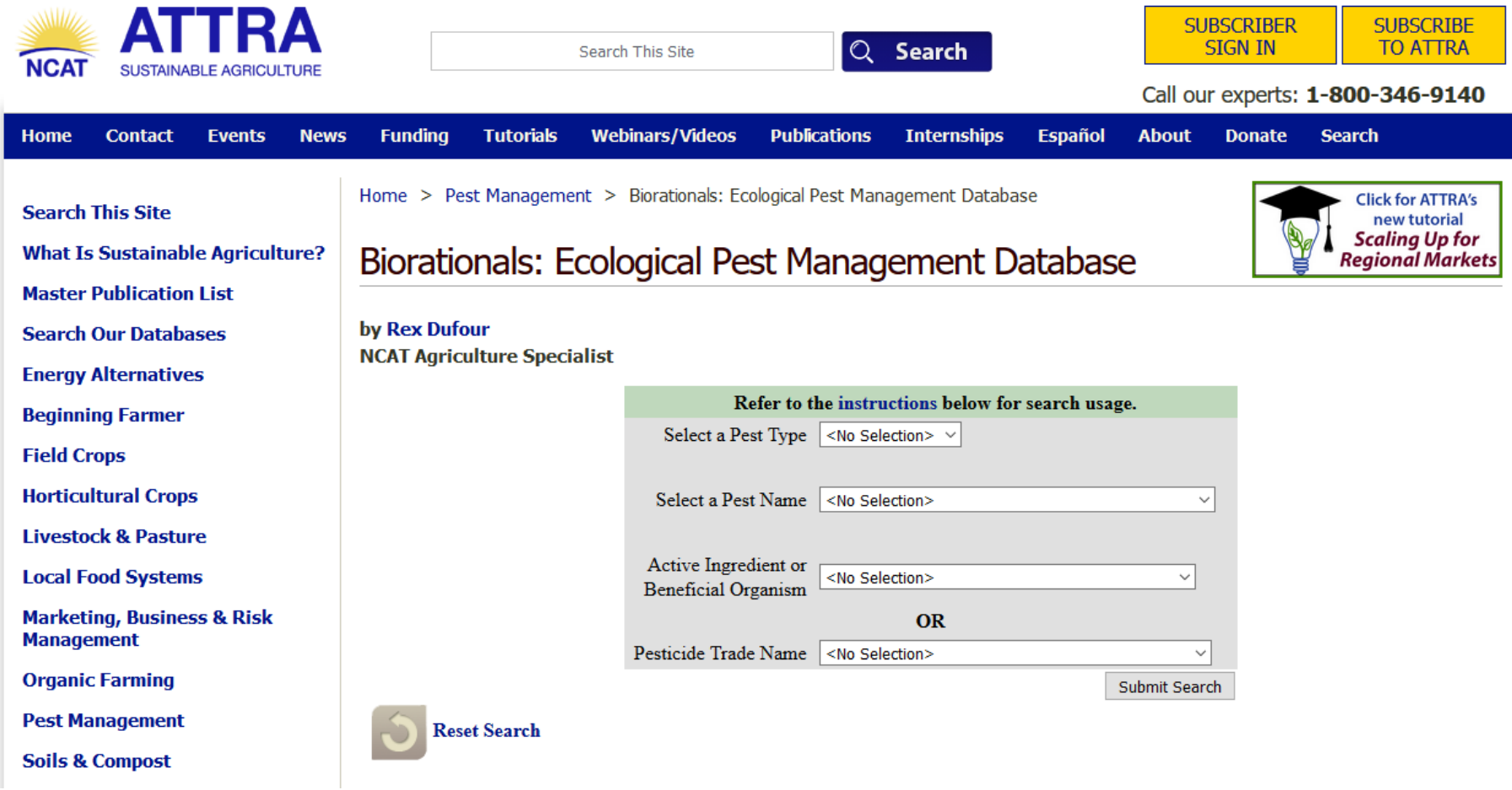


Pacific Northwest Pest Management Handbooks
Google: PNW Handbook for links

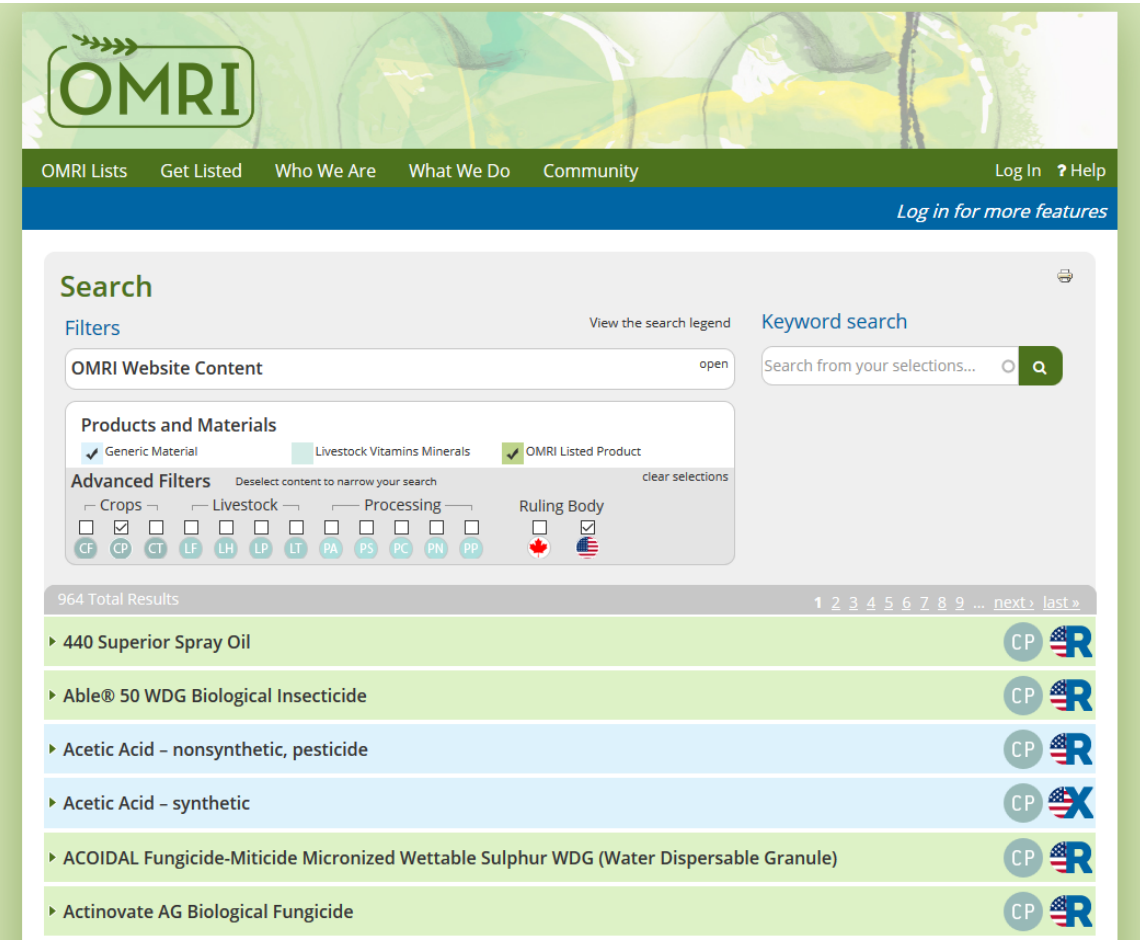




ATTRA Biorationals Database



Listing of OMRI Products



Suppliers of IPM Products

Great Lakes IPM

- wide variety of IPM products

Peaceful Valley Farm and Garden Supply

- monitoring tools, beneficial insects, biological control agents, floating row covers, and organically approved pesticides

Gemplers

- monitoring tools, hand lenses, safety equipment

BioQuip Products

- hand lenses and insect collecting, counting, and preserving supplies; books on insects

Suppliers of Beneficial Organisms

Arbico Organics

- organic supplies for home, garden, and agriculture use

Biocontrol Network

- beneficial insects, mites, nematodes and others

Rincon-Vitova Insectaries Inc.

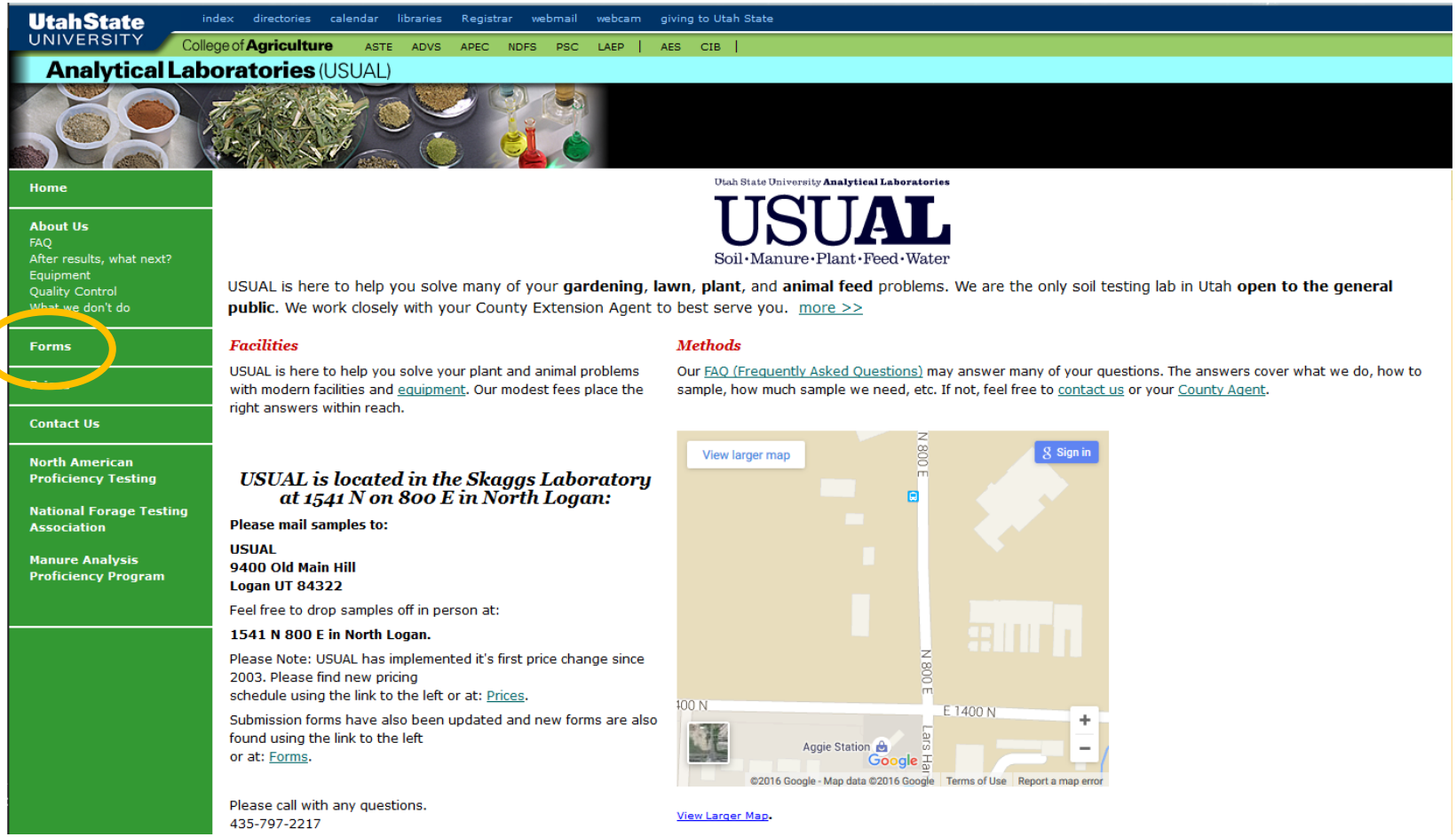
- beneficial insects, mites, and nematodes

Green Methods

Koppert

Utah Plant Pest Diagnostic Lab – utahpests.usu.edu/uppdl

USU Analytical Laboratories (usual.usu.edu)



Current Status of Brown Marmorated Stink Bug and Spotted Wing Drosophila

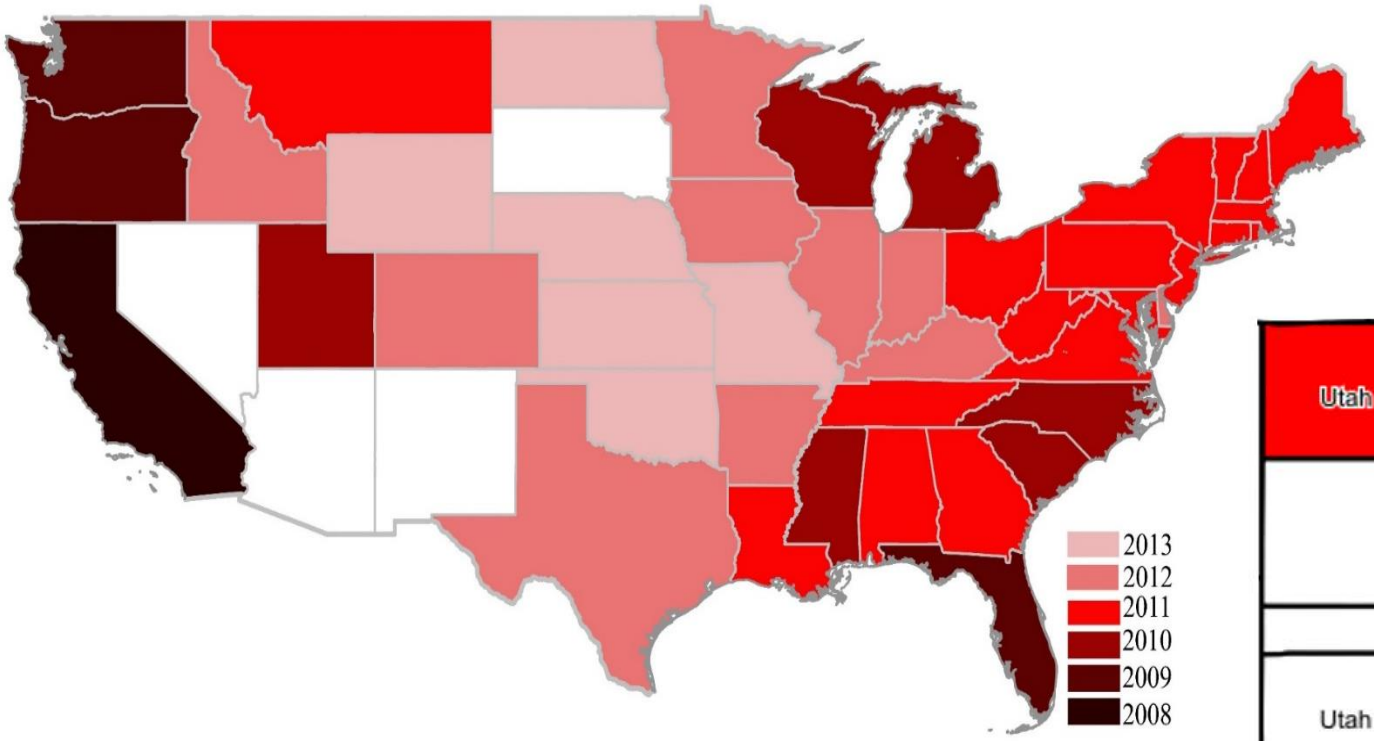
Lori Spears
Utah State Horticulture Association
January 22, 2016

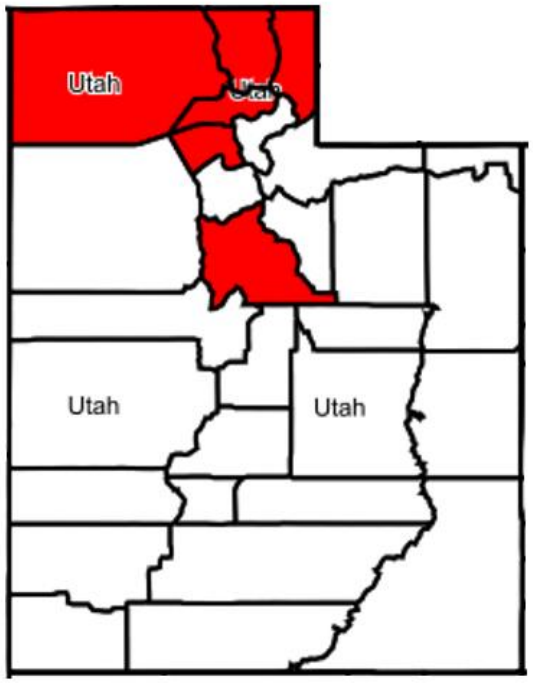
Spotted Wing Drosophila

Spotted Wing Drosophila
(Drosophila suzukii)

- Native to southeast Asia
  - First detected in CA in 2008
  - Introduced to Utah in 2010
- Most *Drosophila* spp. attack overripe and rotting fruit
- SWD preferentially infests ripening and ripe fruit

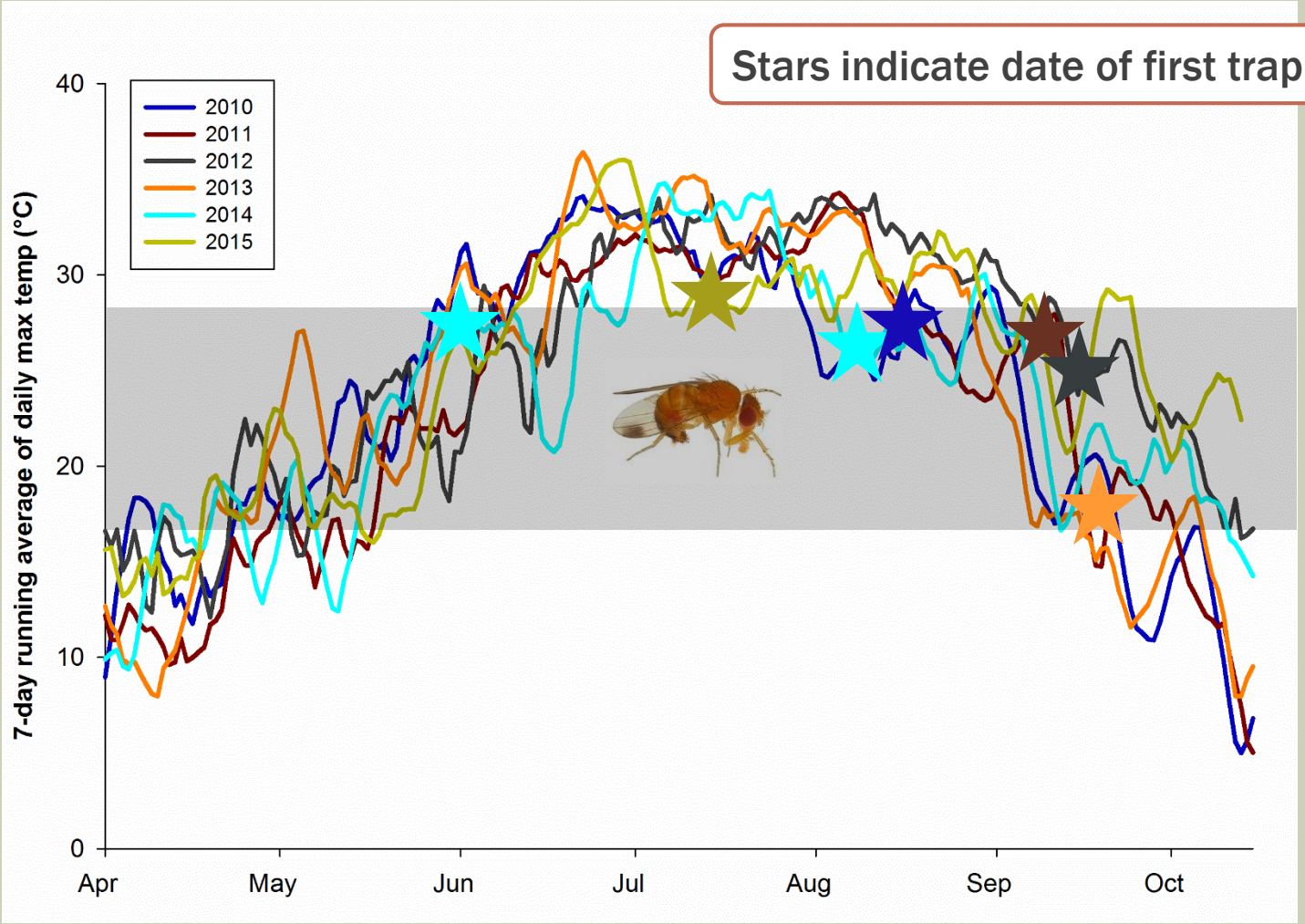
Current Distribution





All Years			
Year	Total # of SWD	1st trap capture	County
2010	73	Aug 18	Davis
2011	61	Sep 8	Davis
2012	16	Sep 17	Davis
2013	23	Sep 25	Davis
2014	3582	Jun 2 / Aug 12	6 counties
2015	6917**	Jul 20	6 counties

SWD adults start appearing in traps after peak summer temperatures have decreased



Life Cycle of the Spotted Wing Drosophila

Drosophila suzukii (Matsumura)

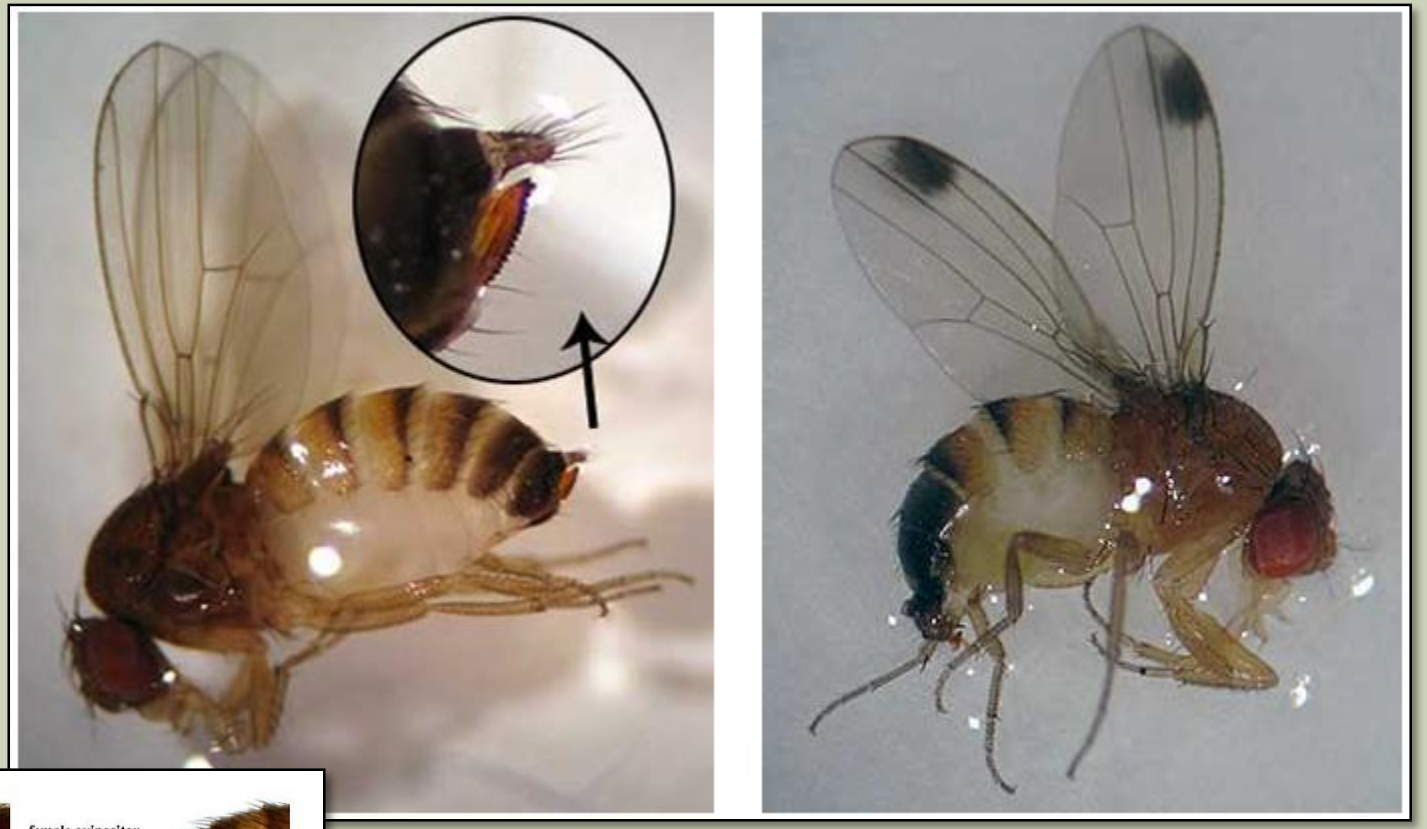
Pupation 4-15 days
Inside or outside of fruit

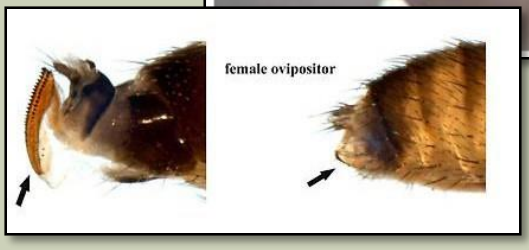
Adults
20-30 days

Eggs 12-72 hours
350+ eggs in a lifetime

Three Larval Instars
5-7 days

Identification





SWD Monitoring
(Adult Activity)

- Pheromone-baited trap (Scentry or Trece)
  - Add 1-2 drops of unscented dish soap
  - Place trap in shaded fruit zone
  - Check trap and change bait weekly
- 2 T yeast, 8 T sugar, 24 oz. water (makes 4 traps)

SWD Management
(Cultural Control)

- Harvest early
- Eliminate fallen and suspicious fruit
- Maintain open canopy
- Repair leaking irrigation lines and minimize overhead irrigation
- Consider removing alternative fruit hosts

African Fig Fly

African Fig Fly
(Zaprionus indianus)

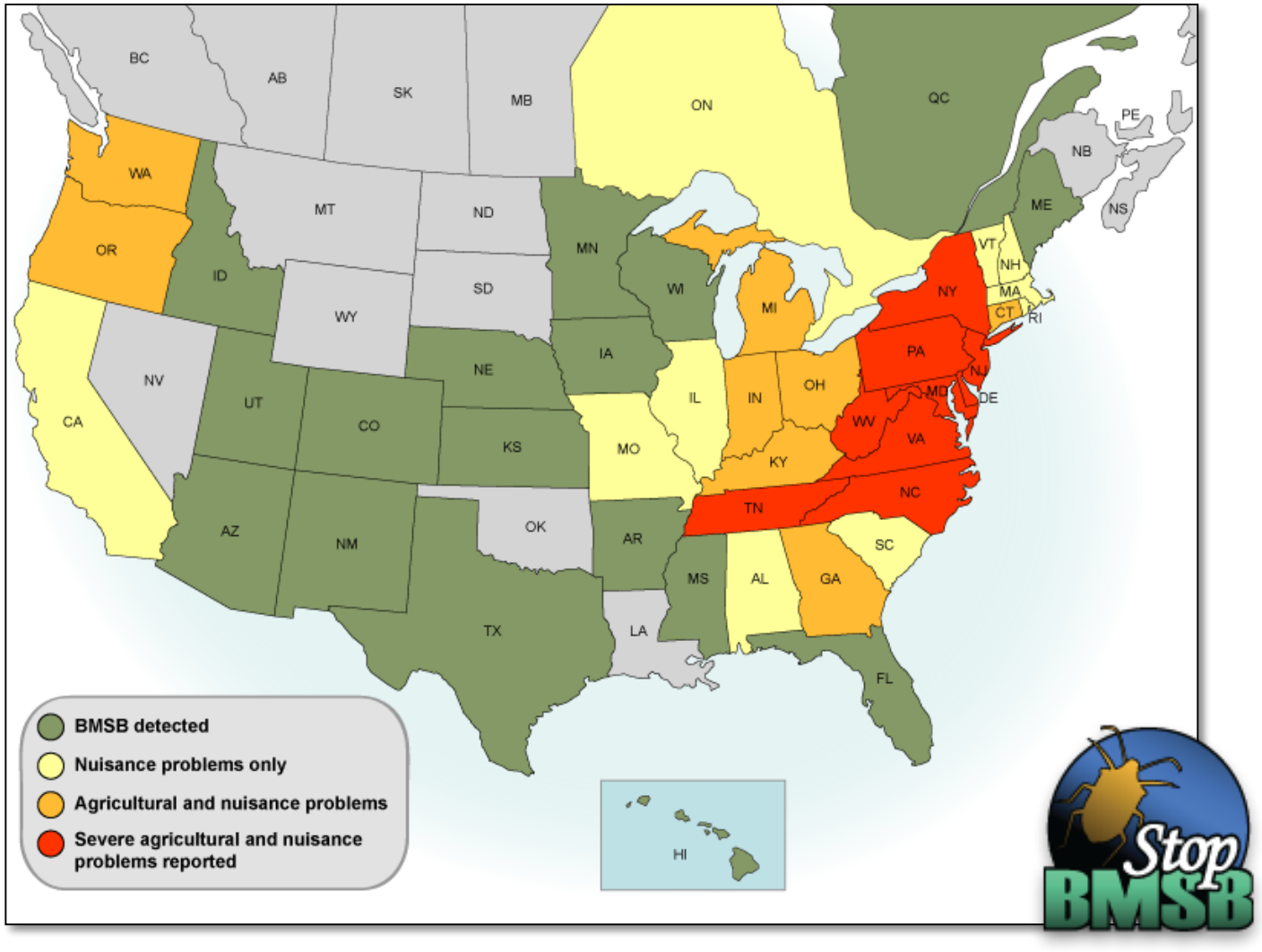
- Native to Africa, the Middle East, and Eurasia
  - Found in Central America
  - First detected in Florida in 2005
  - Detected in Utah in 2015
- Can be distinguished by their "prominent racing stripes"
- Lays eggs in overripe or previously damaged fruit

Brown Marmorated Stink Bug

Brown Marmorated Stink Bug
(*Halyomorpha halys*)

- A highly invasive crop pest
  - Native to eastern Asia
  - First detected in PA in 1998
  - Detected in Utah in 2012
- Has a very broad host range
- Nuisance in urban landscapes
- Strong fliers and excellent hitchhikers

Current Distribution



BMSB Feeding

- Feeding stylet
  - Physical damage
  - Secondary infections
- Feed on vegetative and reproductive structures – even woody tissue

Specialty Crops at Risk to BMSB Damage

HIGH RISK	apple, Asian pear, beans (green, pole, snap), bee-bee tree, edamame, eggplant, European pear, grape[1], hazelnut, Japanese pagoda tree, nectarine, okra, peach[2], Peking tree lilac, pepper, redbud, sweet corn, Swiss chard, tomato	
MODERATE RISK	apricot, asparagus, blueberries[1,3], broccoli, cauliflower, cherry[2], collard, cucumber, flowering dogwood, horseradish, lima bean, littleleaf linden, serviceberry, tomatillo	
LOW RISK	blackgum, carrot, cranberries, garlic, ginkgo, greens, Japanese maple, kohlrabi, kousa dogwood, leeks, lettuce, many gymnosperms, onion, potato, spinach, sweet potato, turnip	
UNKNOWN ?	almond, citrus, hops, kiwi, olive, pistachio, plum, strawberries, walnut	HOSTS — Non-Specialty Crop BMSB Hosts Contributing to Specialty Crops Risk: field corn, soybean

1—Potential risk of taint/contamination. 2—Additional risk potential due to bark feeding. 3—Considered moderate-high risk.

USDA

Funded by USDA-NIFA SCRI Coordinated Agricultural Project, grant #2011-51181-30937. Image credits—sweet corn: Joe Zlomek; eggplant: Howard F Schwartz, Colorado State University, Bugwood.org; apple, carrots: morguefile.com/creative/bekahboo42; flowering dogwood: Richard Floyd, Creative Ideas LLC, Bugwood.org; blueberries, cauliflower: Gerald Holmes, California Polytechnic State University at San Luis Obispo, Bugwood.org; ginkgo: Jan Samanek, State Phytosanitary Administration, Bugwood.org; cranberries: Cjboffoli (CC-BY-3.0). Printed May 2015.

About BMSB

The brown marmorated stink bug, *Halyomorpha halys* (Stål), is a voracious eater that damages fruit, vegetable, and ornamental crops in North America. With funding from USDA's Specialty Crop Research Initiative, our team of more than 50 researchers is uncovering the pest's secrets to find management solutions that will protect our food, our environment, and our farms.

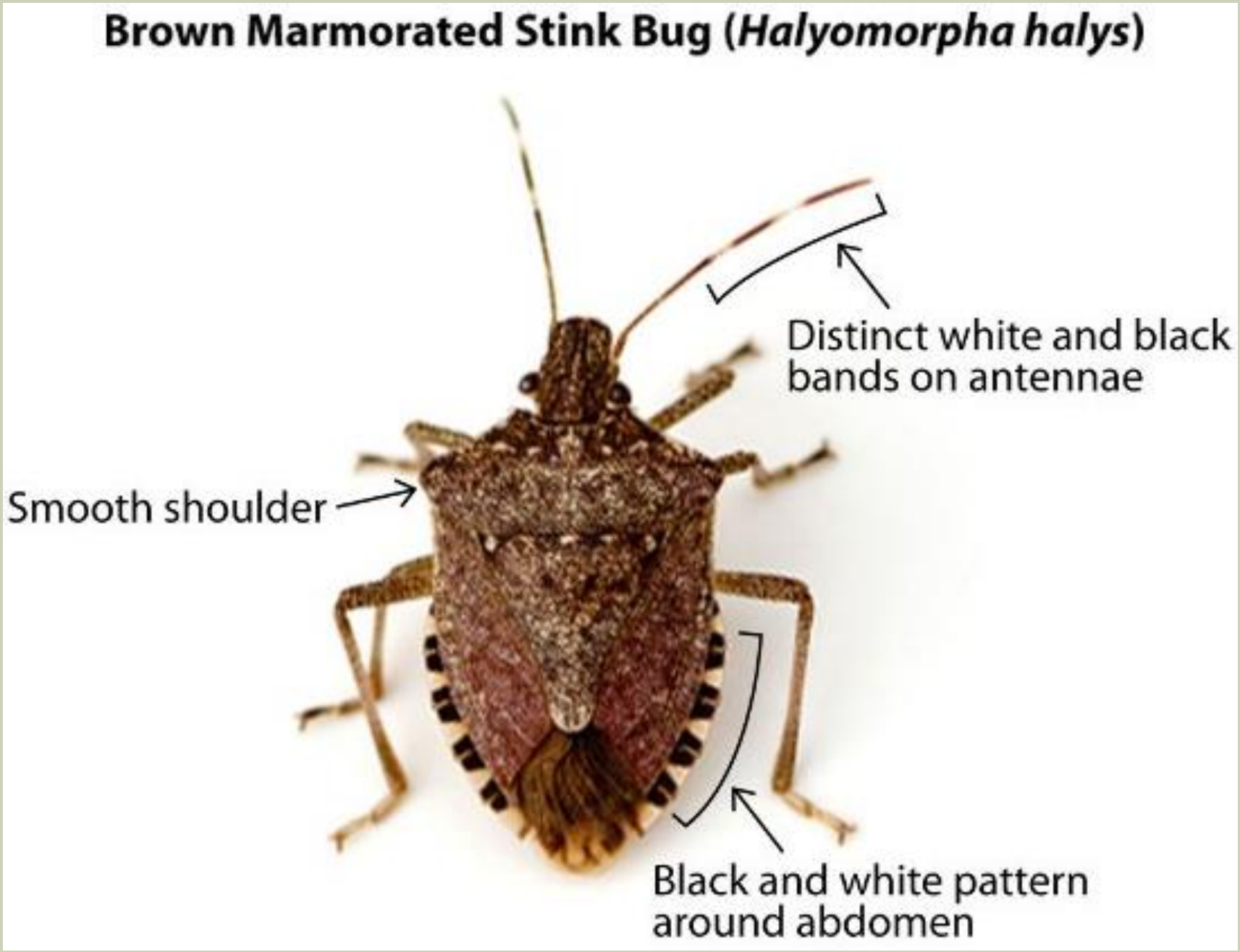
Learn more at **StopBMSB.org**.

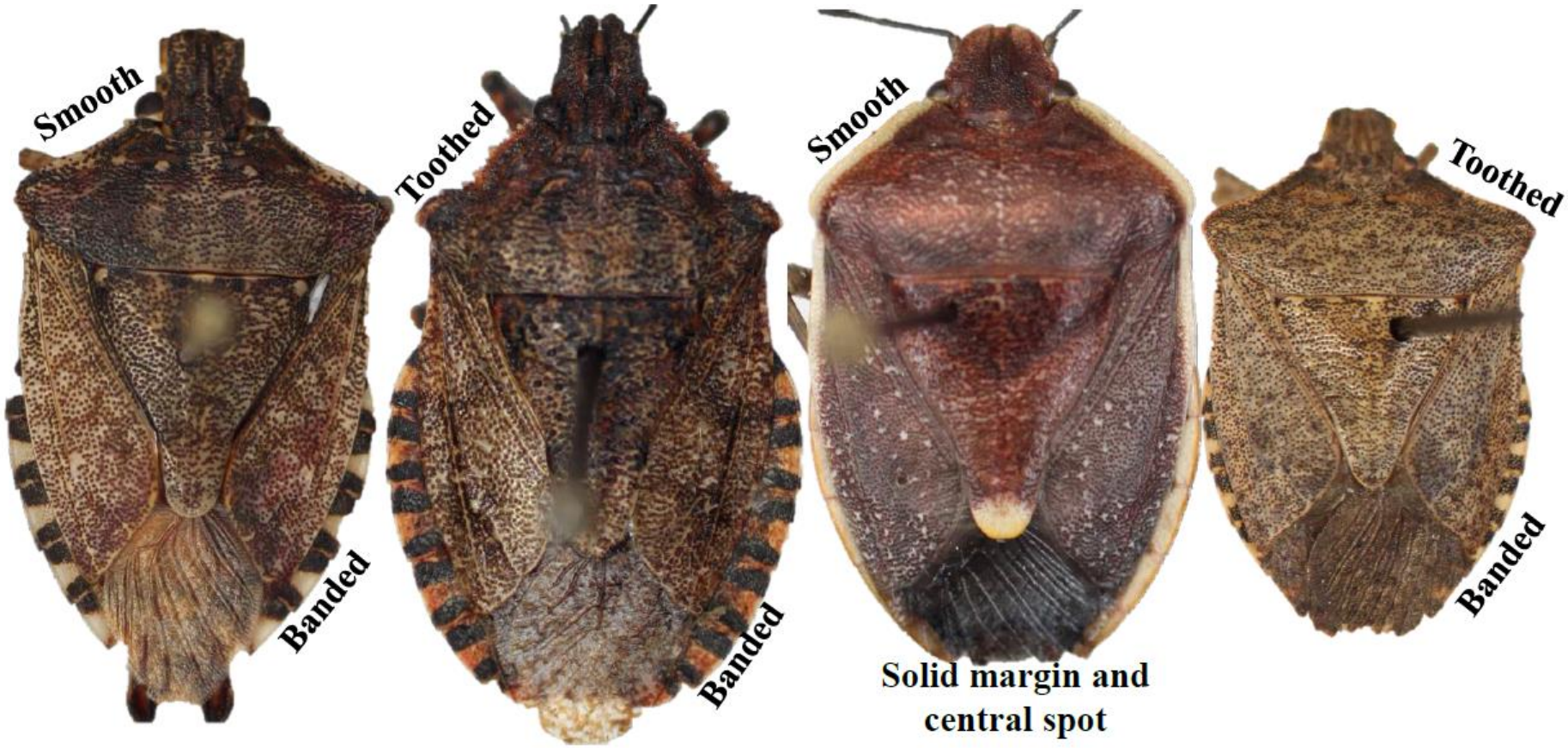
Stop BMSB

Damage on fruit caused by BMSB feeding can occur throughout the entire growing season

- Early season feeding causes misshapen fruit
- Late season feeding causes depressions on the fruit surface and "corking" just below the fruit surface
- Internal damage can be present even when external damage is not detectable

Brown Marmorated Stink Bug (*Halyomorpha halys*)





Brown Marmorated ***Brochymena*** **sp.** ***Chlorochroa*** **sp.** **Consperse**

Life History and Biology

- Eggs laid under leaves in clusters
- 1st instars feed on egg mass
- 2nd instars disperse from host plant
- Developmental period from egg to adult lasts ~50 days

28 eggs

“red ring”

1st instars

2nd instars

Life History and Biology

Nymphs (5 stages)

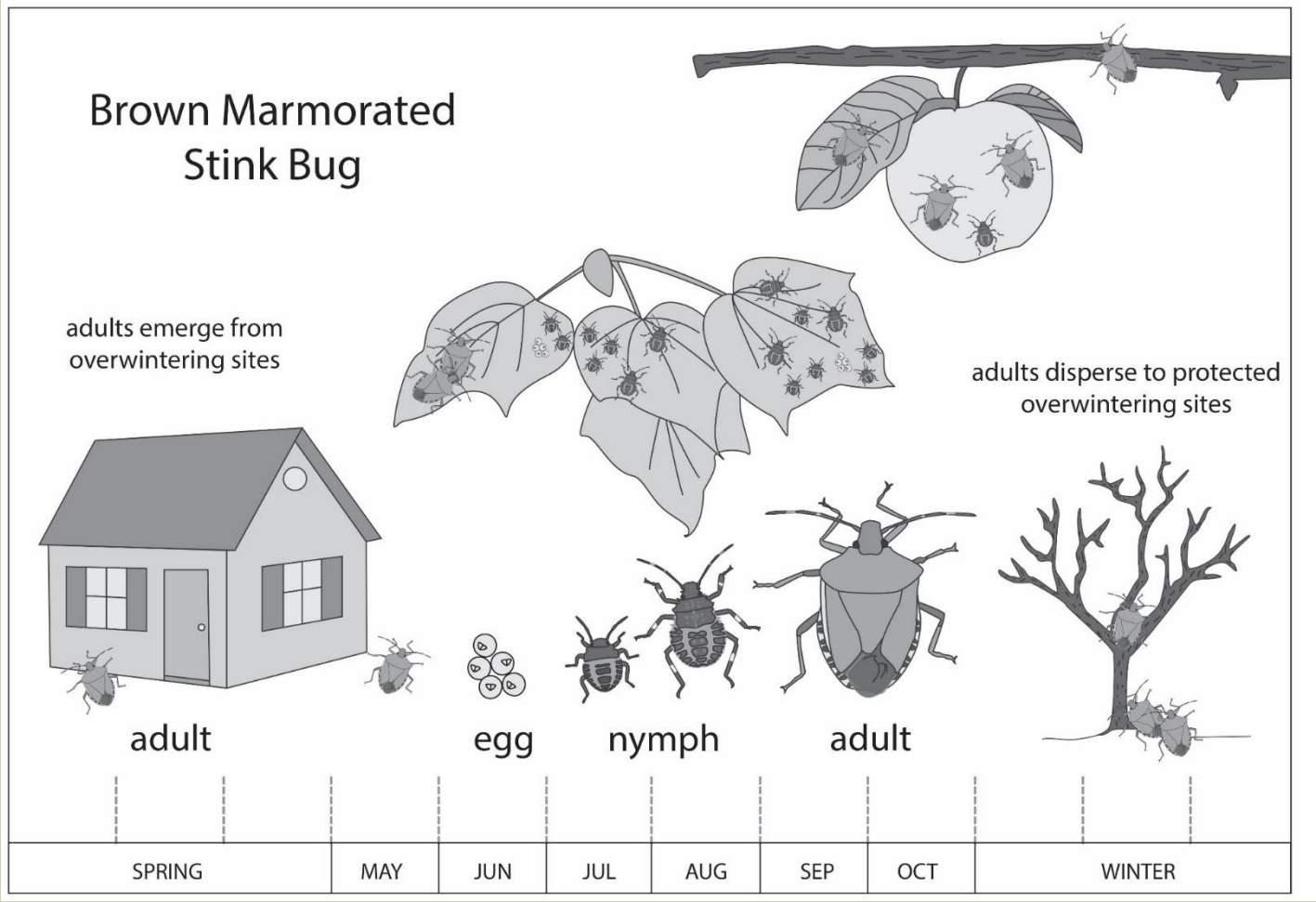
2 3 4 5

Winged adults

male female

All except stage 1 are damaging

Spring emergence of adult bugs from overwintering sites is usually very extended



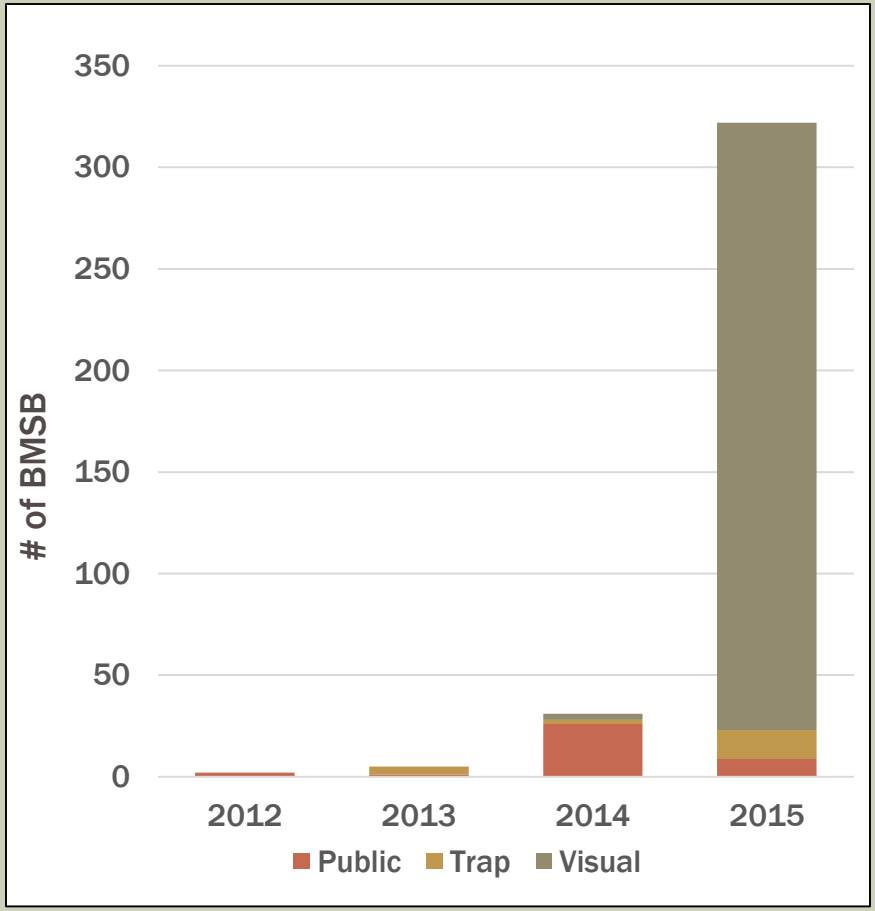
Detection Approaches

- Surveys
  - Passive (traps)
  - Active (beating trays)
- Reports
  - Citizens
    - Workshops / media
    - Overwintering bugs
  - Growers
    - Our highest concern
    - Please report!

caps@usu.edu

BMSB is here and most likely will be an important and serious threat to Utah's agriculture

- 2 new county detections
  - Salt Lake
  - Utah
  - Davis
  - Weber
- Massing adults and breeding populations



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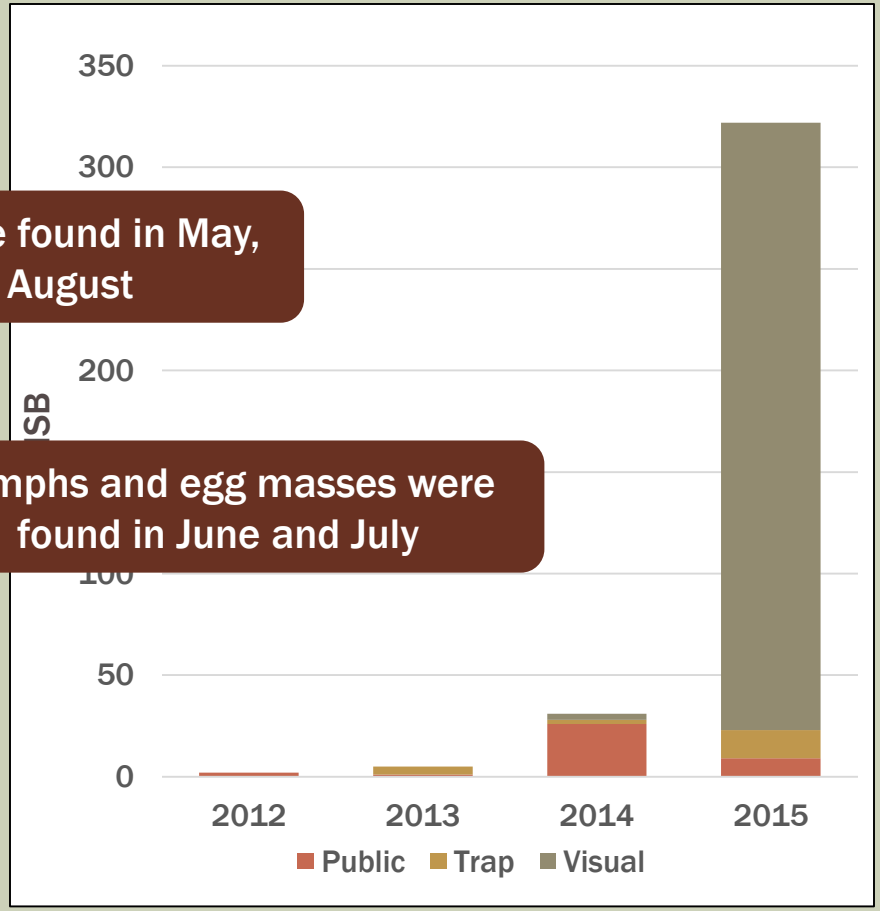


It is unclear how BMSB captures relate to density or damage potential

Honeysuckle

Downy Japanese Maple

Siberian Peashrub

Butterfly Bush

Catalpa

IPM Tools for Managing BMSB
(Chemical Control)

- Effective products include methomyl, pyrethroids, and some of the neonicotinoid products
  - Intensive spray programs are still seeing high damage
  - Pesticides are hard on biological control
- Barriers to effective chemical control
  - Mouthparts enable them to “by-pass” insecticide residues
  - Only tarsi (feet) are in contact with surface residues
  - Hard-bodied

IPM Tools for Managing BMSB
(Biological Control)

- Parasitoid from China
  - > 50% egg parasitism in China
  - Low levels of parasitism in the U.S. (~4%)
  - Found in Maryland, Virginia and Washington
- Fungal pathogens
- Other natural enemies

Online Resources

www.utahpests.usu.edu/caps/

UTAH PESTS fact sheet

UtahState University COOPERATIVE EXTENSION

Published by Utah State University Extension and Utah Plant Pest Diagnostic Laboratory ENT-144-11 May 2011

Brown Marmorated Stink Bug

[Halyomorpha halys (Stål)]

Erin Petrizzo, Research and Extension Assistant • Diane G. Alston, Entomologist

Do You Know?

- Brown marmorated stink bug was introduced into the U.S. from eastern Asia in the late 1990s, and has since spread to the East, upper Midwest, and Northwest regions.
- It feeds on a broad range of plants includi vegetables, field crops, ornamentals, weed native species.
- Adult- and nymph-feeding causes light-col stippling and lesions on leaves, necrotic les and scars on fruits, and deformed pods an on legumes.
- Adults can be a major nuisance pest by overwintering inside buildings.
- This insect has not yet been reported in Uta Please report suspected specimens or crop to USU Extension or the Utah Department o Agriculture and Food.

Commercial growers were caught by surprise during the 2009 growing season when they began to see crop damage inflicted by BMSB. Since then an increasing number of farms and gardens have experienced extensive crop damage (high levels of crop damage were experienced in 2010, especially in the Mid-Atlantic

Brown marmorated stink bug (Order Hemipter Pentatomidae) (BMSB) (Fig. 1) was accidenta introduced into the eastern U.S. from Asia in the 1990s. In 2001 it was officially identified in Pennsy and has since spread along the eastern seaboa westward into the Great Lakes region. In 2002 it found in Portland, Oregon, and has since spreac localized areas in Washington and California. It yet been found in Utah, but it is likely only a matt time before it will occur in most states due to its adaptation to a wide range of climates. Since 2 BMSB has gained notoriety as a major nuisance large aggregations of the bugs invading building fall to overwinter, attracted to the protective wc

Fig. 1. Adults are shield-shaped, brown, and ⅝inch lo

UTAH PESTS fact sheet EXTENSION UtahStateUniversity

Published by Utah State University Extension and Utah Plant Pest Diagnostic Laboratory ENT-175-15 August 2015

Invasive Insect Look-Alikes

Mistaken Insect Identity

Lori R. Spears, CAPS Coordinator • Ryan S. Davis, Arthropod Diagnostician • Ricardo A. Ramirez, Entomologist

Pest identification is the cornerstone of integrated pest management, but is a skill that can be difficult to master. Mistakes in identification are common, as many insects look and act alike, and/or can cause similar injury. Misidentifications could potentially lead to adverse agricultural and ecological consequences. For this reason, suspected pest species should be quickly identified. A number of guides and websites are available to assist with insect identifications (e.g., bugguide.net is complete with color photographs and links to identification keys). In addition, several state and federal agencies are specialized in insect identifications and have diagnostic labs to help assess suspected insect injury (for contacts in Utah, see page 6 of this factsheet).

Here, we provide a quick identification reference guide for two invasive insects that have been found in Utah (i.e., the brown marmorated stink bug and Japanese beetle) and two that have not been found in the state (i.e., the emerald ash borer and Asian longhorned beetle), but are on our radar as they have been found elsewhere in the U.S. We focus on these four insects because they are often mistaken in Utah as native insects. We also briefly describe some similar species that can be mistaken for these insects. **Note that this publication, for spacing reasons, does not cover ALL species that resemble a particular invasive insect.** We highlight the most common look-alike species.

Keep in mind that insect look-alike species are sometimes other pests, but they can also be beneficial insects. For example, the spined soldier bug (*Podisus maculiventris*) is a beneficial, predatory stink bug (Fig. 2), but can be mistaken for the destructive and invasive brown marmorated stink bug (*Halyomorpha halys*). Similarly, the six-spotted tiger beetle (*Cicindela sexguttata*) is a predatory ground beetle (Fig. 3) that can be misidentified by some as the invasive Japanese beetle (*Popillia japonica*). We describe the brown marmorated stink bug and the Japanese beetle (and more of their look-alikes) in more detail in the next section.

Fig. 2. The spined soldier bug is a predatory stink bug.

Fig. 3. The six-spotted tiger beetle is a beneficial, predatory beetle, but can be mistaken for the invasive Japanese beetle.

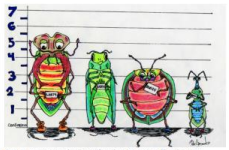


Fig. 1. Proper species identification is key to effective IPM.

UPPDL, 5305 Old Main Hill, Logan UT 84322, utahpests.usu.edu Page 1

UTAH PESTS fact sheet

UtahState University COOPERATIVE EXTENSION

Published by Utah State University Extension and Utah Plant Pest Diagnostic Laboratory ENT-161-12 January 2012

Monitoring for Spotted Wing Drosophila in Utah

(Drosophila suzukii)

Cory A. Stanley, Extension Entomologist

Do You Know?

- Spotted wing drosophila (SWD) is an non-native vinegar fly that was first detected in Utah in 2010.
- SWD attacks a broad range of fruits, including tree fruits, berries, vegetables, and ornam
- SWD can infest unripe, ripe, over-ripe, fruits.
- Detection and monitoring are crucial management of SWD.
- Because the fly is not widespread in th the identification of suspect SWD flies verified by the Utah Plant Pest Diagno (UPPDL).

WHEN TO MONITOR

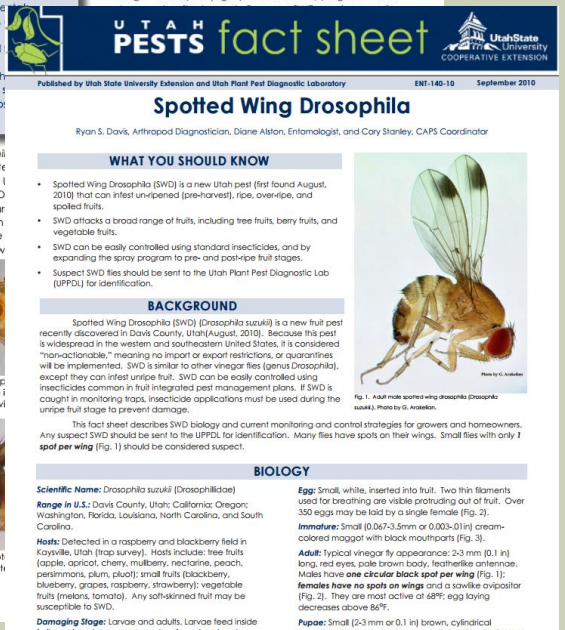
Spotted wing drosophila can attack fruit as soon as it begins to ripen, so that is when monitoring should begin. For example, place a trap in a cherry tree when the fruits begin to turn pink (Fig. 3). Continue trapping for at least

Spotted wing drosophila (SWD) (*Drosophi* new fruit pest first introduced to the Unite 2008. SWD was detected in Davis County, SWD is similar to other vinegar flies (genus D except they can infest unripe fruit. Males ar identified by the single spot found on each 1). Females are identified by the presence serrated ovipositor (egg laying structure), w be difficult to see without the aid of a hand lens or microscope (Fig. 2).

Monitoring is a crucial first step for management of SWD. Suspected SWD caught in monitoring traps can be sent to the UPPDL for identification before applying an insecticide.

Fig. 1. A male sp sophila can be spot on each wi

Fig. 2. Left: Female spotted wing drosophila; not of spots on the wings and presence of the serrat Right: Close-up of the serrated ovipositor.



UTAH PESTS fact sheet

UtahState University COOPERATIVE EXTENSION

Published by Utah State University Extension and Utah Plant Pest Diagnostic Laboratory ENT-140-10 September 2010

Spotted Wing Drosophila

Ryan S. Davis, Arthropod Diagnostician, Diane Alston, Entomologist, and Cory Stanley, CAPS Coordinator

WHAT YOU SHOULD KNOW

- Spotted Wing Drosophila (SWD) is a new Utah pest (first found August, 2010) that can infest un-ripened (pre-harvest), ripe, over-ripe, and spoiled fruits.
- SWD attacks a broad range of fruits, including tree fruits, berry fruits, and vegetable fruits.
- SWD can be easily controlled using standard insecticides, and by expanding the spray program to pre- and post-ripe fruit stages.
- Suspect SWD flies should be sent to the Utah Plant Pest Diagnostic Lab (UPPDL) for identification.

Fig. 1. Adult male spotted wing drosophila (*Drosophila suzukii*). Photo by G. Arakelian.

BACKGROUND

Spotted Wing Drosophila (SWD) (*Drosophila suzukii*) is a new fruit pest recently discovered in Davis County, Utah(August, 2010). Because this pest is widespread in the western and southeastern United States, it is considered "non-actionable," meaning no import or export restrictions, or quarantines will be implemented. SWD is similar to other vinegar flies (genus Drosophila), except they can infest unripe fruit. SWD can be easily controlled using insecticides common in fruit integrated pest management plans. If SWD is caught in monitoring traps, insecticide applications must be used during the unripe fruit stage to prevent damage.

This fact sheet describes SWD biology and current monitoring and control strategies for growers and homeowners. Any suspect SWD should be sent to the UPPDL for identification. Many flies have spots on their wings. Small flies with only ***1 spot per wing*** (Fig. 1) should be considered suspect.

BIOLOGY

Scientific Name: *Drosophila suzukii* (Drosophillidae)

Range in U.S.: Davis County, Utah; California; Oregon; Washington, Florida, Louisiana, North Carolina, and South Carolina.

Hosts: Detected in a raspberry and blackberry field in Kaysville, Utah (trap survey). Hosts include: tree fruits (apple, apricot, cherry, mulberry, nectarine, peach, persimmons, plum, pluot); small fruits (blackberry, blueberry, grapes, raspberry, strawberry); vegetable fruits (melons, tomato). Any soft-skinned fruit may be susceptible to SWD.

Damaging Stage: Larvae and adults. Larvae feed inside fruit causing abscesses; secondary fungal and pest infection may occur. Adults cause superficial scarring by sawing into fruit to lay eggs.

Overwintering Stage: Unknown if SWD will survive winter in northern Utah; survival in southern Utah is likely. Adults and pupae may overwinter.

Egg: Small, white, inserted into fruit. Two thin filaments used for breathing are visible protruding out of fruit. Over 350 eggs may be laid by a single female (Fig. 2).

Immature: Small (0.067-3.5mm or 0.003-.01in) cream-colored maggot with black mouthparts (Fig. 3).

Adult: Typical vinegar fly appearance; 2-3 mm (0.1 in) long, red eyes, pale brown body, featherlike antennae. Males have ***one circular black spot per wing*** (Fig. 1); ***females have no spots on wings*** and a sawlike ovipositor (Fig. 2). They are most active at 68ºF; egg laying decreases above 86ºF.

Pupae: Small (2-3 mm or 0.1 in) brown, cylindrical capsules with two extensions on one end (Fig. 4). Found in fruit or just below leaf litter in soil.

Generations per year: Unknown for Utah. Three to eight gen/yr have been observed in Oregon, and 10-13 gen/yr in California.

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In the News

No current news

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for your attention...

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Small Flock Chickens

Biographical Information:

David Frame
Utah State University, Sampete County Extension Office

A 1980 graduate of Utah State University with a B.S. in Animal Science, Dr. Frame subsequently received his DVM degree from Oregon State/Washington State Universities in 1984. Dr. Frame completed an avian medicine residency with the University of California, Davis specializing in poultry pathology and diagnostics. He is board certified in the American College of Poultry Veterinarians. Dr. Frame was employed as chief veterinarian for Moroni Feed Company (Norbest) for 12 years before joining the faculty of the USU Animal, Dairy, and Veterinary Sciences Department in 1998 as an Associate Professor. He currently serves as the USU Extension Poultry Specialist with an additional assignment as poultry diagnostician for the Utah Veterinary Diagnostic Laboratory. He has served on various national boards, including the General Conference Committee of the National Poultry Improvement Plan, an advisory committee to the United States Secretary of Agriculture. He presently serves as editor for the Western Poultry Disease Conference, an internationally renowned poultry disease forum. Before beginning a professional career in poultry extension and diagnostics, Dr. Frame raised and showed many different breeds and varieties of exhibition chickens.

Session Description:

I will present an overview of basic concepts and needs for raising chickens in small area settings, such as suburban and small acreage lots. Emphasis will be made on utility of chickens in weed and insect control and aesthetics of using chickens in an overall backyard garden design

Agriculture

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extension.usu.edu

June 2010 **AG/Poultry/2010-02pr**

Basics for Raising Backyard Chickens

David D. Frame, DVM, Diplomate ACPV
Utah State University Extension Poultry Specialist

This fact sheet is constructed to be used by local municipalities for training or as an evaluation tool in the permitting process for allowing poultry keeping in population-dense settings. It also serves as a condensed review of basic poultry keeping practices.

Backyard chicken keeping is increasing in popularity. There are many reasons for this. Perhaps it is to have a ready source of eggs and meat, or as a backyard help in pest control, or perhaps it is just because they are fun to watch. Whatever the reason, chickens can be a great source of enjoyment if properly managed and given appropriate care.

Figure 1. Hens enjoy the spring breeze.

Get Your Chicks Off to a Good Start

Baby poultry cannot generate enough heat to sustain themselves. That is the reason the mother hen keeps the young under her wings. The process of getting chicks off to a good start is called *brooding*. The brooding period is roughly the first 3 to 4 weeks of a chick's life. By then, most breeds are fully feathered and can generate enough heat on their own to get by.

Basic needs for brooding chicks are:

- Heat source, such as a 250 watt infrared light. Keep a temperature gradient from 110°F under the heat source to 84°F at edge of brooder ring. Decrease temperature about 5°F each week. However, if chicks appear too cold or hot, adjust accordingly.
- Clean water.
- Good quality chick starter feed.
- Clean litter (pine or cedar shavings are recommended).
- A circular confined area to keep the chicks from wandering away from the heat source.

Figure 2. Example of a brooder ring.

Housing

Chickens are very adaptable and no single best way exists to house them. Creative architectural construction may even be considered in building a "designer" chicken house in order to enhance the backyard landscape. Regardless of ultimate design, the

following practical considerations should be observed. The building must:

- Be large enough for proper air circulation (i.e., ventilation), but small enough to keep from getting too cold and drafty in winter;
- Allow 1.5 to 2.0 ft^2 (0.14 to 0.19 m^2) floor space per adult chicken;
- Provide easy access to feed and water; and
- Provide nesting areas for hens in egg production.

Perches

Although not mandatory, it is usually a good idea to provide perches for the chickens. Perches will allow birds to stay off the floor – particularly as they roost at night. Most breeds seem to enjoy spending time on perches. Manure will tend to accumulate in greatest concentration under the roost area, thereby helping to keep the rest of the bedding material in the house cleaner. A good rule of thumb is to allow 6 to 10 inches (15 to 25 cm) of linear perch space for each chicken housed.

Nest Boxes

Nest boxes are essential furnishings of any hen house because she will seek a secluded place to lay her eggs. Properly constructed and maintained, nest boxes provide a clean environment for laid eggs and facilitate gathering them. Again, there are no hard and fast rules for nest box construction. Commercial boxes are available from various retail sources, or you may construct your own.

- Nest box height and width should be 12 to 15 inches (30 to 38 cm); depth should be at least 12 inches (30 cm).
- One nest box is required for each four to five hens. Place nest boxes no less than 18 inches (46 cm) above the floor.
- A front panel, 4 to 6 inches (10 to 15 cm) high, is necessary to provide seclusion and keep eggs from rolling out of the nest.
- Maintain at least 2 to 3 inches of clean dry shavings in each nest box to reduce egg breakage and to minimize number of soiled eggs.
- A perch may be attached to each box to facilitate access, running parallel to the front of the box and located 6 to 8 inches out.

Don't Forget the Water

Remember, the nutrient consumed in the greatest quantity by a chicken is *water*. A direct relationship exists between the amount of water a chicken drinks and the amount of feed consumed. If inadequate water is available, not only will chickens decrease eating, but there will also be a negative effect on egg production and growth.

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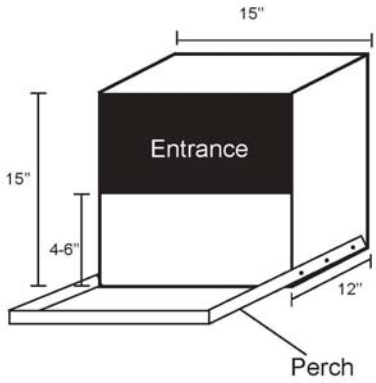

Figure 3. Example of a nest box design.

Although types and designs of drinkers vary, the fact that fresh clean water must be present at all times should never be forgotten. Fountain-type drinkers have the advantage of being affordable and easily moved around; however, because the reservoir holds only a finite quantity of water, it is necessary to watch carefully that they don't become empty.

Figure 4. Chicks shown drinking from a 1 gallon fountain-type waterer.

- Water should be changed frequently in order to prevent bacterial growth, over-warming (in summer), or freezing (in winter).
- A fountain-type drinker commonly available in most feed stores will hold 1 gallon of water. Each drinker will provide enough daily water for 12 to 15 adult chickens during cool weather and 6 to 12 during hot weather.
- Always provide at least two or three additional drinkers in excess of the estimated water

consumption for the number of birds in the chicken house. This provides a buffer for a short term water supply in the event of spillage or leakage. It also offers an opportunity for the more timid birds in the flock to satisfy their water needs without competing with more aggressive individuals for drinker space.

- When planning number of drinkers to place in the chicken house, consider that in cool weather each adult chicken will consume about 0.05 to 0.08 gallon per day; in hot weather, 0.08 to 0.16 gallon per day.

Feed Quality Is Important

- Feed quality will affect feed consumption. Ensure that the feed is not stale, rancid, or moldy.
- Immediately remove obviously moldy, rancid smelling or any other questionable feed. Such feed will, at best, not be eaten; and at worst, cause disease or nutritional deficiencies if consumed.
- Purchase feed as fresh as possible. Vitamins will start to degrade if finished feed is stored for prolonged periods. Plan your schedule so that new feed is purchased at least every 2 months.
- Always store feed away from heat, moisture, and direct sunlight. Protect from rodents.

Feeder Styles

Feeders come in a wide array of sizes and designs from egg carton lids for starting newly hatched chicks to sophisticated automatic adult feeding systems. Trough feeders are usually used to start off young chicks. Bucket feeders of various sizes are popular and appropriate for both growing and adult chickens. The advantage of bucket feeders is that they can store a few days' worth of feed, thereby alleviating daily hand feeding; however, care must be taken not to let old feed accumulate in them and become stale and moldy. Clean and brush them out often. Use the appropriate size of bucket feeder for the class of poultry being raised. Using too large of feeders with chicks will prevent them from being able to reach the feed. Also chicks might get inside the lip of the feeder and not be able to get back out. Feeders with too narrow of a lip for adult birds will cause excessive spilling and wasted feed.

- Feeders should be raised off the ground, and generally positioned level with the mid to upper breast region of the chickens being fed.
- A good rule of thumb is to allow 1 linear inch of feeder space per chick and 2 to 3 linear inches per adult chicken.
- Always keep feeders in an area where it is protected from moisture, wild animals, and free flying birds, preferably inside the chicken house.
- Purchase feed from a reliable commercial feed manufacturer.
- It's OK to let your chickens forage around for bugs and greens, but always provide them access to the appropriate type of formulated balanced feed as well. Totally "free-ranged" poultry will rarely be able to consume a proper balance and quantity of nutrients necessary for their maximum rate of meat and egg production.

Figure 5. Example of one type of feeder commonly used to start chicks.

Feed Consumption Guidelines

There is great variation in feed consumption patterns of chickens depending on breed, feed source and environmental conditions. The following information, however, serves as a guide for feeding large fowl breeds of poultry.

<u>Meat-type</u> strains (Commercial-type broilers, roasters, "Cornish-Rock" crosses)

0-2 weeks.	22-24% protein chick starter
2-4 weeks.	20-21% protein grower
4 weeks to market . . .	18-20% protein finisher*

<u>Layer strains</u> (Commercial-type leghorns, brown egg layers)

0 to 6 weeks.	20-21% protein chick starter
6 weeks to prior to egg production	16-19% protein pullet grower or developer
At onset of egg production.	16-18% protein layer diet**

<u>Dual-purpose breeds</u> (Plymouth Rock, Rhode Island Red, New Hampshire, etc.)

0 to 6 weeks.	20-21% protein chick starter

6 weeks to prior to egg production.	15-19% protein pullet grower or developer
At onset of egg production	16-18% protein layer diet**

*These recommendations are based on common protein levels for feeds available in most local feed stores. It is assumed that the finished feed is balanced for energy, vitamins, and minerals in relation to specific protein content.

**Do not feed a layer diet to chickens not in egg production (too high in calcium).

Varmint Control

Maintain a rodent control program around the poultry house. When building the floor, integrating heavy gauge wire mesh beneath the subflooring is recommended to discourage entrance of predators and other varmints. Cover windows and vent openings with good quality poultry wire to keep out birds. Make sure doors and windows fit tightly. Caulk and seal all cracks and crevices. Small rodents can gain entry through holes the size of a nickel or quarter. Keep the poultry house locked to discourage theft and uninvited visitors.

Figure 6. House mouse. Average litter size is six and one female can have up to eight litters per year. Average range is 15 to 30 feet. A mouse can last longer without water than a camel. (Photo from KoreanRodent_pm39-HouseMouse.)

Lighting

Laying hens require at least 14 hours of light to maintain good egg production. Most experts recommend 16 hours of light per 24 hour period. Artificial lights wired into a timer will accomplish this during fall and winter, when daylight is decreasing. Decreasing daylight will cause hens to quit laying and go into a molt.

Egg Production

Hens do not need roosters present to produce eggs. Increasing day length, not the presence of males, is what stimulates egg production. A rule of thumb is that four to five hens will supply two to four eggs per day during their production cycle. Pullets (young females) reach sexual maturity and are capable of laying eggs when about 5 to 7 months of age; however, this can vary considerably depending on breed and strain of chicken.

Molting

Molting is a natural process that chickens go through. It is nothing more than a resting part of the physiological cycle of birds. During the molt the hen will go out of egg production and lose feathers. Under natural conditions, this occurs in the fall or winter. However, modern layer strains have been bred to maintain high egg production over a long period. Therefore, you may find your flock laying eggs and losing feathers at the same time. The laying cycle causes the feathers to become worn and broken. After the molt, the hens will have a new covering of feathers. Hens generally produce fewer eggs with each molt. Eggshell strength may also be reduced with each subsequent molt.

Be a Good Neighbor

- Chickens do not respect property lines. Keep your chickens enclosed and confined to your property.
- Properly dispose of used poultry litter. In many instances, used litter can be incorporated into the garden soil or composted; however, improper composting or storage may create excessive odor and fly problems. Proper composting requires careful management of moisture, aeration, and temperature.
- Although in most circumstances chickens pose a relatively low risk of giving disease to humans, there are a few infections that can be transmitted back and forth. Proper care and handling of eggs and processing of poultry carcasses are critical to avoid problems.
- The commercial poultry industry is a significant and vital part of the agricultural economy of the U.S. It is important that these flocks be protected from serious diseases that would adversely affect each one of us. Small backyard flocks if not properly managed, might significantly increase the probability of disease exposure to the commercial industry.
- Past history has shown that diseases such as exotic Newcastle disease (END) can occur in the small flock poultry community. The discovery of END would have devastating economic consequences from death loss as well as the loss of trade with other countries.

Figure 7. Always think about what you can do to protect your own birds and your neighbor's birds from disease.

ENJOY!

Poultry raising can be an inexpensive and fulfilling hobby and pastime. Good wishes in embarking on this exciting opportunity!

For additional information contact your county Extension agent or Extension poultry specialist.

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July 2009 **AG/Poultry/2009-02pr**

Considerations in Raising Small Backyard Flocks of Poultry in Population-dense Communities

David D. Frame, DVM, Diplomate ACPV
Extension Poultry Specialist

During these times of economic challenge many people are considering raising a few chickens in the backyard to augment their food supply. This has raised numerous questions ranging from how to feed chickens to addressing local animal-keeping ordinances. Often, the answers are a work in progress for many communities. The following considerations should be taken into account.

Science-based Education Is Critical

Be cautious of advice from self-proclaimed "experts" or people with informal training who attempt to fill a perceived educational niche. Many would-be poultry raisers are novices or first time owners. Learning how to do things correctly from qualified science-based sources is paramount in order to be successful. Optimal decision-making must be based on facts – not hearsay or folktales. Utah State University Cooperative Extension offers research-based education in small flock poultry raising. County agents and an Extension poultry specialist are available to educate groups and community leaders in poultry health and management issues. Fact sheets are also available on line:
http://extension.usu.edu/files/publications/publication/AG_Poultry_2008-01pr.pdf
http://extension.usu.edu/files/publications/publication/AG_Poultry_2008-02pr.pdf
http://extension.usu.edu/files/publications/publication/AG_Poultry_Health_Biosecurity_01.pdf

Effects on the Economy

The commercial poultry industry contributes a significant and vital part to the agricultural economy of the U.S. Anything that jeopardizes the viability of this industry also jeopardizes the economic health of Utah. It is important that these commercial flocks be protected from serious diseases that would decimate this sector of Utah's economy. An upsurge in number of small backyard flocks, particularly if not properly managed, might significantly increase the probability of disease exposure to the commercial industry. Past history has shown that diseases such as exotic Newcastle disease (END) can become present in the small flock poultry community. Exotic Newcastle disease can cause tremendous poultry death in both the small backyard flocks and in large commercial poultry operations. The discovery of END, for example, will have devastating economic consequences from death loss as well as the loss of trade with other countries.

Community Impacts

The local community may experience unanticipated impacts from an abrupt unregulated increase in backyard poultry keeping. Any potential undesirable repercussions can be minimized through recognition and well thought out planning to ensure that all remain good neighbors.

Noise: Hens are quieter than roosters. There are no practical or humane methods to "de-crow" a male fowl. It takes experience and knowledge to properly identify the gender of young chicks. Your local farm implement store may not be able to provide this service reliably when chicks are purchased. Be prepared to cull roosters as the chicks mature. Hens do not need a rooster present in order to lay eggs.

Mixing of species. It is extremely risky to raise multiple species of poultry and waterfowl on the same premises – particularly if there is chance of exposure to wild birds. This is how many deadly poultry diseases get started, such as END or avian influenza ("bird flu").

Zoning. Some municipalities do not allow the raising of poultry or have strict ordinances that restrict this activity. Check with your city or county office to determine if there are specific regulations or restrictions that might preclude keeping poultry on your property. Along with city or county ordinances, some communities or subdivisions have rules or "covenants" that restrict the raising of poultry. Be sure to check if your domicile is in one of these.

Animal control. Chickens are no respecters of property lines. They are prone to wander at will into neighbors' yards and gardens. Remember chickens can also fly. To minimize the impact on neighbors, enclosures should be considered that properly restrain poultry and confine them to your property.

Animal waste. In many instances, used chicken litter can be incorporated into the garden soil or composted; however, improper composting or storage may create excessive odor and fly problems. Proper composting requires careful management of moisture, aeration, and temperature. Allowing chickens to superficially scratch through a pile of manure is not sufficient for optimal composting to occur for a number of reasons. There are many Extension publications from various universities addressing the issue of general composting techniques. These should be thoroughly perused during any decision-making process.

Disposal of deceased and spent fowl. It is important to realize that chickens have a relatively short life span. The productive life of a hen is about three to five years. Baby chicks soon grow up to be adult chickens and adult chickens end up as old chickens. Community leaders need to seriously address the issue of bird disposal. Do local ordinances allow birds to be buried on the premises or composted on-site or taken to the landfill?

Human health. Although in most circumstances chickens pose a relatively low risk of giving disease to humans, there are a few that can be transmitted back and forth. Proper care and handling of eggs and processing of poultry carcasses are critical to avoid problems. Appropriate disposal of dead birds and used litter are also important.

Mice thrive in areas where chicken feed is improperly stored and excessive spillage occurs. Rats could become a problem in excessively wet areas or where water leaks occur. Feed should never be sprinkled into the litter or floor of poultry houses. This only encourages rodents to hang around the coops. Feed is to be properly dispensed in hanging hoppers that limit access to marauding rodents. Also, unused feed should be stored in closed containers in a cool area. A rodent control program of bait feeding and/or trapping should be mandatory in addition to all other precautions.

Animal Welfare

Proper care and feeding. It is imperative that poultry owners learn and implement proper care of their birds. Inhumane practices such as denying poultry access to water or a protected coop during hot days or during inclement and cold weather are intolerable. Many would-be poultry owners may never have raised chickens or farm animals before. They may not realize what the proper care and feeding of poultry entails. Birds are to be provided with a proper diet at all times and not left to fend for themselves. Enough space must be provided to adequately accommodate the number of birds kept. This is where appropriate science-based education becomes indispensible.

Enforcement of noncompliance. If some type of local poultry permitting program is practiced, will there be sufficient funds and personnel to carry out the program? Does the community have the adequate resources and personnel to deal with people who break the rules or handle poultry in cruel or inhumane ways?

Protection from predators and disease. Chickens are to be enclosed in a coop at night to protect them from predators. Although the debate could go on *ad infinitum* as to what the optimal construction should be, common sense is usually adequate. Doors should tightly close, glass or strong plastic windows should be used, and a solid floor should be in place. Periodic

inspection around the coop will indicate if varmints are trying to enter. Then take care of the varmint problem.

Outside runs need to be covered with good quality wire or roofing that will keep out wild birds and keep the chickens inside. Many people might find this a serious inconvenience, but it is imperative! Wild birds can carry diseases that could kill their birds or set up a reservoir of infection that could get into the area's commercial poultry industry with devastating consequences. This is a risk that any responsible community governing body should not take. The satisfactory demonstration of properly enclosed and restrained chickens should be a mandatory requirement in any permitting process.

Disease transmission. Chicks must be purchased from sources certifying that they are free from specific diseases. Certain species of poultry can carry organisms that may do little harm to them but could cause devastating disease in another species. Mixing of species, such as ducks and chickens or chickens and turkeys increases the potential infection and spread of avian influenza (bird flu). Raising chickens and turkeys together could cause devastating disease in the turkeys. It is important to understand the nature of poultry diseases and how to deal with them. Contact your local veterinarian or Extension poultry specialist for further information on disease transmission and optimal biosecurity practices.

Visit these Web sites for other important information:
http://extension.usu.edu/files/publications/factsheet/AG_poultry_2005-01.pdf
http://www.aphis.usda.gov/animal_health/birdbiosecurity/
http://ag.utah.gov/divisions/animal/health/index.html#avianHealth

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Farms are More than Food: The Value in Selling Farm Experiences

Biographical Information:
Luke Petersen
Petersen Family Farms

Luke Petersen is a 5th generation farmer in Southwest Salt Lake County. He grew up working alongside his father and grandfather raising hay and small grains. He is the first Petersen farmer to receive a formal education, earning a Bachelors from USU and an international Master's degree in Agriculture and Business from the Royal Agricultural University in England.

His education took him around the world but his heart brought him back to the family farm in Riverton. Of all the experiences Luke has had, his greatest achievement is becoming a full-time grower. He believes in farming as not only a way to produce food, but as a culture of growth that extends from food to people and community. He has incorporated this philosophy into the next generation of agriculture at Petersen Family Farm where he follows his dream of growing people, food, and community.

Session Description:
Food is the anchor of agriculture, but the sail in the experience or the agri-CULTURE. We as farmers and ranchers have an opportunity to capitalize on the experiences the farm offers our communities. Through this we can generate more revenue and hold our place in urban communities. Working farms are powerful tools to education and create quality of life for all people, rural and urban. Through innovation, technology, and social media we can take our working farms to the next level and preserve them as an amenity in our communities for generations to come

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Aquaponics in Practice

Biographical Information:
Terry and Sandy Stapley
Deseret Peak Aquaponics

We have been operating a farmers market size Aquaponics System for three years in Grantsville Utah. We have grown everything from radishes, beets, turnips, Kohlrabi, broccoli, corn, all lettuce green and winter greens like Kale, Swiss Chard, and Poc Choi, to tomatoes, squash, strawberry and melon vine fruit. We have even grown Corn.

Session Description:

We will cover the Whys of Aquaponic, and the mechanics of water, fish and plant filtration.

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Aquaponic Laws and Fish Options

Biographical Information:
Anna Marie Forest
Utah Department of Agriculture and Food

Anna Marie Forest is a Fish Health Specialist at the Utah Department of Agriculture and Food. She conducts fish health inspections for private aquaculture facilities in Utah. She also licenses private aquaculture and fee fishing facilities and issues entry permits for the 6 million sport fish that enter the state on an annual basis.

Biographical Information:
Krissy Wilson
Utah Division of Wildlife

Krissy Wilson is a Native Aquatic Species Coordinator at the Division of Wildlife. Administers a statewide program to evaluate and assess the status of native fish, amphibians, reptiles and mollusks; oversees implementation of conservation actions to protect and enhance populations of native species. This included developing and implementing a "must kill" policy for nonnative smallmouth bass and burbot caught in the Green River, and a rapid response to an illicit introduction of nonnative fishes into Utah's Red Fleet Reservoir.

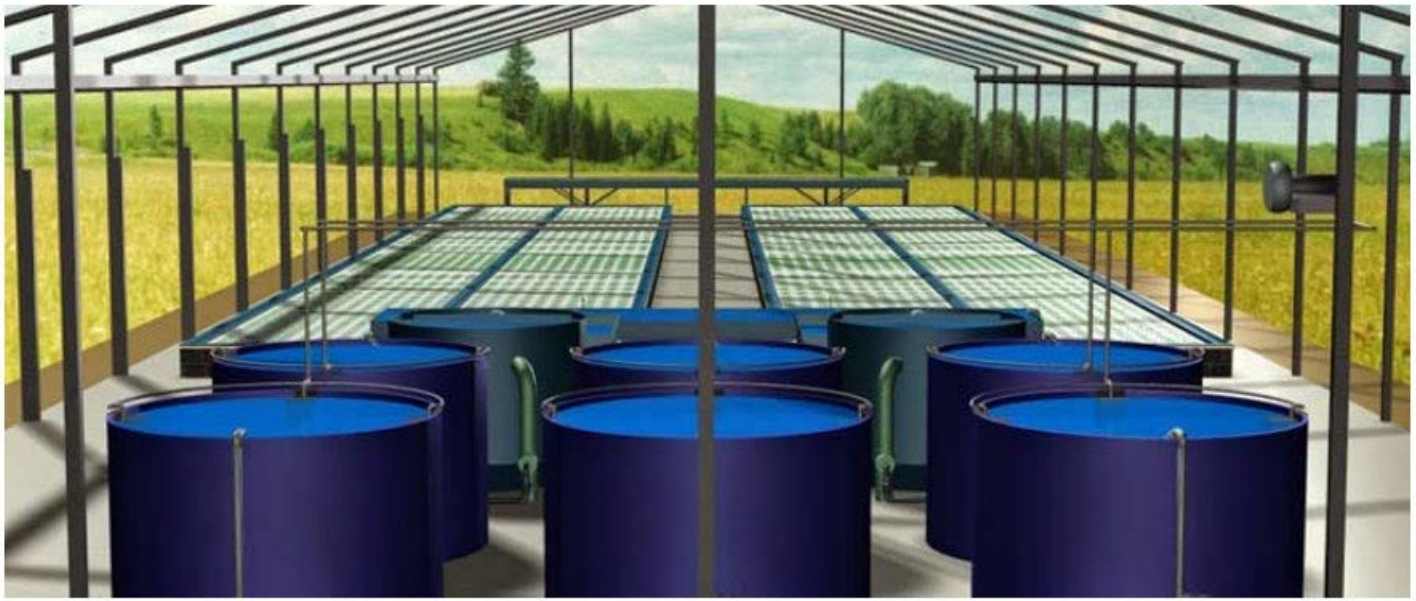
Session Description:

Fish are regulated by the Division of Wildlife and the Department of Agriculture and Food. The Division of Wildlife is responsible for determining; the species of fish that can be propagated. The Division considers the species present in the drainage basin and determines the risk to the ecosystem if the fish escape from the pond / facility. If you want to raise a species of fish that is prohibited by law, you will have to petition the Wildlife Board's Certification Review Committee for a variance. The Division of Wildlife also licenses private ponds (including aquaponics operations) that are for personal use (no sales). The Department of Agriculture licenses commercial aquaculture and fee fishing facilities. The Department also: conducts fish health inspections for facilities that want to sell live fish; determines if fish from out of state facilities meet fish health testing requirements; and issue entry permits for all live fish that enter the State of Utah (including those purchased by the Division of Wildlife

Aquaponic Laws and Fish Options

Anna Forest, Utah Dept. of Ag and Food (UDAF)
Krissy Wilson, Utah Division of Wildlife (DWR)

I built my system, where do I get fish?



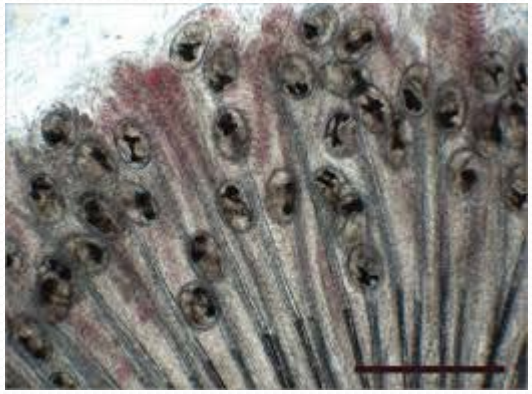
An aquaponics float system based on the UVI (University of the Virgin Islands) design.

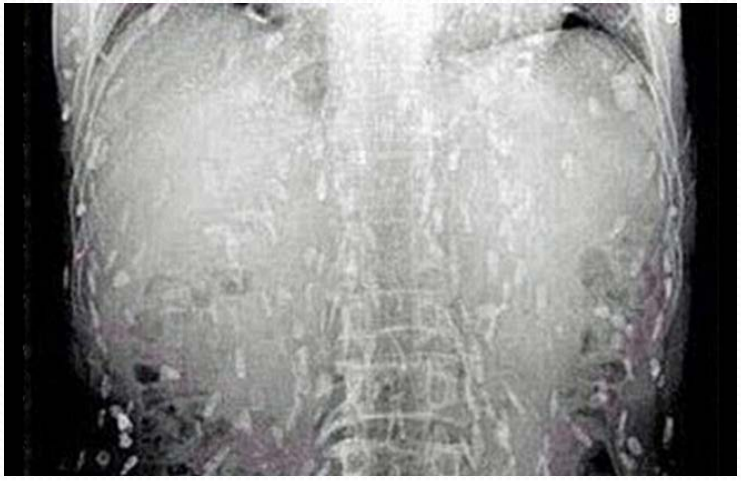
Can I catch them?

- No
  - It is illegal to move fish from one place to another
  - Also illegal to set free (aquarium fish or fish from aquaponics system)

WHY?

Pathogens, predation, competition…





- May spread parasites or diseases to fish and other animals.

When you move fish you also move:

- The fishes bacteria, viruses and parasites
  - Stress of capture, transport and confinement can make fish succumb to disease
  - Fish shed bacteria, viruses and parasite eggs into water
  - Water (and pathogens) flows downstream
- Other species exposed to the same organisms (bacteria, virus or parasite), can be much more susceptible

Fish must be purchased from a facility with "**Fish Health Approval**"

- Tested for fish pathogens
  - Cause high mortality
  - Cannot be treated
- Approved facilities on UDAF website
- UDAF will approve new facilities if they meet testing standard of the Aquatic Animal Health Rule (R58-17)

Fish Health Testing Requirements

- Must be tested for:
  - Infectious hematopoietic necrosis virus (IHNV)
  - Infectious pancreatic necrosis virus (IPNV)
  - Viral hemorrhagic septicemia virus (VHSV)
  - Oncorhynchus masou virus (OMV)
  - Spring viremia of carp virus (SVCV)
  - Epizootic hematopoietic necrosis virus (EHNV)
  - White spot syndrome virus (WSSV)
  - Yellow head virus (YHV)
  - Taura syndrome virus (TSV)
  - Infectious hypodermal and hematopoietic necrosis virus (IHHNV)
  - Myxobolus cerebralis (whirling disease)
  - Renibacterium salmoninarum (bacterial kidney disease)
  - Ceratomyxa shasta (ceratomyxosis disease)
  - Bothriocephalus (Asian tapeworm disease bothriocephalosis)
  - Tetracapsuloides bryosalmonae or PKX (proliferative kidney disease)

APPROVED Utah Fish Growers, Out-Of-State Growers and Utah Brokers

Note: It is necessary to use the approved fish growers from the two lists below for delivery of live aquaculture products in Utah. The approved fish grower shall deliver his product directly to the site of private ponds. If the use of a broker or other delivery options is necessary, then a certificate of registration may be needed for private pond owners (call Utah Division of Wildlife Resources at 801-538-4701). The following lists are subject to periodic change. **If you have any questions, contact UDAF at 801-538-7046.**

EFFECTIVE January 2016

FISH HEALTH APPROVED & LICENSED AQUACULTURE FACILITIES IN UTAH

Name	City	Phone	Species (& expiration date)
Christensen Catfish	Newcastle	435-691-4584	Hybrid striped bass (April 2016)
Cold Springs Trout Farm	N. Ogden	801-782-7282	Sterile and diploid rainbow, brown & brook trout, tiger trout, wipers, bluegill (January 2017)
Pine Creek Trout Farm	Bicknell	435-425-3281	Rainbow trout and wipers (February 2016)
Spring Lake Trout Farm	Payson	801-369-7177	Diploid and sterile rainbow trout and wipers (January 2017)
Water and Environmental Testing	American Fork	801-763-0660	Fathead minnows (January 2017)
West Haven Ranch	Richfield	435-896-4922	Diploid and triploid rainbow trout (May 2016)

FISH HEALTH APPROVED AQUACULTURE FACILITIES OUT-OF-STATE

Name	State	Phone	Species (& expiration date)
Black Canyon Trout Farm	Idaho	208-425-3239	Sterile and diploid rainbow trout, including eggs (Oct. 2016)
Desert Springs Trout Farm	Oregon	541-943-3192	Sterile and diploid rainbow trout (June 2016)
F&L Anderson	Arkansas	501-676-2035	Black crappie, largemouth bass, bluegill and fathead minnows (Dec. 2015)
Hartley Fish Farm	Kansas	620-532-3093	Bluegill, largemouth bass, smallmouth bass (March 2016)
Hopper Stephens	Arkansas	501-676-2435	Largemouth bass, bluegill, hybrid bluegill, black crappie, sunfish, catfish, grass carp, redear sunfish, yellow perch (March 2016)
Keo Fish Farms	Arkansas	501-842-2872	Hybrid striped bass (wiper), striped bass, bluegill, brem/grass carp (June 2016)
Osage Catfisheries Inc	Missouri	573-348-2305	Channel catfish, largemouth bass, black crappie, fathead minnows, and redear sunfish (February 2016)
Oswald Fisheries - Bruce Facility	South Dakota	507-684-3808	Tiger Muskie (August 2016)
Troutlodge Inc.	Washington	253-863-0446	Diploid and triploid rainbow trout eggs (steelhead) (Nov. 2016)
Wright's Rainbows	Idaho	208-547-7452	Diploid rainbow trout (April 2016)

LICENSED BROKERS IN UTAH

Name	City	Phone	Species
Cold Springs Trout Farm	N. Ogden	801-710-4905	Bluegill, largemouth bass, splake, tiger trout. Diploid and sterile rainbow trout, brook trout and brown trout
Koosharem III	Koosharem	435-638-7325	Brown trout, rainbow trout, splake
Mt. View Trout Farm	Brigham City	435-730-1723	Brook trout, brown trout, rainbow trout, tiger trout, brook trout
Spring Lake Trout Farm	Payson	801-369-7177	Bluegill, brook trout, brown trout, channel catfish, largemouth bass, rainbow trout, tiger trout, splake

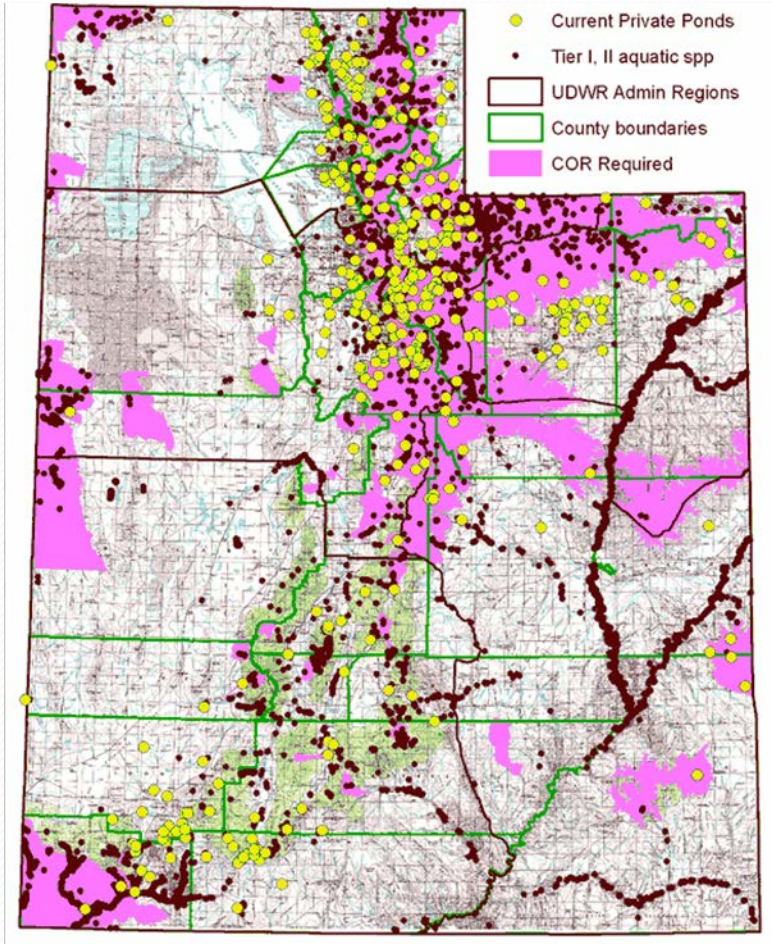
Do I need a license/permit to buy live fish?

- Yes
- Licenses are called a COR (Certificates of Registration)
  - Legal description of the facility and the species allowed
- CORs issued by
  - Division of Wildlife
    - Private / personal use
  - Dept. of Ag and Food
    - Commercial Production / Sales
    - Fee fishing facilities

COR Requirements

- May not be developed on
  - Natural lakes
  - Natural flowing streams
  - Reservoirs constructed on natural stream channels
- Screens Required
  - Prevent the movement of fish into or out of facility
- CORs renewed annually
- Annual report required
  - Lists transfer of fish into facility, out of facility (sales)
  - Certify presence of adequate screens

Exceptions to the rule

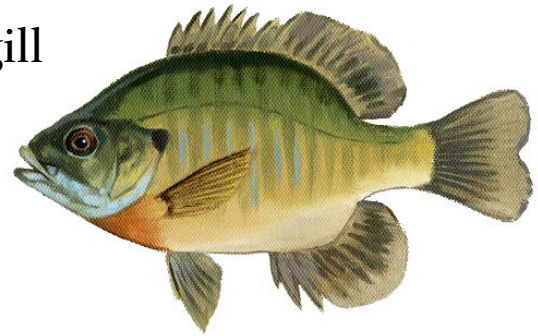


The Division of Wildlife Private Ponds Rule R657-59

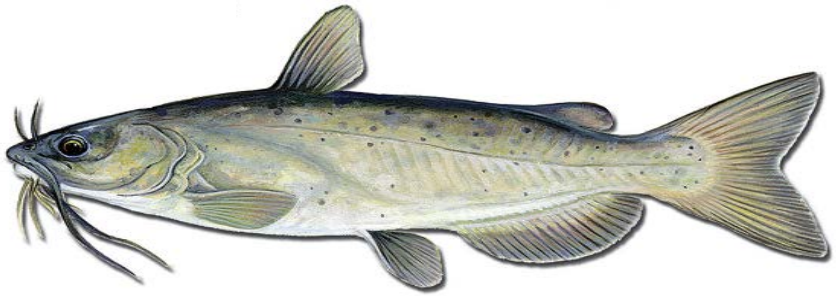
- Private ponds do not need COR if:
  - Receive less than 50 lbs of sterile rainbow trout from a licensed (Fish Health Approved) facility
  - Facility is properly screened
  - Pond is not in a pink area
- Best to check with DWR first

What type of fish can I get for my aquaponics system?

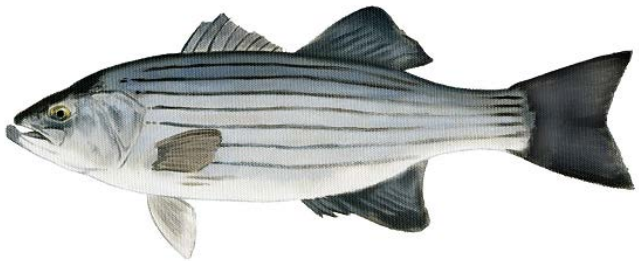
Bluegill



Catfish

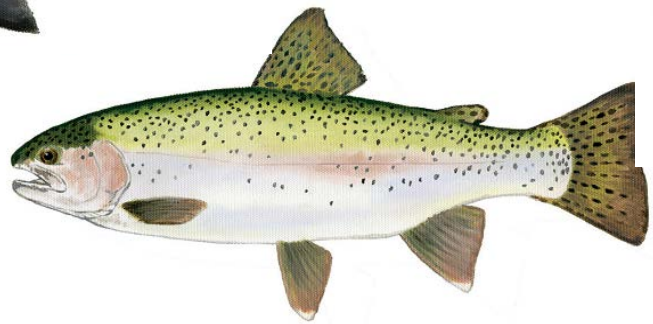


Hybrid Striped Bass



Koi or Goldfish

Trout



Can I sell live fish?

- For live sales, you MUST HAVE
  - Aquaculture COR from UDAF
  - **Fish Health Approval** from UDAF
    - Requires specific pathogen testing
      - May take 1 year to obtain
      - Trout: 2 inspections 6 months apart
    - Fish tested annually
      - Facility pays for testing
      - Additional testing may be requited for out of state sales
        - CO, WY require additional testing

Can I sell my fish?

- For whole fish (dead) sales
  - Must have aquaculture COR from UDAF
- For fillet sales
  - Need food handling training
  - Processing facilities inspected by UDAF
    - Division of Regulatory Services: 801-538-7144
  - Heed HACCP Plan
    - For Sushi, Sashimi or Ceviche
      - Needs to be frozen for 7 days
      - Health Department Rule

Can I sell my produce?

- Produce (Unprocessed fruits and vegetables)
  - NO Registration with UDAF required

Salad? (Cut, sliced, torn or processed)

- Requires registration with UDAF
- Cottage Food Production License
- Food Handlers Training

DWR's Concerns with Nonnative Species

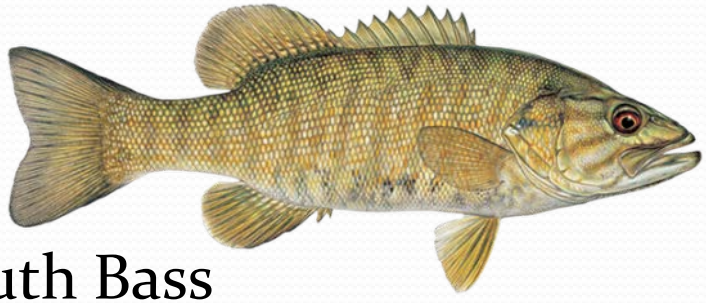
- Our mission is to serve the people of Utah as trustee and guardian of the state's wildlife
- DWR spends significant resources to eradicate, control, and suppress introduced nonnative invasive species
  - Quagga mussel in Lake Powell
    - Clean, drain, dry
  - Nonnative fish species in the Colorado River drainage
  - Northern pike in Utah Lake
  - Carp in Utah Lake

Problematic Nonnative Species

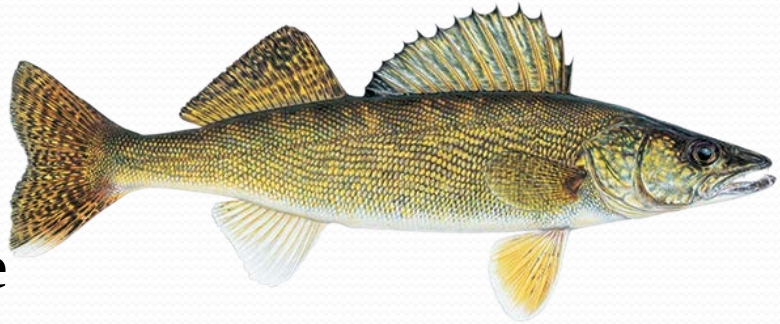
Upper Colorado River Endangered Fish Recovery Program

San Juan River Basin Recovery Implementation Program

Northern Pike

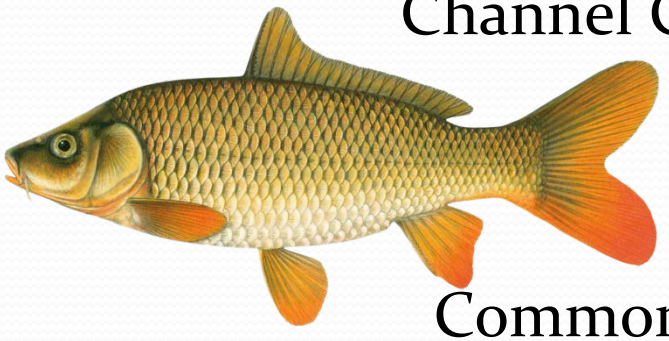


Smallmouth Bass



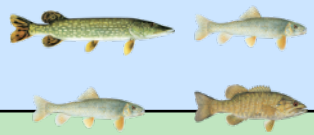
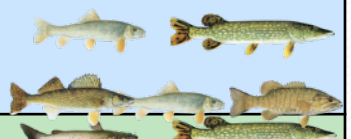
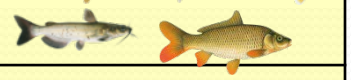
Walleye

Channel Catfish

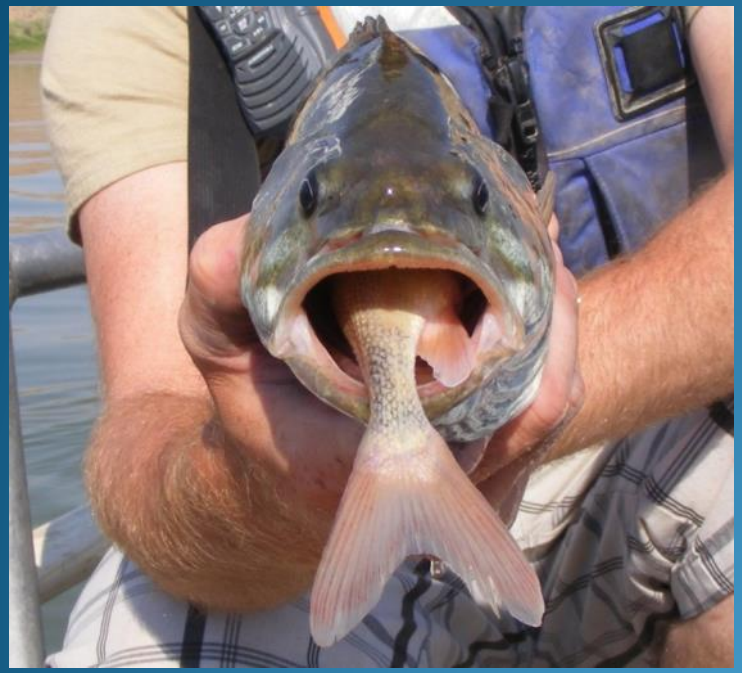


Common Carp

Fish illustrations by Joseph Tomelleri

River Reach	Presence of invasive aquatic species by decade			
	1980	1990	2000	2010
Colorado (Rifle to Fish Ladder)				
Colorado (Fish Ladder to Westwater)				
Colorado (Westwater to Green River)				
Dolores (McPhee to San Miguel River)				
Dolores (San Miguel to Colorado River)				
Gunnison (Colorado to Uncompahgre River)				
Green (Flaming Gorge to Yampa River)				
Green (Yampa to White River)				
Green (White to Colorado River)				
White (Kenney to Green River)				
Little Snake (Baggs to Yampa River)				
Yampa (Stagecoach to Craig)				
Yampa (Craig to Green River)				

Ecological Impacts: Predation



Ecological Impacts:
High Reproduction and Competition

Difficult to control

- Introductions can change the ecosystem
- Difficult to control or eradicate.

Genetic issues

- Species loss through hybridization
  - White sucker----Colorado River drainage
  - Rainbow trout---throughout Utah
- Hybrids
  - Swamp out the “pure” lineage
  - Do not count towards recovery, if species is listed endangered or State sensitive

What if I want Tilapia?

- Tilapia have been identified by the International Union for Conservation of Nature (IUCN) as one of the **top 100 most invasive groups** in the world
- Threat to native and sport fishes in Utah
  - Omnivore
  - Tolerate marginal water quality
  - Reproduction: mouthbrooders spawn multiple times during reproductive season

Tilapia Life History Traits

- Early sexual maturation: 3-6 months
- Competition and predation of resident fishes, mollusks, amphibians
- Remove vegetation
- Disease / health issues

Tilapia:

Classified as **prohibited** species in Utah

- What does that mean?
  - Variance process (UDWR R657-3-36, $200 fee)
  - Applicant prepares variance proposal and completes required business / operational plan
  - Present to the Certification Review Committee
    - recommendation to Wildlife Board
  - Wildlife Board makes final decision

Items to Consider Prior to Applying for Variance

- Only indoor recirculation facilities
- Species of tilapia must be pre-approved by UDWR
- Areas that will not be approved
  - Virgin River drainage
  - Portions of the Provo River drainage
- Areas will not be approved within the 100 year flood plain of the following drainages:
  - Green, Colorado, and San Juan Rivers

Business/Operational Plan

- Description of company
- Location
  - Identify flood risk, proximity to waterways, UTM's
- Facility design
  - Water source, effluent
- Describe operation of facility
  - Temperature, diet, sterile or fertile fish, market (if commercial), methods to track fish
- Identify source of Tilapia
  - Strain/species
  - Disease free
- Exit strategy—disposal of fish
- Ecological damage assurances
  - Performance bond is required

Questions?

FISH AND AQUAPONICS SYSTEMS

1) Apply for an aquaculture or private pond license (COR: Certificate of Registration)
COR will describe your facility and species allowed

Utah Department of Agriculture and Food
Aquaculture / commercial applications (sale of fish or aquaculture products)
http://ag.utah.gov/animal.html?id=168:aquaculture&catid=49
Fish Health Program: 801-538-7046

Utah Division of Wildlife:
Private ponds (personal use, no sales)
http://wildlife.utah.gov/fishing/fish_ponds.php
Cedar City: (435) 865-6100
Ogden: (801) 476-2740
Price: (435) 613-3700
Salt Lake City: (801) 538-4774
Springville: (801) 491-5678
Vernal: (435) 781-9453

2) Identify a supplier for your fish
Must have Fish Health Approval: http://ag.utah.gov/animal.html?id=168:aquaculture&catid=49
***** If supplier is not listed, contact the Utah Department of Agriculture and Food. The Fish Health Program will determine if the facility meets testing standards.

3) Obtain an Entry Permit (for fish shipments from out of state)

4) Must renew aquaculture COR annually

5) Must submit an annual report
Transfer of fish into and out of facility
Certify presence of screens

YOU CANNOT TRANSFER LIVE FISH TO ANOTHER FACILITY OR RELEASE THEM TO THE WILD

APPROVED Utah Fish Growers, Out-Of-State Growers and Utah Brokers

Note: It is necessary to use the approved fish growers from the two lists below for delivery of live aquaculture products in Utah. The approved fish grower shall deliver his product directly to the site of private ponds. If the use of a broker or other delivery options is necessary, then a certificate of registration may be needed for private pond owners (call Utah Division of Wildlife Resources at 801-538-4701). The following lists are subject to periodic change. **If you have any questions, contact UDAF at 801-538-7046.**

EFFECTIVE January 2016

FISH HEALTH APPROVED & LICENSED AQUACULTURE FACILITIES IN UTAH

Name	City	Phone	Species (& expiration date)
Christensen Catfish	Newcastle	435-691-4584	Hybrid striped bass (April 2016)
Cold Springs Trout Farm	N. Ogden	801-782-7282	Sterile and diploid rainbow, brown & brook trout, tiger trout, wipers, bluegill (January 2017)
Pine Creek Trout Farm	Bicknell	435-425-3281	Rainbow trout and wipers (February 2016)
Spring Lake Trout Farm	Payson	801-369-7177	Diploid and sterile rainbow trout and wipers (January 2017)
Water and Environmental Testing	American Fork	801-763-0660	Fathead minnows (January 2017)
West Haven Ranch	Richfield	435-896-4922	Diploid and triploid rainbow trout (May 2016)

FISH HEALTH APPROVED AQUACULTURE FACILITIES OUT-OF-STATE

Name	State	Phone	Species (& expiration date)
Black Canyon Trout Farm	Idaho	208-425-3239	Sterile and diploid rainbow trout, including eggs (Oct. 2016)
Desert Springs Trout Farm	Oregon	541-943-3192	Sterile and diploid rainbow trout (June 2016)
F&L Anderson	Arkansas	501-676-2035	Black crappie, largemouth bass, bluegill and fathead minnows (Dec. 2015)
Hartley Fish Farm	Kansas	620-532-3093	Bluegill, largemouth bass, smallmouth bass (March 2016)
Hopper Stephens	Arkansas	501-676-2435	Largemouth bass, bluegill, hybrid bluegill, black crappie, sunfish, catfish, grass carp, redear sunfish, yellow perch (March 2016)
Keo Fish Farms	Arkansas	501-842-2872	Hybrid striped bass (wiper), striped bass, bluegill, brem/grass carp (June 2016)
Osage Catfisheries Inc	Missouri	573-348-2305	Channel catfish, largemouth bass, black crappie, fathead minnows, and redear sunfish (February 2016)
Oswald Fisheries - Bruce Facility	South Dakota	507-684-3808	Tiger Muskie (August 2016)
Troutlodge Inc.	Washington	253-863-0446	Diploid and triploid rainbow trout eggs (steelhead) (Nov. 2016)
Wright's Rainbows	Idaho	208-547-7452	Diploid rainbow trout (April 2016)

LICENSED BROKERS IN UTAH

Name	City	Phone	Species
Cold Springs Trout Farm	N. Ogden	801-710-4905	Bluegill, largemouth bass, splake, tiger trout. Diploid and sterile rainbow trout, brook trout and brown trout
Koosharem III	Koosharem	435-638-7325	Brown trout, rainbow trout, splake
Mt. View Trout Farm	Brigham City	435-730-1723	Brook trout, brown trout, rainbow trout, tiger trout, brook trout
Spring Lake Trout Farm	Payson	801-369-7177	Bluegill, brook trout, brown trout, channel catfish, largemouth bass, rainbow trout, tiger trout, splake

Tilapia in Utah

Tilapia is the common name given to nearly a hundred species of cichlid fish from the genera *Oreochromis, Sarotherodon,* and *Tilapia*. In their native ranges of Africa and the Middle East, tilapia have been of major importance to subsistence fishing. Outside of its native range, tilapia are often utilized in aquaculture and aquaponic facilities; due to their high protein content, large size, high reproductive rates, rapid growth, propensity to exist in high densities, omnivorous diet, and their ability to exist in or adapt to wide range of environmental conditions. **However these traits that are desirable by fish producers, also allow the tilapia to establish themselves into new habitats quickly** where they have the ability to impact and alter local habitat and pose a significant threat to sport and native species populations in Utah. In fact, **tilapia have been identified by the International Union for Conservation of Nature (IUCN) as one of the top 100 most invasive groups in the world (Lowe et. al 2000).**

<u>Threats to native and sport fishes in Utah</u>

- **Omnivore:** they eat anything that fits in their mouth. Tilapia are opportunistic generalists that feed on whatever food source is available including fish, mollusks, tadpoles, phytoplankton, algae, zooplankton, small insects and their larvae, shrimp, earthworms, and aquatic macrophytes.

- **Tolerate marginal water quality**: The ability to tolerate marginal water quality and withstand a wide array of water temperatures allow tilapia to establish and thrive in a diverse set of habitat conditions. Although they prefer freshwater, tilapia possess a high tolerance for saline conditions and have known to exist in brackish water, even seawater. The maximum salt level tolerated by tilapia is similar to salt levels currently measured in Farmington Bay. Tilapia also tolerate low dissolved oxygen (DO) levels and can utilize atmospheric oxygen when oxygen levels decline in the water.

- **Reproduction**: Most species of tilapia are **mouthbrooders.** Mouthbrooders offer parental care to their offspring by holding them in their mouth for extended periods of time. This adaptation allows a species to produce smaller numbers of offspring at a time, but by providing parental care, it ensures a **higher chance of survival** than those species that offer no brood care. The ability to transport young in their mouth allows tilapia to **occupy many niches during spawning**. Also, tilapia have the capacity to **spawn multiple broods during the reproductive season.**

- **Early sexual maturation:** 3-6 months. Due to their adaptive nature and reproductive strategies, tilapia can fill all available niches and dominate the aquatic community.

- **Out compete resident fishes**: Tilapia have the ability to out compete resident fish species through direct competition for similar resources; food, habitat, and spawning sites. Their omnivorous food habits enable them to exploit all available resources.

- **Predation**: Tilapia can be harmful through direct predation on fish, mollusks, and amphibians. Declines in mollusk abundance have been attributed to tilapia predation in at least two waters in Texas (USGS 2013).

- **Remove vegetation** (cover): Tilapia are also voracious herbivores that can impact aquatic macrophyte communities and the fish that rely on them for cover, foraging, or spawning sites. Similarly, tilapia contribute to the turbidity of water, thus reducing the amount of light available for organisms relying on photosynthesis (primary producers). Macrophytes are the preferred substrate of native aquatic mollusks. Sensitive species of mollusks found in springs in the west desert would be significantly impacted through the removal of macrophytes and associated increase in turbidity.

- **Fish Disease/Health Issues:** There are documented findings of a number of **serious fish pathogens in various species of tilapia,** many of which have not previously been found in Utah, and which could affect other species of fish within the State if allowed to disseminate.

- **Legal implications**: although there are several pathogens of concern, most of the pathogens of concern are not currently listed as prohibited pathogens under Utah's Fish Health Rule, so there is no legal requirement for inspection. In addition, with the exception of the viruses, there are no established protocols for inspections for these other pathogens in the Fish Health Section (FHS) Bluebook.

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Using Local Biochar for Vegetables

Biographical Information:
Britney Hunter
Extension Assistant Professor
Utah State University
Botanical Center

Britney Hunter is a Horticulture Extension Assistant Professor for USU in Davis County where she develops educational programs for home gardeners, horticulture professionals, and farmers. Britney is also involved with applied research demonstrations at the USU Botanical Center in Kaysville.

Session Description:
Biochar is a charcoal product made by heating plant biomass via pyrolysis and is increasingly marketed as an organic soil amendment. Commonly reported soil improvement properties of biochar include organic carbon increases and improved water and nutrient retention. Biochar application is also thought to stimulate plant resistance to soil borne diseases. As energy-producing pyrolysis industries expand, there is increasing opportunity to utilize locally produced biochar for its value in sustainable agriculture. Initial field study results indicate biochar has potential to benefit Utah agricultural operations.

Using Local Biochar for Vegetables

Britney Hunter, Extension Assistant Professor
Utah State University

UtahStateUniversity
COOPERATIVE EXTENSION

What is Biochar?

- Modern biochar production attempts to create a soil amendment similar to the ancient terra preta soils in Brazil
- “Amazonian dark earth” or "black earth of the Indian“ areas 1-80 hectares in diameter
- Contains **charcoal**, bone, pottery shards, and manure

Left - a nutrient-poor oxisol; right - an oxisol transformed into fertile terra preta

Introduction to Biochar

Biochar is a charcoal product created through the pyrolysis process which also produces combustible gases and oils for energy generation and biochemical manufacturing

Plant Biomass

Mobile Pyrolysis Unit

~350-750°C

- **Heats biomass in closed system**
- **high temperatures >300°C**
- **limited supply of oxygen**

- **HEAT**
- **ELECTRICITY**
- **BIO FUELS**
- **BIO CHAR**

Biomass Utilization and Renewable Energy

- Orchard growers
- U.S. Forest Service
- Renewable Energy
- Utah Biomass Resources Group

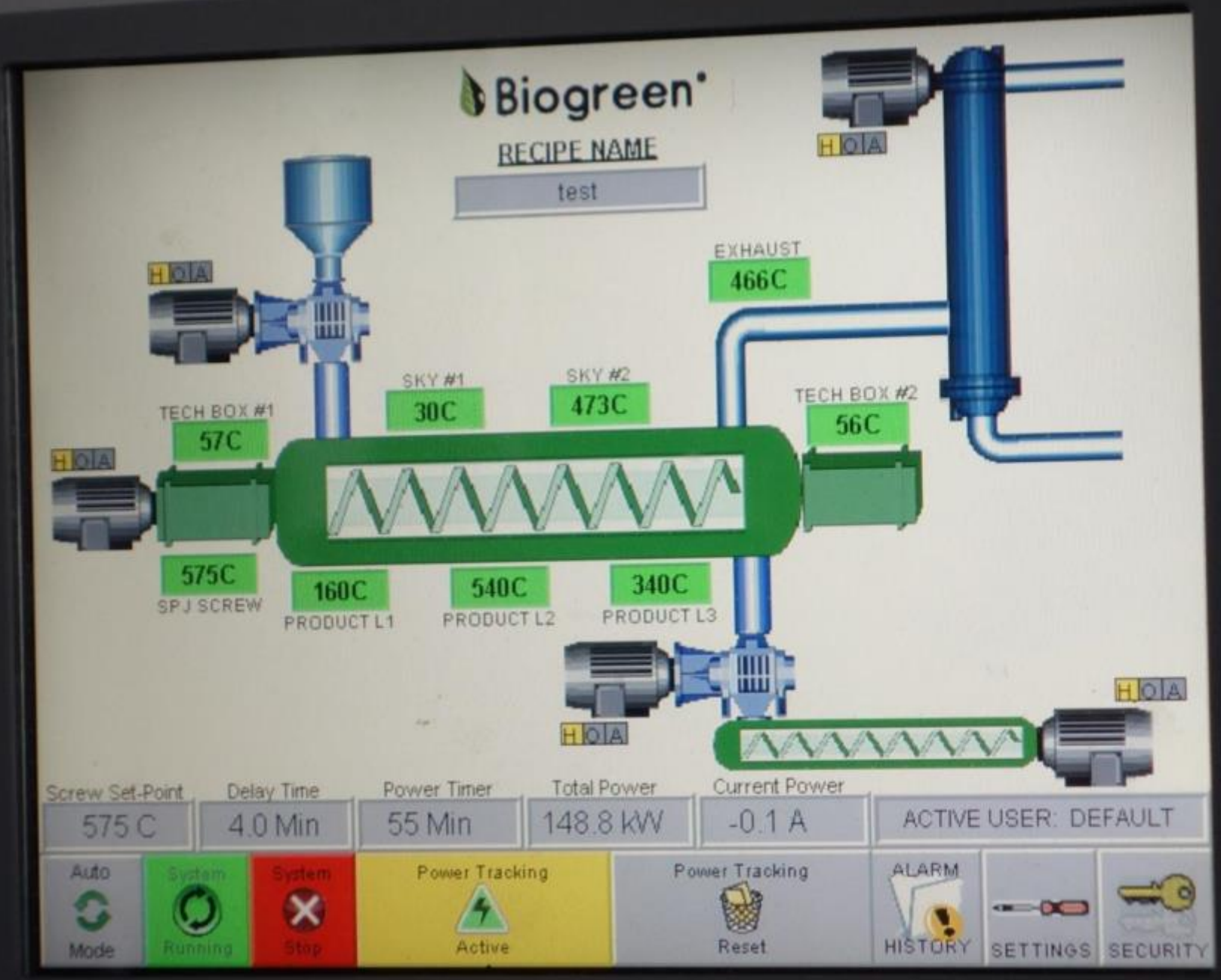
Fruit Wood → Biochar

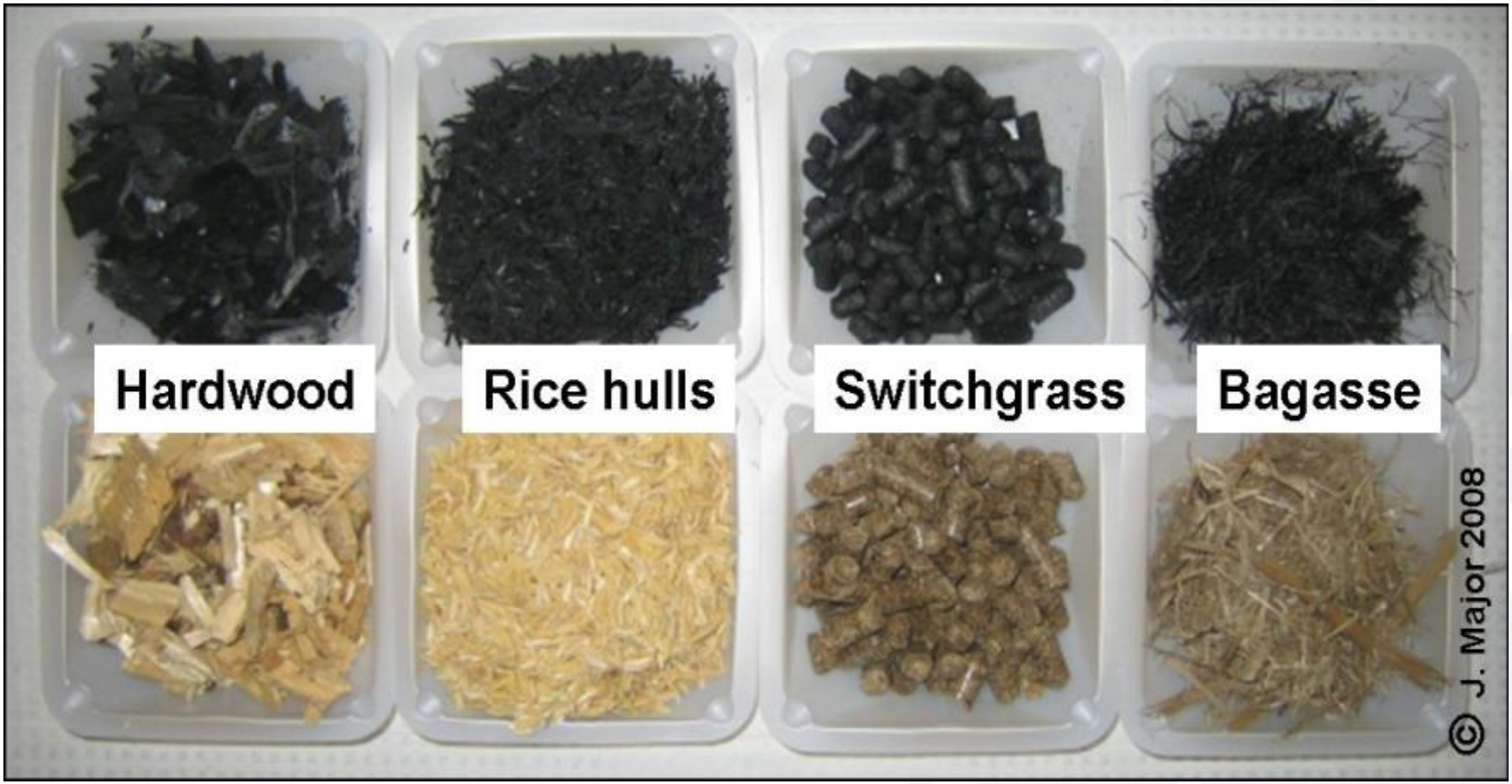
Robert McMullin

Biogreen pyrolysis® unit
Western Renewables Technology in Linden, UT

UtahStateUniversity
COOPERATIVE EXTENSION


PINCH POINTS
PINCH POINTS
AER


Biogreen
RECIPE NAME
test
H O A
EXHAUST
466C
SKY #1
30C
SKY #2
473C
TECH BOX #1
57C
TECH BOX #2
56C
575C
SPJ SCREW
160C
PRODUCT L1
540C
PRODUCT L2
340C
PRODUCT L3
Screw Set-Point
575 C
Delay Time
4.0 Min
Power Timer
55 Min
Total Power
148.8 kW
Current Power
-0.1 A
ACTIVE USER: DEFAULT
Auto
Mode
System
Running
System
Stop
Power Tracking
Active
Power Tracking
Reset
ALARM
HISTORY
SETTINGS
SECURITY

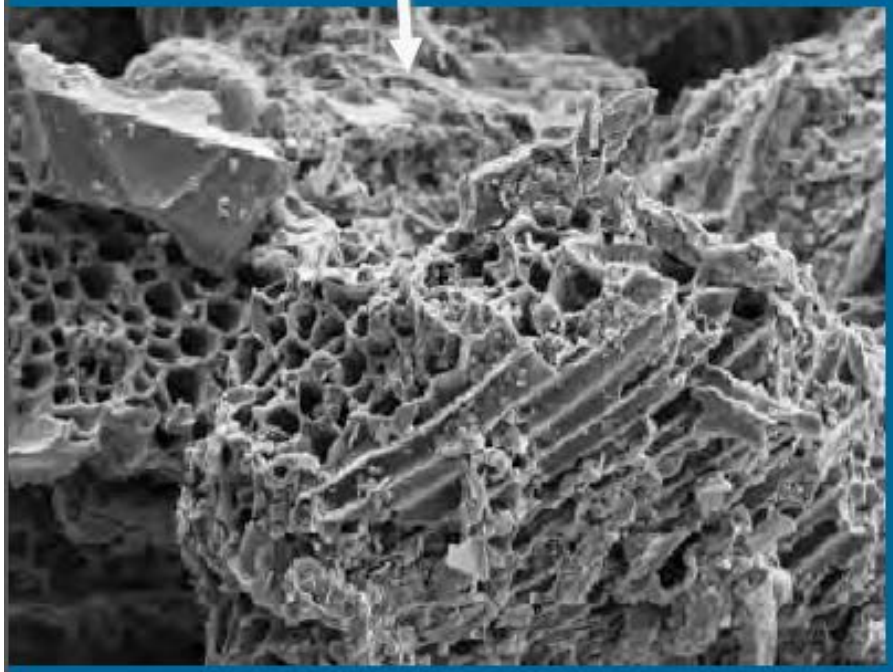


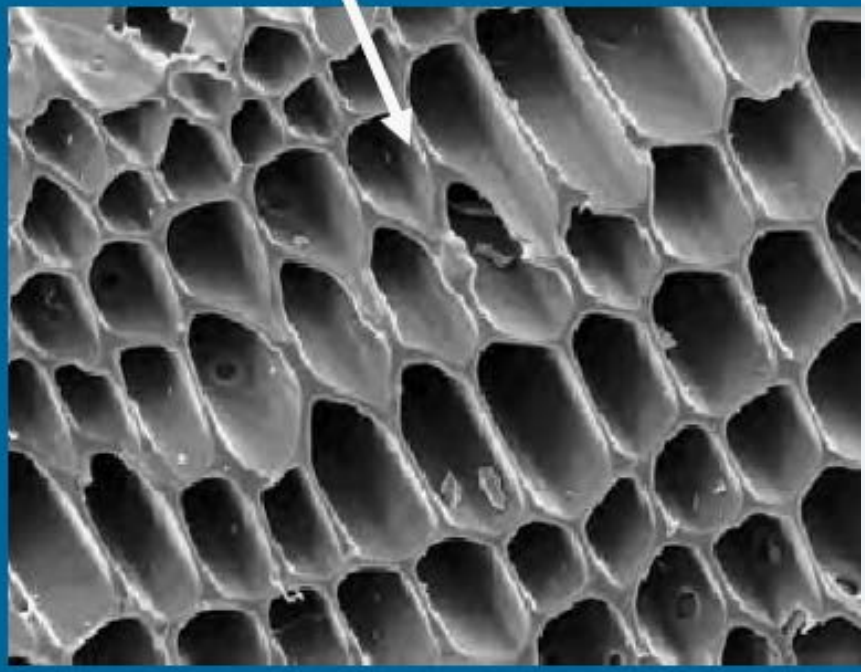
www.biochar-international.org

Various Biochars

Poultry Manure

Radiata Pine





Biochar for Soil Improvement

Physical:

water retention, soil structure, drainage

Chemical:

CEC, pH, nutrient holding capacity

Biological:

microbial activity, nutrient release

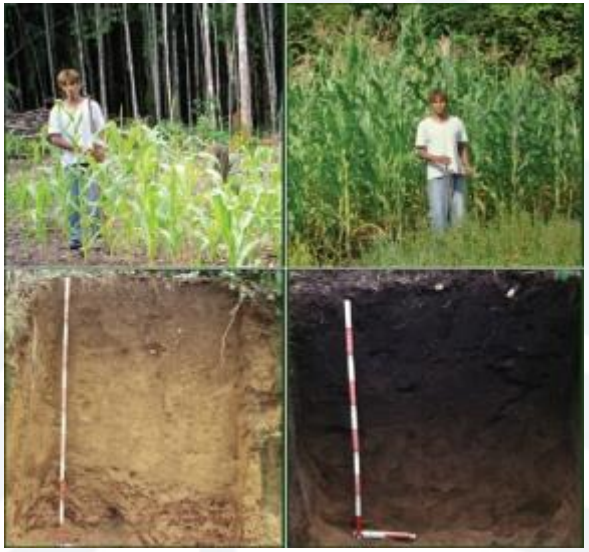
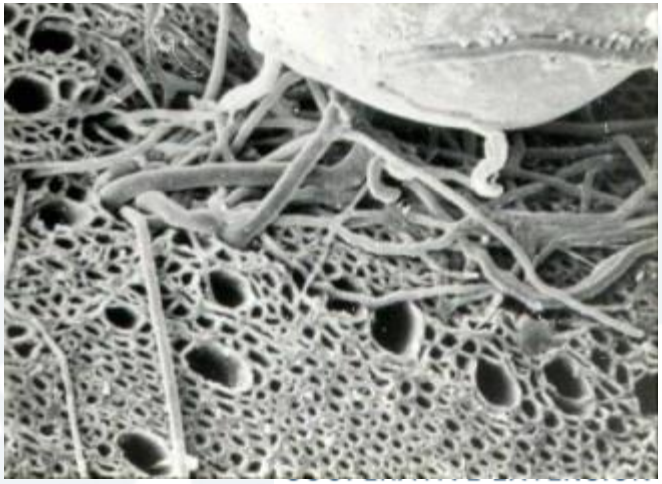


Image credit:
www.biocharinternational.org/biochar/soils



(*Photo credit: Makoto Ogawa, Kansai Environmental Institute)*

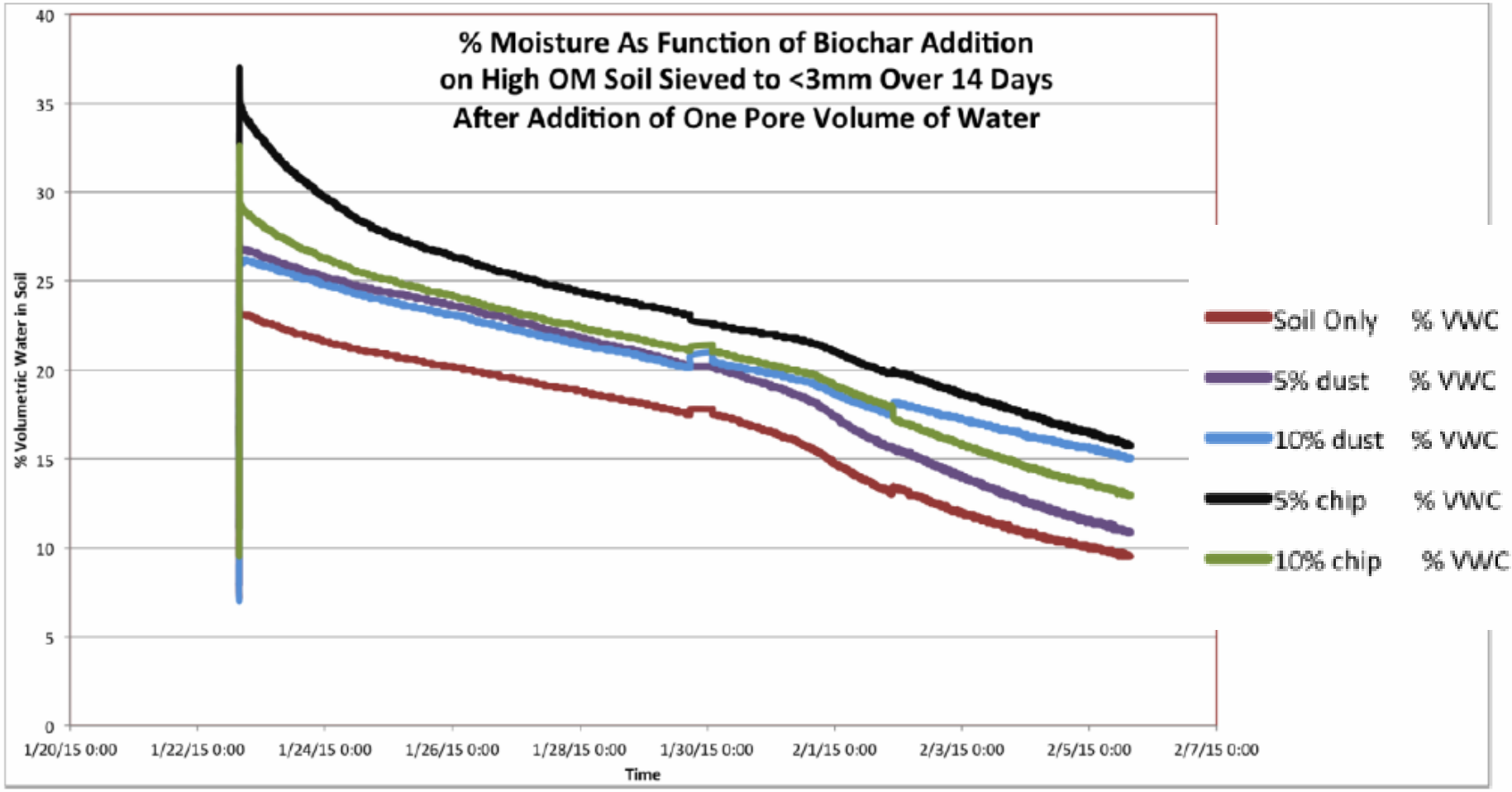
Biochar vs. Compost

- Lasts for 100's of years to support overall fertility
- Reactive material / exchange sites for water and nutrients
- Long term carbon storage

- Breaks down over several years to "feed" the soil
- Humic Acid / Humate

% Moisture as a Function of Biochar Addition to High OM Soil

Morgan Williams.
Applied Soils, LLC.
2/8/2015



Biochar is so awesome, why don't we use it everywhere?

#1 Not all char is created equal

#2 Has different effect in different environments

#3 Economics

Agronomic Effects Summary

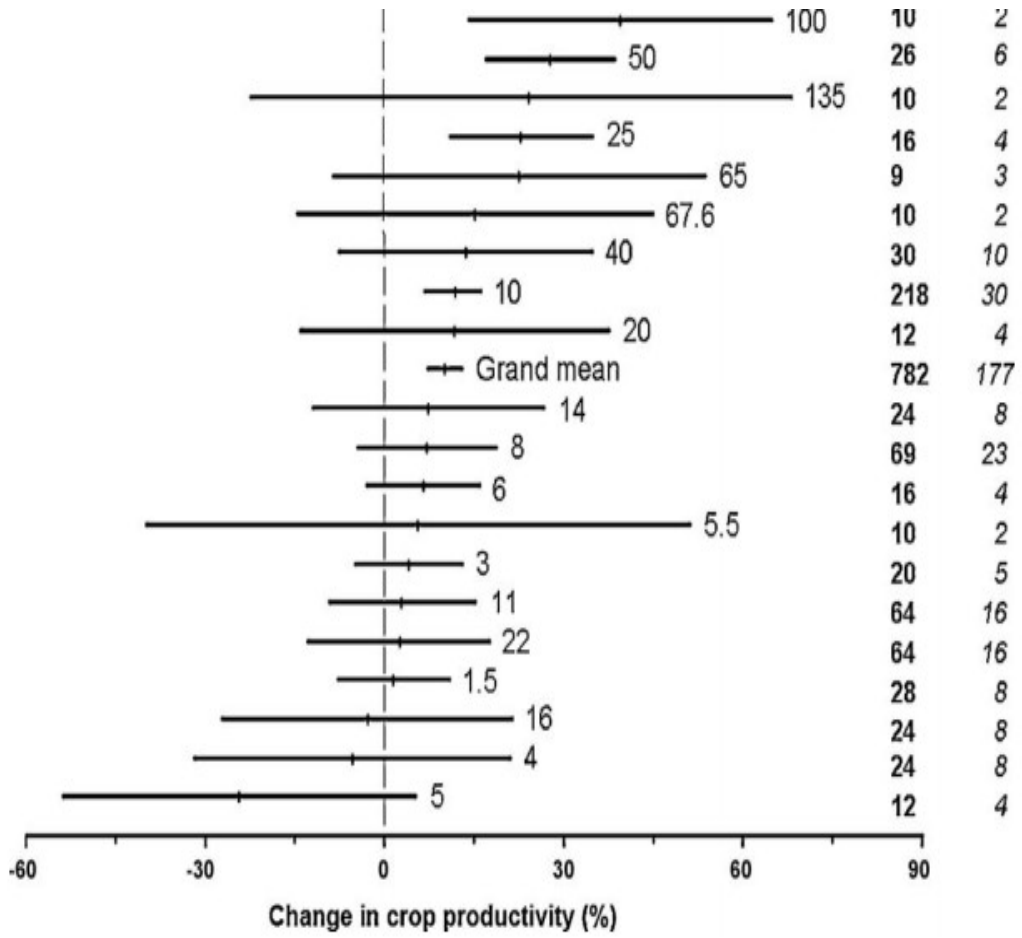


Fig. 1. A forest plot showing the mean change in crop productivity as a percentage of the control, for a range of different biochar application rates. Points show means of treatments, bars show 95% confidence intervals. Numbers to the right of bars show biochar application rates (t ha^{-1}), while numbers in the two columns on the right show the total number of 'replicates' (*n*) from the combined studies upon which the statistical analysis is based (bold), and the number of 'experimental treatments' that have been grouped for each analysis (italics).

(Jeffery et al., 2011)

How to Use Biochar

- Crush it so it is a small particle size
- Add water
- Add compost or other fertilizer (inoculation)
- Incorporate into root zone (6”-8” for annual crops)
- Rate: approximately 1% by weight
  - Assuming 2,000,000 lbs/acre 6-7 in deep **10 tons/acre**

www.biocharapplication.com

Specialty Biochar Products - $1.50+ per lb

Amazon
$19.99 - 1 Cubic foot

(Blue Sky Biochar)

Home Depot
$24.99 - 1 Cubic foot

Whole Foods / Amazon
$47.95 - 1 Cubic foot

Bulk Pricing

- Varies highly depending on producer and “quality”
- $200 - $800 per ton
- 1% application = $2,000 - $8,000/acre

https://www.biochar-journal.org/en/ct/71

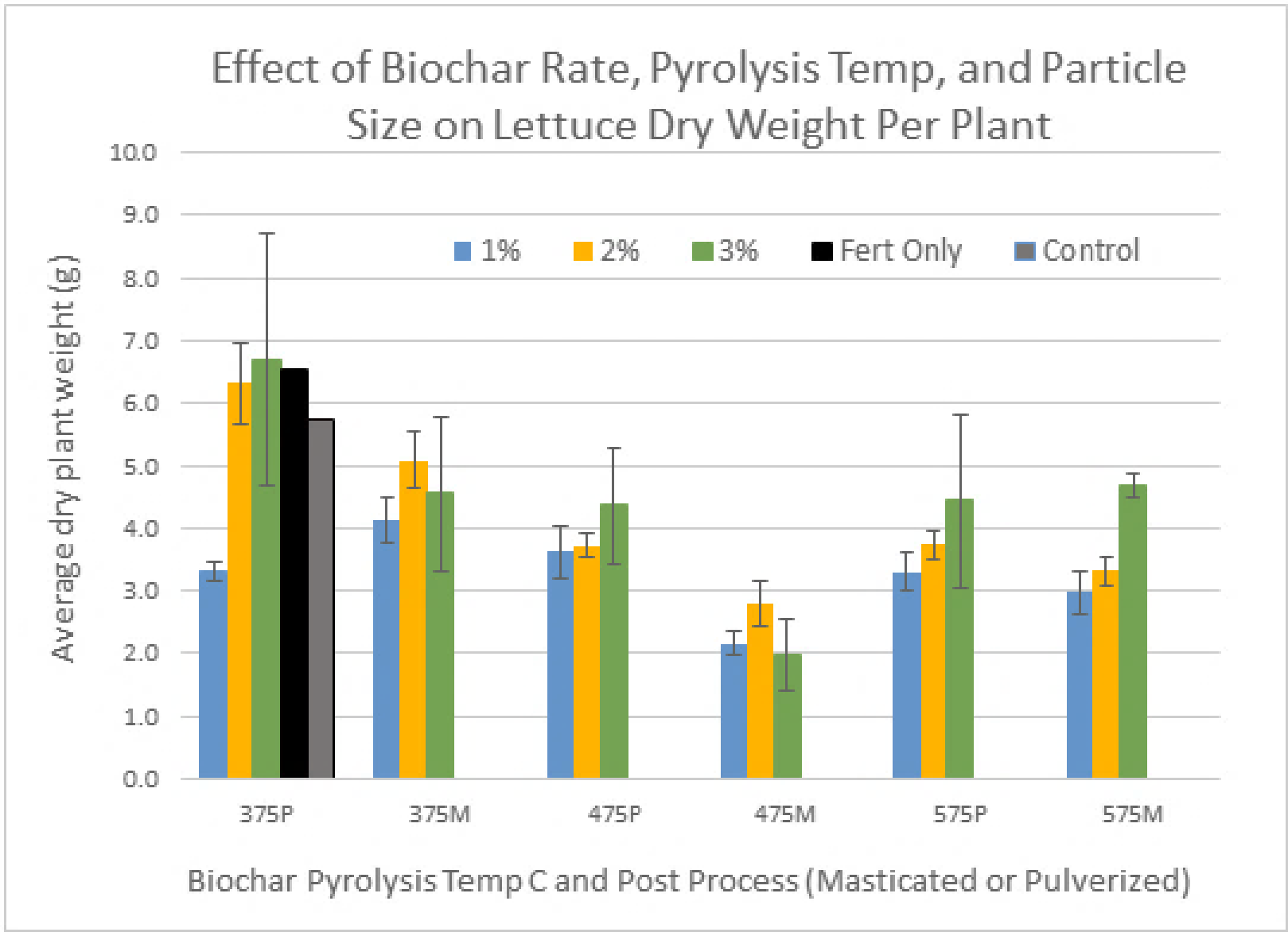
Pyrolysis Technology Pricing from Western Renewable Technologies (Linden, UT)

- $400,000 - Smaller batch style
  - 500 lbs chips per hour
- $937,900 - Biogreen 450
  - Mobile or fixed, turnkey
  - Half ton chips per hour, continuous
- $1,380,700 - Biogreen 600
  - Mobile or fixed, turnkey
  - Full ton chips per hour, continuous

2014 container trial

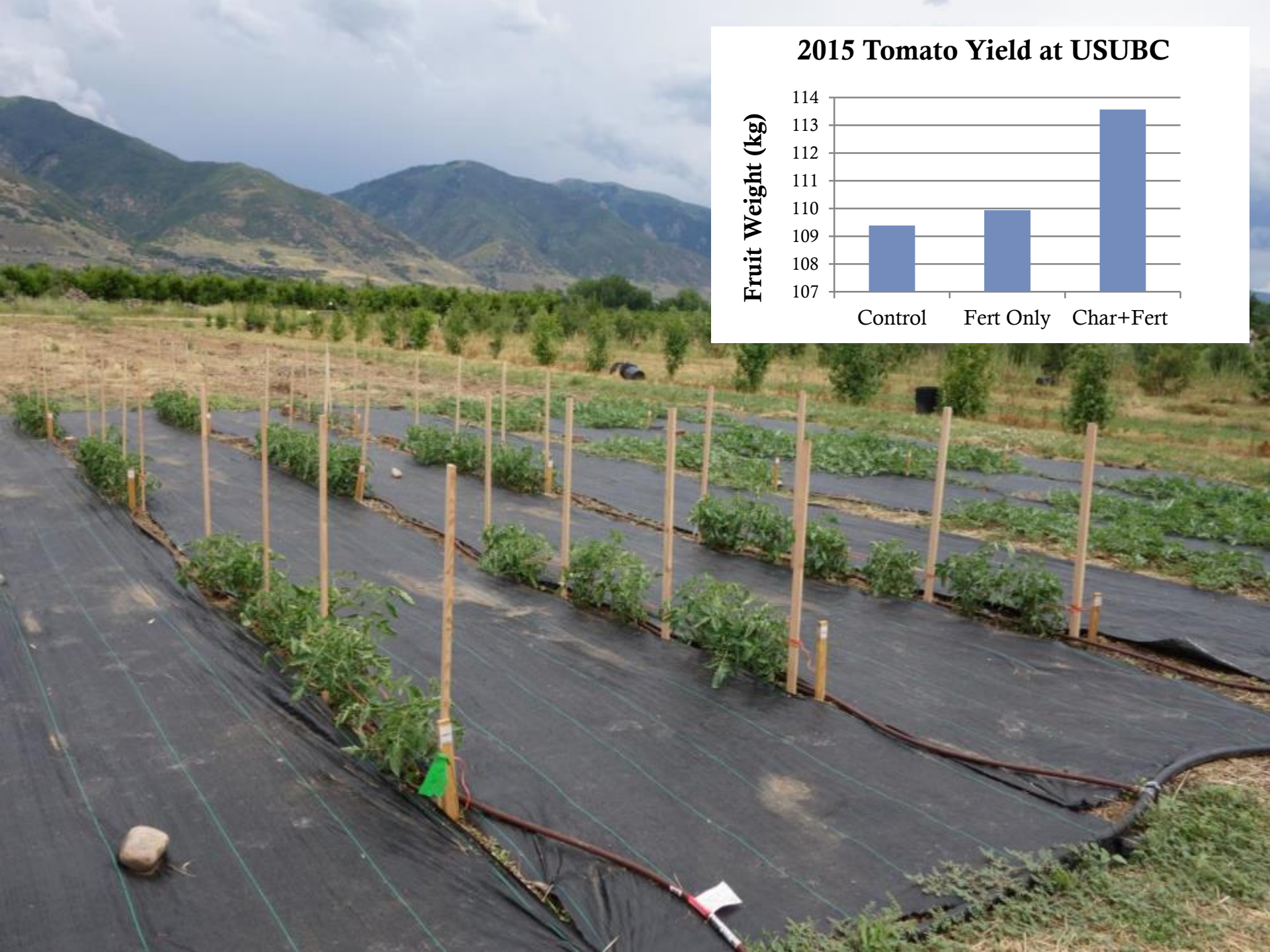
- Harvested after 9 weeks
- Average dry plant weight (g)

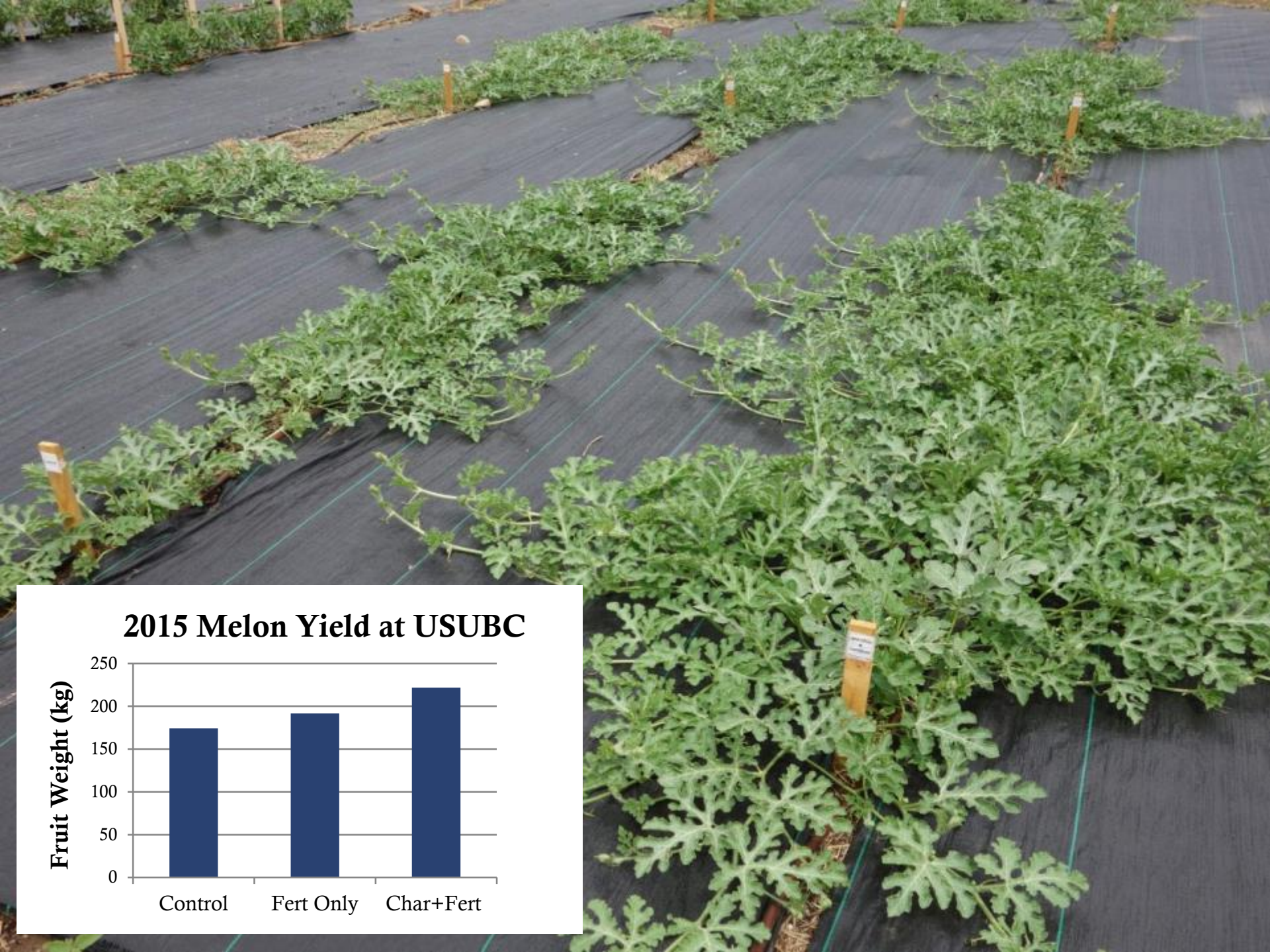
Results


Effect of Biochar Rate, Pyrolysis Temp, and Particle Size on Lettuce Dry Weight Per Plant
Average dry plant weight (g)
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1%
2%
3%
Fert Only
Control
375P
375M
475P
475M
575P
575M
Biochar Pyrolysis Temp C and Post Process (Masticated or Pulverized)

2015-16 Farm Study
Tomatoes and Melons

- 3 Vegetables Growers + USU Botanical Center
- Measure
  - Water and nutrient retention
  - Plant growth
  - Yield
  - Disease resistance


2015 Tomato Yield at USUBC
Fruit Weight (kg)
114
113
112
111
110
109
108
107
Control
Fert Only
Char+Fert


2015 Melon Yield at USUBC
Fruit Weight (kg)
250
200
150
100
50
0
Control
Fert Only
Char+Fert


Resistance to Phytopthora with biochar
(Results pending)

Thank You – Stay Tuned

http://utahbiomassresources.org

WESTERN SARE
Sustainable Agriculture Research & Education

Britney Hunter
Extension Assistant Professor
Utah State University

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UtahStateUniversity
COOPERATIVE EXTENSION

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Vegetable Weed Management
(Curcurbits and Solanum Crops)

Biographical Information:

Ed Peachey
Oregon State University
Department of Horticulture

Ed is an associate professor in the OSU department of horticulture with an extension and research assignment. I have been working in weed management (veggies and berries) and vegetable production at OSU for about 25 years. Prior to that I worked as an ag extension agent for 3 years in Bangladesh. Vegetable crops that get most of my attention now are irrigated crops grown for processing, vegetable seed crops, and some fresh market vegetables in the Willamette Valley of OR with a Mediterranean type climate and very dry summers. I also do applied research in berry and nut crops. Currently we are evaluating interseeding as a way to improve establishment and survival of cover crops in crops such as sweet corn.

Session Description:

Will discuss integrated strategies to control weeds in cucurbits and solanum crops. The primary focus will be on how to get the most out of the herbicides that are labeled for these crops, including strategies to maximize control, minimize potential to damage the crop, and limit illegal residues in the crop or limit carryover to other crops.

Weed Control in
Cucurbit and Solanum Crops

Ed.Peachey@oregonstate.edu

Http://horticulture.Oregonstate.Edu/content/ed-peachey

Http:// oregonvegetables.Com

Http://extension.Oregonstate.Edu/linn/commercial-vegetables

Main cucurbit in W OR

C. maxima

var. Golden Delicious

Hubbard type

Winter squash

3000 A for seed

300 A pumpkin filling

Butternut (Dickinson)

Interseeding cover crops

Weed Control in **Cucurbit and Solanum Crops**

I. Integrated Management

II. Using herbicides in cucurbits and tomatoes

III. Attacking the seedbank (if time)

I. Integrated management

PREVENTION IS THE BEST CURE

1. Sanitation/ Prevent seed production
2. Mechanical
3. Biological
4. Cultural
5. Chemical

Diversifying selection pressures

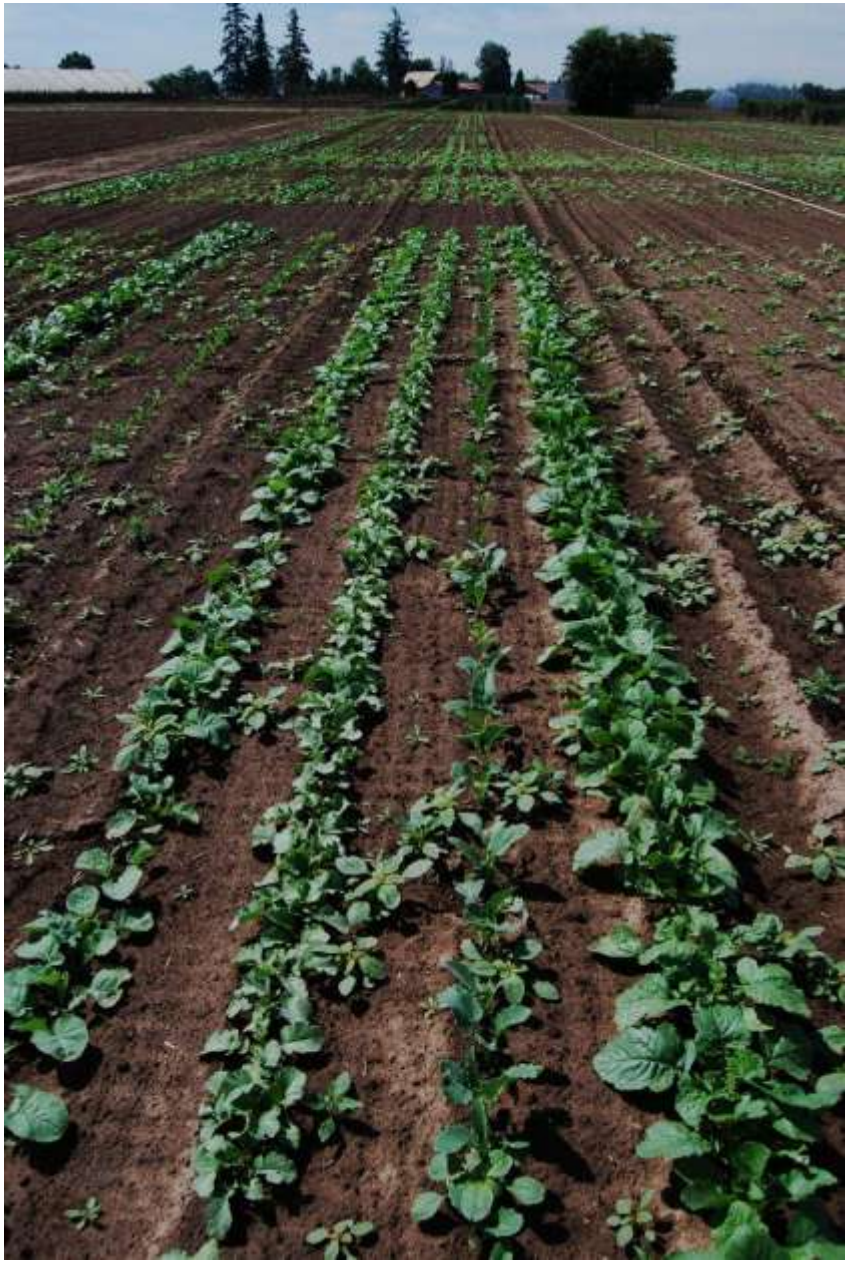
Puncturevine contaminating beans

Careful sanitation to prevent this

Monroe, 2007

Millet going to seed in processing squash

II. Using herbicides



- Read and understand the label
- **Pesticide tolerances** are legal limits
- **PHI** (Pre harvest Intervals)
- **MRLS** Maximum Residue Limits
- **Carryover** to next crop

Types of herbicides

PPI, PRE, PES, PPS, POST

Preplant Incorporated Herbicides

- ✓ degrade quickly on surface
- ✓ insoluble

Preplant Incorporated Herbicides

Must get herbicide next to seed

Good for large seeded weeds

Kill buried crowns and shoots

Absorbed through shoot and roots

PrePlant and Post Plant Surface (PPS)

- Also known as PRE (preemergence)
- Herbicides that kill as weed seed roots emerge
  - Dual Magnum
  - Prowl
  - Curbit

Postemergence (POST)

Contact	***Translocated***
Aim	Roundup
Paraquat	Poast
Acetic Acid	Select
	Fusilade

PRE and POST activity

Matrix

Many sulfonylurea herbicides

PHI and MRLs

PHI= preharvest interval

MRL=Maximum Residue Limits

- International tolerances
- Country specific
- No MRL for you product means you will not be shipping to that country

Trading partner MRLS

Chemical Name (a.i.)	Product Name*	USA	Canada	Codex	EU/UK	Japan	Korea	Taiwan
~ ~ ~ ~ *Herbicides* ~ ~ ~ ~ ~								
2,4-D	Saber	0.2	0.01	0.1	0.1	0.1	0.05	0.02
Carfentrazone-ethyl	Aim	0.1	0.1	NT	0.01	0.1	0.1	NT
Clethodim	Select	0.2	0.2	NT	0.1	NT	0.1	NT
Clopyralid	Stinger	0.5	0.1	NT	0.5	NT	NT	NT
Dichlobenil	Casoron	0.15	NT	NT	0.01	0.2	0.15	NT
Diuron	Karmex	0.1	NT	NT	0.01	0.05	1.0	NT
Flumioxazin	Chateau	0.02	0.02	NT	0.02	0.1	0.1	NT
Glufosinate	Rely	0.15	0.1	0.1	0.5	0.1	0.1	0.1
Glyphosate	Roundup, etc	0.2	NT	NT	0.1	0.2	0.2	0.2
Halosulfuron	Sandea	0.05	0.05	NT	0.01	0.05	0.05	NT
Hexazinone	Velpar	0.6	NT	NT	NT	0.2	0.5	0.01
Mesotrione	Callisto	0.01	0.01	NT	0.05	0.01	0.2	NT
Napropamide	Devrinol	0.1	0.1	NT	0.1	0.1	0.1	0.01
Norflurazon	Solicam	0.2	NT	NT	NT	0.2	0.1	0.1
Oryzalin	Surflan	0.05	NT	NT	0.01	0.08	0.05	NT
Paraquat	Gramoxone	0.05	0.05	0.01	0.02	0.05	0.05	NT
Pelargonic acid	Scythe	Ex	--	--	--	--	--	--
Pronamide (propyzamide)	Kerb	0.05	NT	NT	0.02	0.04	NT	NT
Rimsulfuron	Matrix SG	0.01	0.05	NT	0.01	0.05	NT	NT
S-metolachlor	Dual Magnum	0.15	0.15	NT	0.05	NT	0.1	NT
Sethoxydim	Poast	4.0	4.0	NT	0.1	4.0	1.0	NT
Simazine	Simazine, Princep	0.2	NT	NT	0.01	0.2	0.25	0.2
Sulfentrazone	Spartan	0.15	NT	NT	NT	0.05	NT	NT
Terbacil	Sinbar	0.2	NT	NT	NT	0.1	NT	NT

Modes of Action

Group Numbers

13 Command

3 Curbit

15 Devrinol

15 Dual Mag

2 Matrix

1 Poast

8 Prefar

14 Reflex

2 Sandea

5 Sencor

5 Sinbar

1 Select

14 Spartan

3 Treflan

29 unique sites in plants that herbicides attack

Cucurbits

Herbicides for cucurbits

PRE	POST
Command	Sinbar
Curbit	Poast
Dual Mag	Select
Prefar	
Treflan	
Sandea	

Command

CLOMAZONE

Command (clomazone)

Cucumber, melons, squash

3ME vs EC formulations

Weak on pigweed

Rate and Time

cucumbers 0.4 to 1 pint/A;

melons 0.4 to 0.67 pint/A;

summer squash 0.67 to 1.33 pints/A;

winter squash including processing pumpkin 0.67 to 2 pints/A.

Use boom mounted on front of incorporation equipment to ensure immediate incorporation at 1 inch.


19
Command

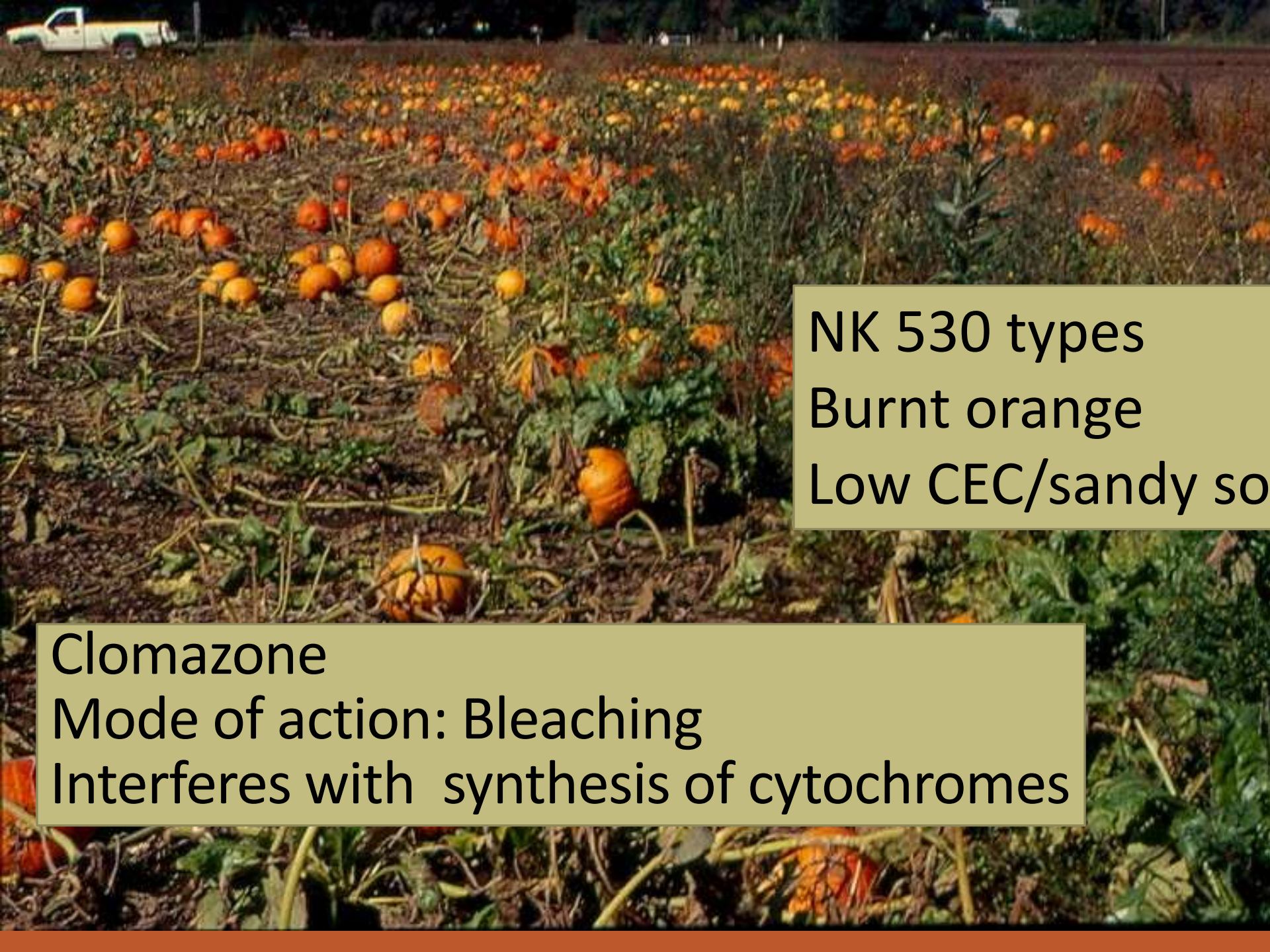
Cautions

Crop-rotation restrictions for up to 16 months after treatment.

May discolor fruit of some orange varieties.

Do not use on NK530, NK580, “Turk’s turban,” “Golden Delicious,” all banana types and all other *Cucurbita maxima* that have a pink or burnt-orange color at harvest.

Do not use on jack-o-lantern pumpkins.



NK 530 types
Burnt orange
Low CEC/sandy so

Clomazone
Mode of action: Bleaching
Interferes with synthesis of cytochromes


Command carryover (4 mon)

Command: offsite movement

Incorporation strategies

Irrigation

Spike tooth harrow

Rototiller

Curbit (ethalfluralin)

CUCUMBER, PUMPKIN, WINTER AND SUMMER SQUASH, WATERMELON

Curbit (ethalfluralin)

Cucumber, Pumpkin, Winter and summer squash, watermelon

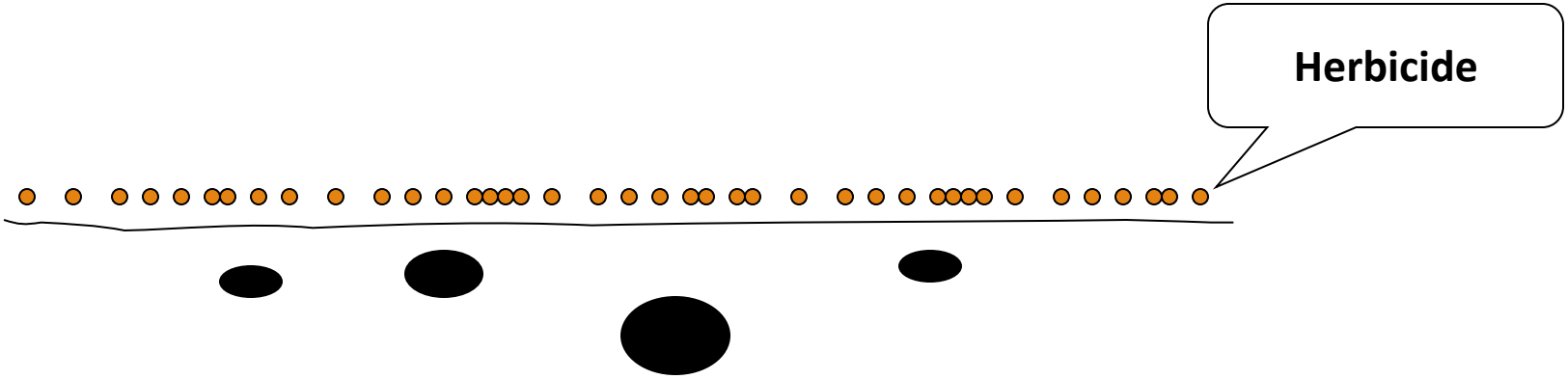
Direct-seed PPS

PRE transplant

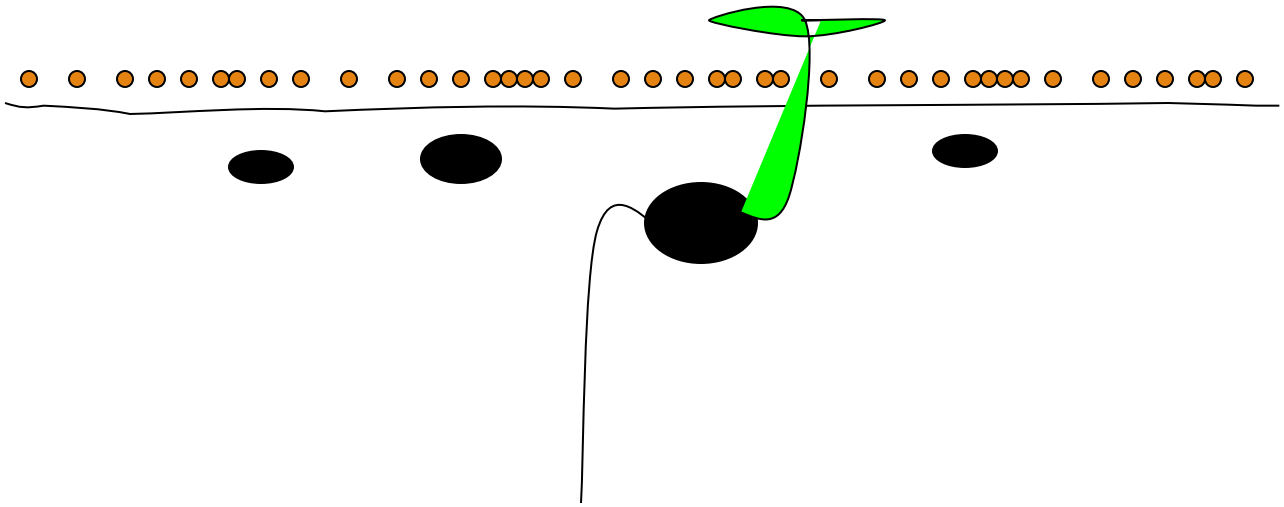
Banded spray between rows of direct seeded or transplants on plastic mulch.


Trifluralin on
Oat Roots
Preplant
Incorporated

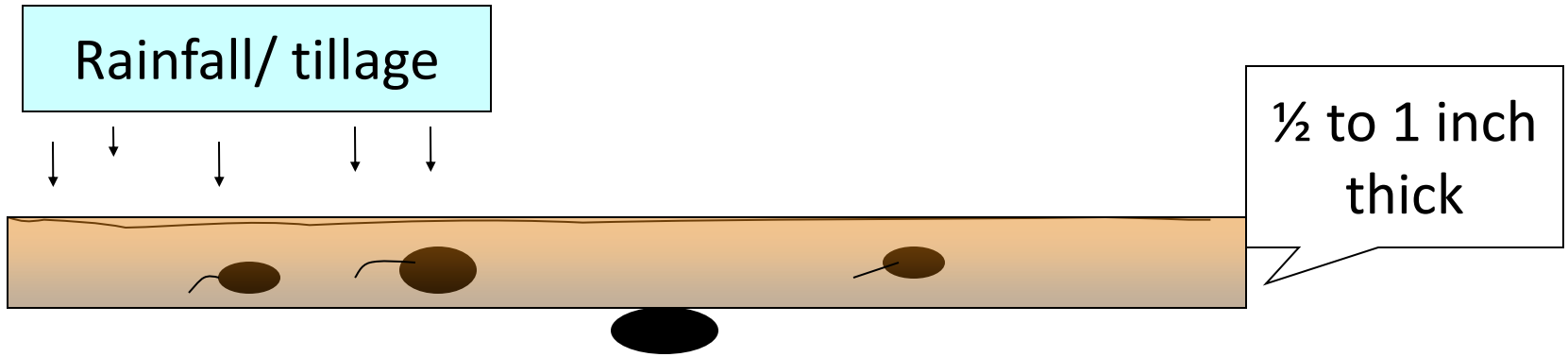
Establishing an herbicide barrier



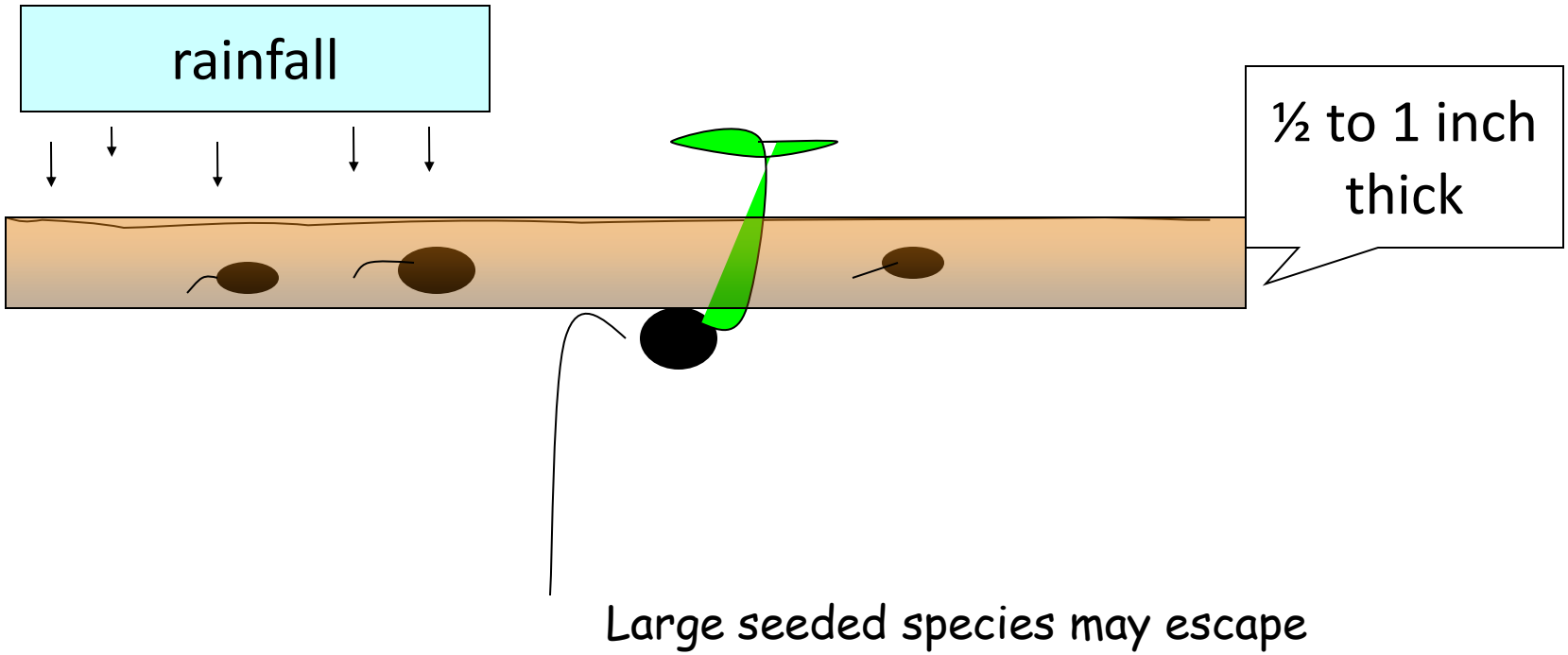
Establishing an herbicide barrier



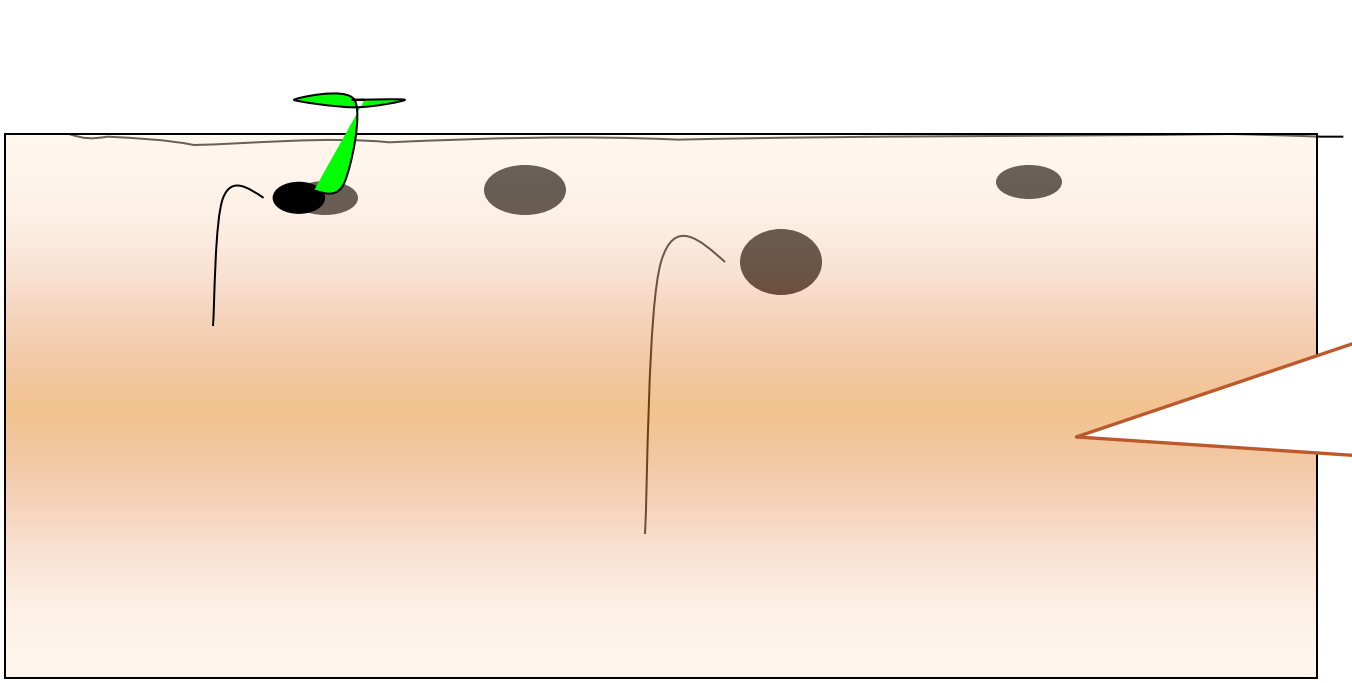
Establishing an herbicide barrier



Establishing an herbicide barrier

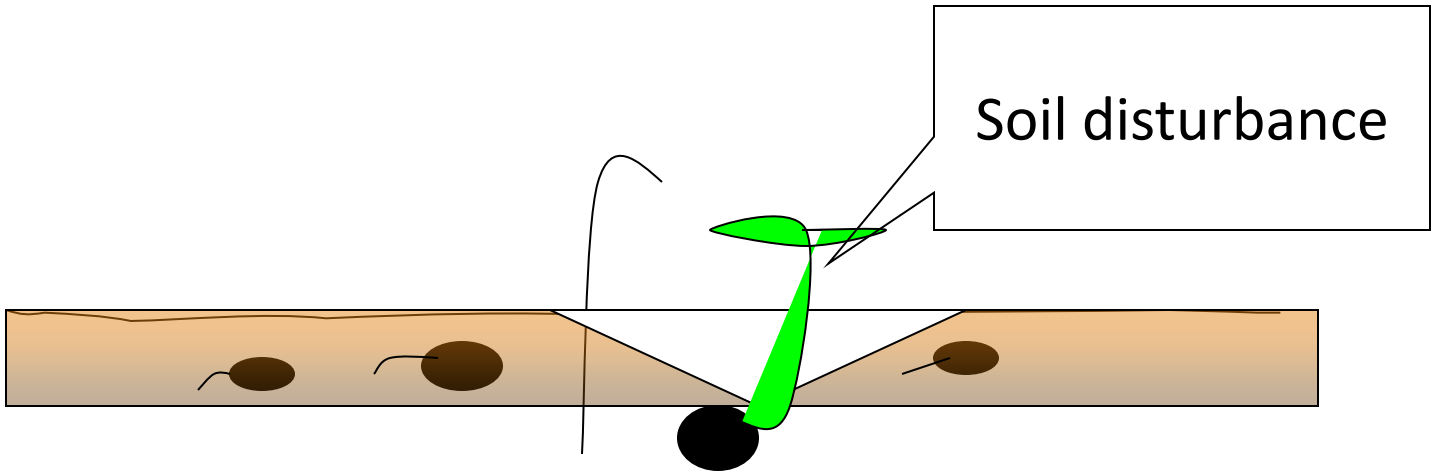


Establishing an herbicide barrier



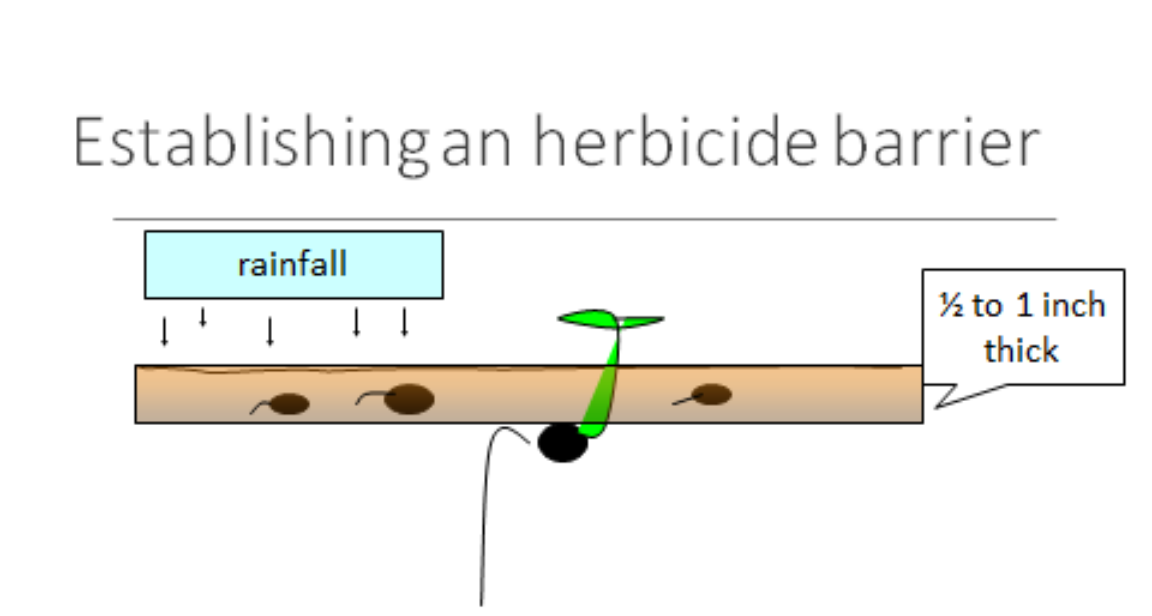
Too much rain or tillage or water

Preserving an herbicide barrier



Curbit herbicide injury

- Cold wet soil
- If seed sits in treated soil



Broadening the spectrum

Curbit (PPS)

- Tankmix, as both get watered in
- Avoid crop injury with lower rates
- May help with nightshade (not)

Command (PPS)

- May improve nightshade control

Command + Curbit Premix

Strategy herbicide (Loveland)

Does not have the 3 ME formulation

More volatile than Command 3 ME when used alone

Broadleaf weeds controlled by Strategy

Broadleaf Weeds:

Black Seeded Plantain
Carpetweed
Lambsquarters, common
Pigweed
(Prostrate pigweed)
(Redroot pigweed)
(Smooth pigweed)
(Spiny pigweed)
Prickly Sida
Purslane, common
Pusley, Florida
Spurred Anoda
Velvetleaf
Venice Mallow
Cocklebur*
Common Ragweed*
Smartweed*

Sandea

Using Sandea in Cucurbits

Where it fits

Maximizing weed control potential

Minimizing risk of crop injury

Complimentary strategies

Carryover (rainfall and pH)

Successfully Using Sandea *(halosulfuron)*

- Very low use rate (2/3 oz per acre)
- Post-plant surface (PPS) or after emergence (POST), depending on crop
- Wide range of tolerance in cucurbits
- Apply within a day or two after planting
  - Incorporate with irrigation maximum efficiency
- Observe crop rotation restrictions

Weed Control Spectrum of Sandea

Lambsquarters

Pigweed

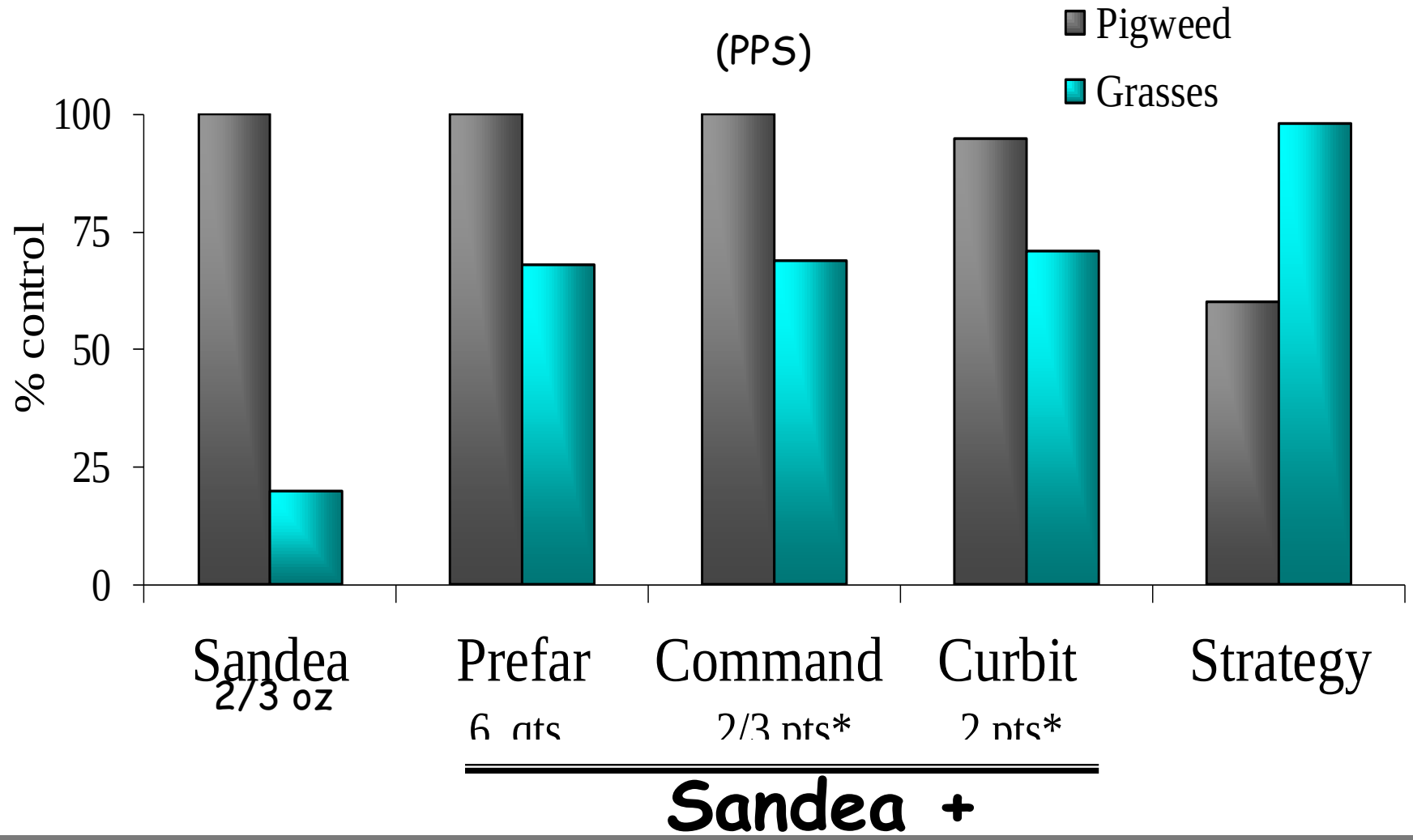
Smartweed

Nutsedge

Does not control nightshade or grasses

- Know potential seedbank

Weed Control with Sandea and Tankmixes



Sandea (halosulfuron)

Nutsedge control

Single application of 0.75 oz/A to nutsedge with **3 to 5 leaves**.

If nutsedge >12 in tall, don't bother

Do not irrigate for 3 to 4 days after application

Dual Magnum

Pumpkin: Group 9B (winter squash)

Inter-row or inter-hill only

Rate: 1 to 1.33 pints/A

Time: Apply PRE or POST before weeds germinate or yellow nutsedge emerges.

Dual Magnum use in pumpkin

- Leave 1 ft of untreated area over the row, OR
- 6 inches to each side of the planted hill and/or any emerged foliage

(inter-row or inter-hill means not directly over the planted seed or young pumpkin)

Treflan

Treflan in Cucurbits

Layby between rows

3- 4 leaf plants

Avoid foliage contact

30 Day PHI

Broadcast Application Rates/Acre:

Soil Texture	Treflan 4L Herbicide
	(pints)
Coarse	1.0
Medium	1.25 - 1.5
Fine	1.5 - 2.0

Sinbar

TERBACIL

WATERMELON, DIRECT SEED, TRANSPLANT

Sinbar (terbacil), watermelon

Direct- seeded: After planting

Transplants: before transplanting

Under plastic

2 to 4 oz/A

Activate with water < 2 weeks

Rotation restrictions may be substantial

Solanum spp.

Tomato

Tomato Herbicides

Clomazone (peppers only)

Devrinol

Dual Magnum

Matrix

Poast

Prowl

Sandea

Select

Sencor (PRE, POST)

Spartan

Treflan (transplants only)

Spartan

SULFENTRAZONE

MOA GROUP 14

Spartan (sulfentrazone)

PPO inhibitor

PreTransplant

Rotation restrictions severe for some crops

Canola	24 mo
Sugar beet	36 mo

Spartan (transplanted tomato)

3.25 to 8 oz/A

Irrigation/rainfall of 0.5 to 1 in.

Excess irrigation should be avoided.

Do not use on coarse, sandy soils with less than 1% organic matter.

Controls nigthshade☺

Spartan (sulfentrazone)

Spartan 4F Herbicide Use Rate Table (Tomato, Transplanted Only) Preplant Applications			
Broadcast Rate	Fluid Ounces Spartan 4F Herbicide per acre		
	Soil Texture		
% Organic Matter	Coarse	Medium	Fine
<1.5%	2.25 – 3.0	3.0 – 4.5	3.0 – 6.0
1.5 – 3.0 %	3.0 – 6.0	6.0	6.0 – 8.0
>3.0 %	6.0 – 8.0	8.0	8.0

Refer to the previous information on soil types under the COARSE, MEDIUM, and FINE categories.

Use higher rates for soils of pH less than 7.0 and lowest rates for pH greater than 7.0 within the rate range.

Using Matrix (rimsulfuron)

2 to 4 oz/A

Grasses and broadleaves, Nightshades

PRE with POST activity

Good complement to Dual Magnum

May want to avoid tankmix with Dual Magnum, however

DualMag Supplemental label
(includes UT)

Transplanted:

- PPI, Preplant, Post Directed
- Last step before plastic applied to beds

Direct-seeded: Post-directed to 4 in tall tomatoes

- Avoid contact with plants

DualMag Supplemental Label
(includes UT)

Recommended S-metolachlor rates (pints/A)			
	Soil texture		
Soil OM	coarse	medium	fine
<3%	1–1.33	1.33–1.67	1.33–1.67
>3%	1.33	1.33–1.67	1.67–2

Dual Magnum Precautions:

Varietal tolerance.

Wet, cool, or unfavorable growing conditions.

In transplanted tomatoes, incorporate to a depth less than the depth of transplanting, and use the lower end of the rate range.

Other Tomato/Solanum Herbicides

Clomazone (peppers only, not bananas)

Devrinol

Poast

Prowl

Select

Sandea

Sencor (PRE, POST)

Treflan (transplants only)

Sandea

- POST to 4 leaf tomatoes
- Pre-transplant
- Pre-transplant under plastic
- Post-transplant
- Split applications for nutsedge control
- Row middles

TOMATOES (30)	1/2 - 1	Apply uniformly with ground equipment in a minimum of 20 gallons of water per acre. **Direct-seeded:** • **Postemergence** - Apply SANDEA over-the-top once tomatoes have reached the 4 leaf stage through 30 days prior to harvest. Applications following bloom could cause some bloom drop under certain environmental conditions. Apply as a directed spray or with crop shield when these conditions are present. **Transplanted:** • **Pre-transplant on Bareground** - Apply SANDEA as a pre-plant application to bareground. Tomatoes can be transplanted into this treated area 7 days after the application unless local conditions demonstrate safety at an earlier interval. Use lower rate on lighter textured soils with low organic matter. SANDEA treated soil from the soil surface into the transplant hole can result in crop injury. Care should be taken to limit the movement of treated surface soil during the transplant process. • **Pre-transplant Under Plastic Mulch Applications** - Apply SANDEA following final bed shaping and just prior to the installation of the plastic mulch. Tomatoes can be transplanted into this treated area 7 days after the application and the installation of the plastic mulch unless local conditions demonstrate safety at an earlier interval. SANDEA treated soil from the soil surface into the transplant hole can result in crop injury. Care should be taken to limit movement of SANDEA treated surface soil during the transplant process. • **Post-transplant** - Apply SANDEA over-the-top, post directed, or with crop shields to tomato transplants that are established, actively growing, and a minimum of 14 days after transplanting unless local conditions demonstrate safety at an earlier interval. Applications following bloom could cause some bloom drop under certain environmental conditions. Application as a directed spray or with crop shields should be considered when conditions are present
TOMATOES (30) (continued)	1/2 - 1	**Direct-seeded and Transplant:** • **Row Middle/Furrow Applications** - Apply SANDEA between rows for the control of nutsedge and listed broadleaf weeds. Avoid contact of the herbicide with the planted crop. If plastic is used on the planted row, adjust equipment to keep the application off the plastic. Reduce rate and spray volume in proportion to area actually sprayed. **Split Applications for Nutsedge** **Direct-seeded and Transplant:** • **Pre-transplant followed by postemergence for nutsedge control** To maximize control of nutsedge, it may be necessary to use a postemergence application to those areas where the nutsedge has broken through the plastic mulch. For these situations, use a spot treatment method treating only those areas of emerged nutsedge. Application rate should not exceed 3/4 oz product per treated acre in these areas. Use a water volume that will allow for good coverage of the plants. SANDEA treated soil in the transplant hole may result in crop injury. If transplanting after herbicide application, care should be taken to limit movement of SANDEA treated soil during the transplant process. • **Postemergence followed by postemergence for nutsedge control** To maximize control of nutsedge, it may be necessary to use a postemergence spot application to those areas where the nutsedge has germinated or regrown. Allow a minimum of 21 days between applications. Application rate should not exceed 1 oz product per treated acre in these areas.
	• A maximum of 2 applications may be made per crop-cycle. • Do not apply more than 2 oz SANDEA per acre per crop-cycle, not to exceed 2 oz per acre per 12 month period (includes applications to the crop and to row middles/furrows). • Consult "Use Precautions" and "For Optimum Results" sections for important usage information.	
FRUITING VEGETABLES GROUP (30) *Including but not limited to eggplant, peppers, tomatoes*	1/2 - 1	**Direct-seeded and Transplant:** • **Row Middle/Furrow Applications** - Apply SANDEA between rows of direct-seeded or transplanted fruiting vegetables while avoiding contact of the herbicide with the planted crop. If plastic is used on the planted row, adjust equipment to keep the application off the plastic. Reduce rate and spray volume in proportion to area actually sprayed.
	• Do not apply more than 2 oz SANDEA per acre per crop-cycle, not to exceed 2 oz per acre per 12 month period. • Consult "Use Precautions" and "For Optimum Results" sections for important usage information.	

Sandea (halosulfuron)

Rate 0.5 to 1 oz/A

Controls nutsedge and other broadleaf weeds.

Postemergence applications are usually more effective than preemergence applications on nutsedge.

May be used under plastic mulch in tomatoes.

Caution Sandea-treated soil in transplant hole may injure crop.

Note crop rotation intervals. Not all pepper varieties have been tested.

MOA Group 2; Sulfonylurea

Treflan (trifuralin)
4L in Utah (Loveland)

Not all formulations labeled in Utah

Transplants only

0.5 to 1 lb ai/A (1 to 2 pints/A) depending on soil type and crop

Apply before transplanting peppers and before or after transplanting tomatoes or eggplant. Incorporate within 24 hours by cross-disking or by using a power take-off (PTO) rotary tiller.

Site of action Group 3

Sencor (metribuzin 5)

Tomatoes only, but not direct-seeded

0.25 to 0.5 lb ai/A (0.5 to 1 pint/A)

Preplant incorporate before transplanting

Use lower rates on soils with 0.5% to 2% organic matter, but do not use on soils with less than 0.5% organic matter

Site of action Group 5

Prowl H2O (pendimethalin) (transplants only)

- Preplant incorporate before transplanting;
- Preplant surface apply before transplanting;
- Post-directed application to transplanted or established direct-seeded tomatoes, peppers, and eggplant.

Do not apply to direct-seeded tomatoes or over the top of tomatoes, as injury will be severe. Consult crop injury disclaimer on label before using.

MOA Group 3: dinitroaniline

Avoiding Prowl Damage

Devrinol (napropamide, 3)

Tomatoes and pepper: direct-seeded or transplant; Eggplant: transplant only

2 to 4 lb/A Devrinol 50DF

Apply to a weed-free soil surface and incorporate uniformly 1 to 2 inches deep before transplanting.

After harvest, plow deeply with moldboard or disk plow before planting succeeding crops. Inhibits seedling roots.

MOA 15, Acetamide

Poast (sethoxydim, 1)

0.28 lb ai/A (1.5 pints/A)

Add crop oil concentrate (COC) to improve leaf absorption.

Control often is erratic on grasses stunted or stressed from drought, high heat, or low fertility.

Resistant grasses include annual bluegrass and all fine fescues; quackgrass can be suppressed.

Preharvest interval is 20 days.

Select (clethodim, 1)

Tomatoes, 6 to 12 oz/A

Peppers and eggplants, 6 to 8 oz/A
Select

Apply to actively growing grass weeds, including annual bluegrass, at growth stage as on label.

Preharvest interval is 20 days.

Site of action Group 1

III. Attacking the weed seed bank

- Weed seed placement
  - Keep on surface
  - Bury deep
- Encourage Predation
- Encourage germination
  - Stale and False seedbeds

Stale seed bed herbicides

Aim

Paraquat

Roundup

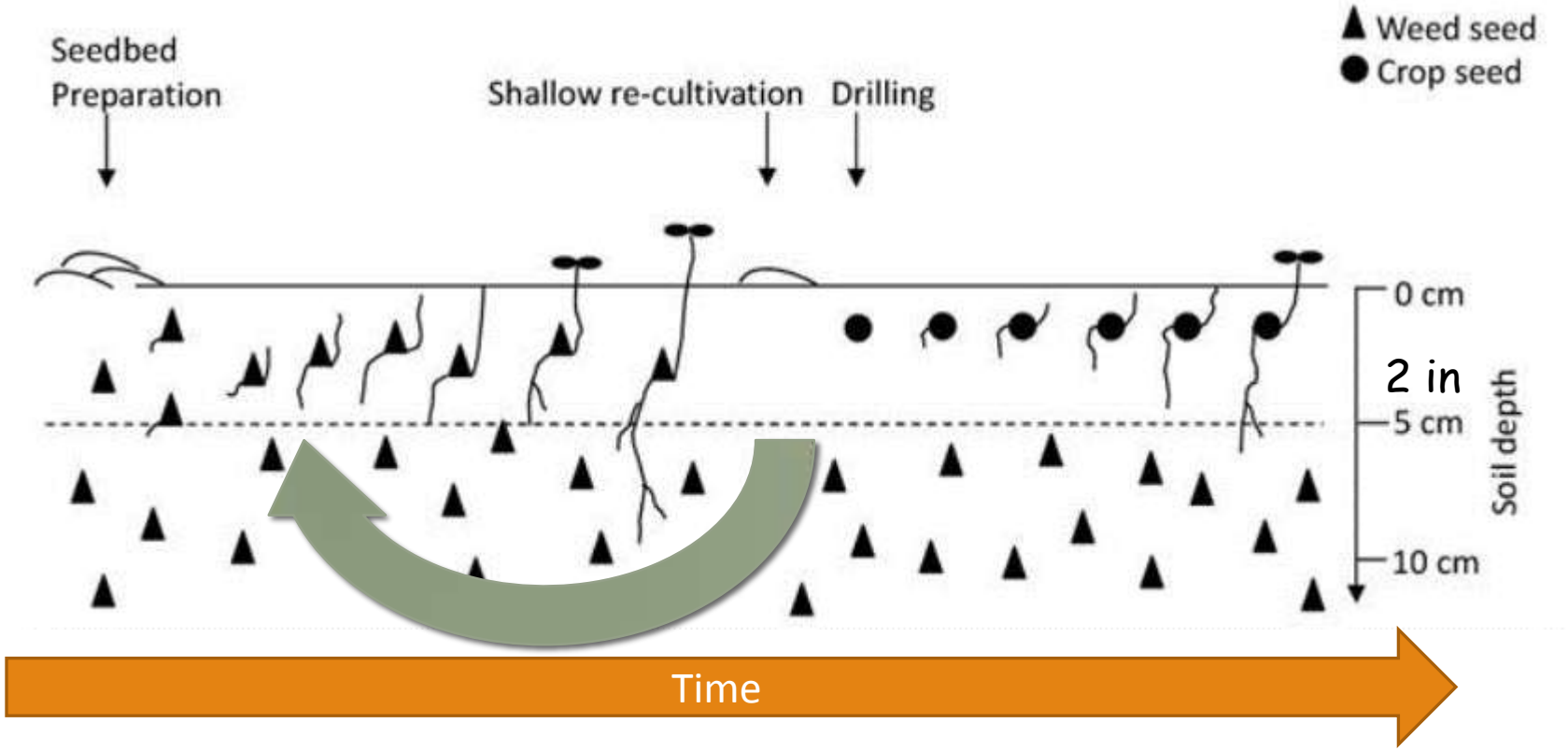
- Limitations on cucurbits, leafy and fruiting vegetables (tomato)

Flame weeding

Contact organics

False seedbeds

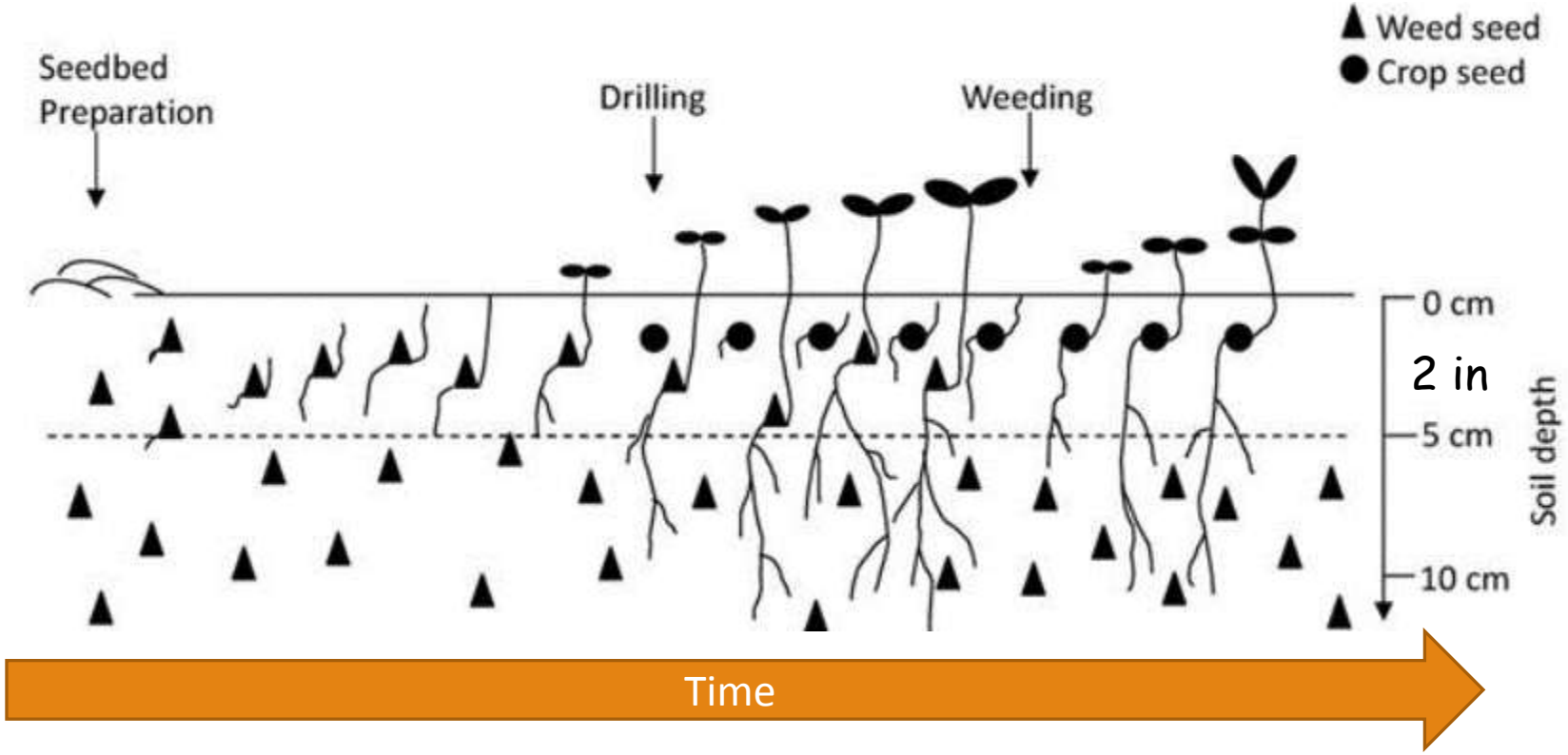
Cultivation, flaming, herbicides



Used by permission, Merfield 2012

Stale seedbeds

Flaming, herbicides



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Why false/stale seedbeds work

1. Most weed seeds are dormant

Only 5 to 10 % germinate at a time

Estimated 38% germination in the top 2 in of soil!


06/08/2003

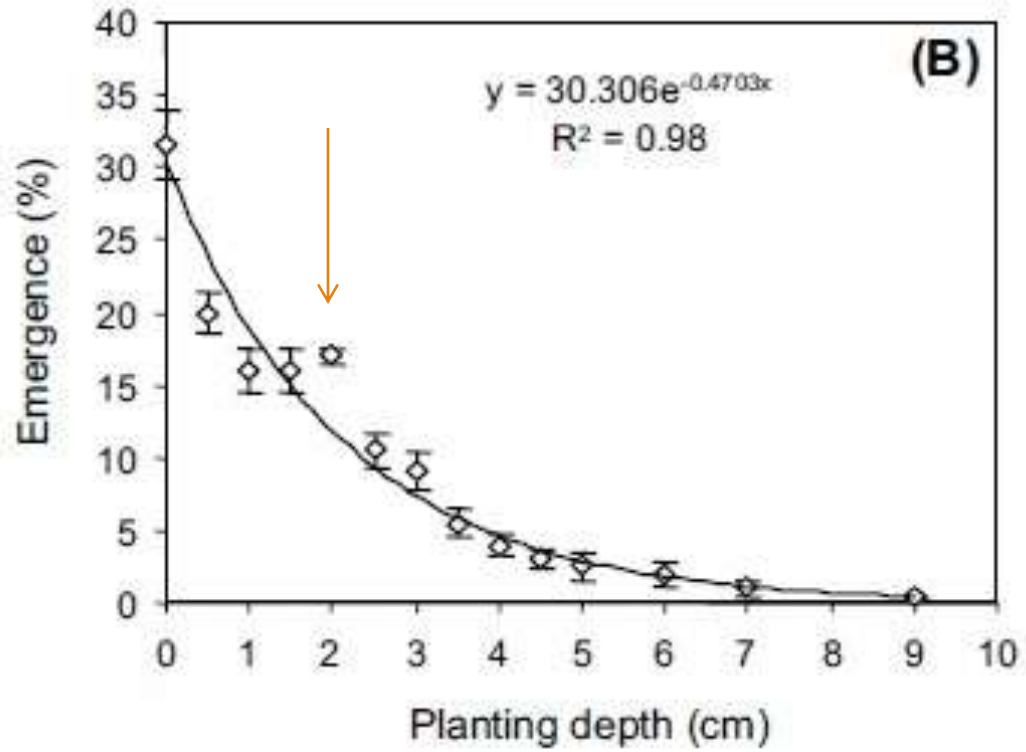
Why false/stale seedbeds work

2. Tillage is the most effective means of germinating weed seeds

Why false/stale seedbeds work

3. Most weeds only emerge from the top ¾ in of soil.

Barnyardgrass (Sadeghloo etal 2013)



The downside

- Impeded by wet springs
- Weed shifts
  - Grasses flourish
  - Growing point on grasses is below ground
  - On broadleaves it is above ground

Roller under-cutter

Rod weeder

Flaming onions

Merfield, Lincoln Univ., NZ

Row flamer

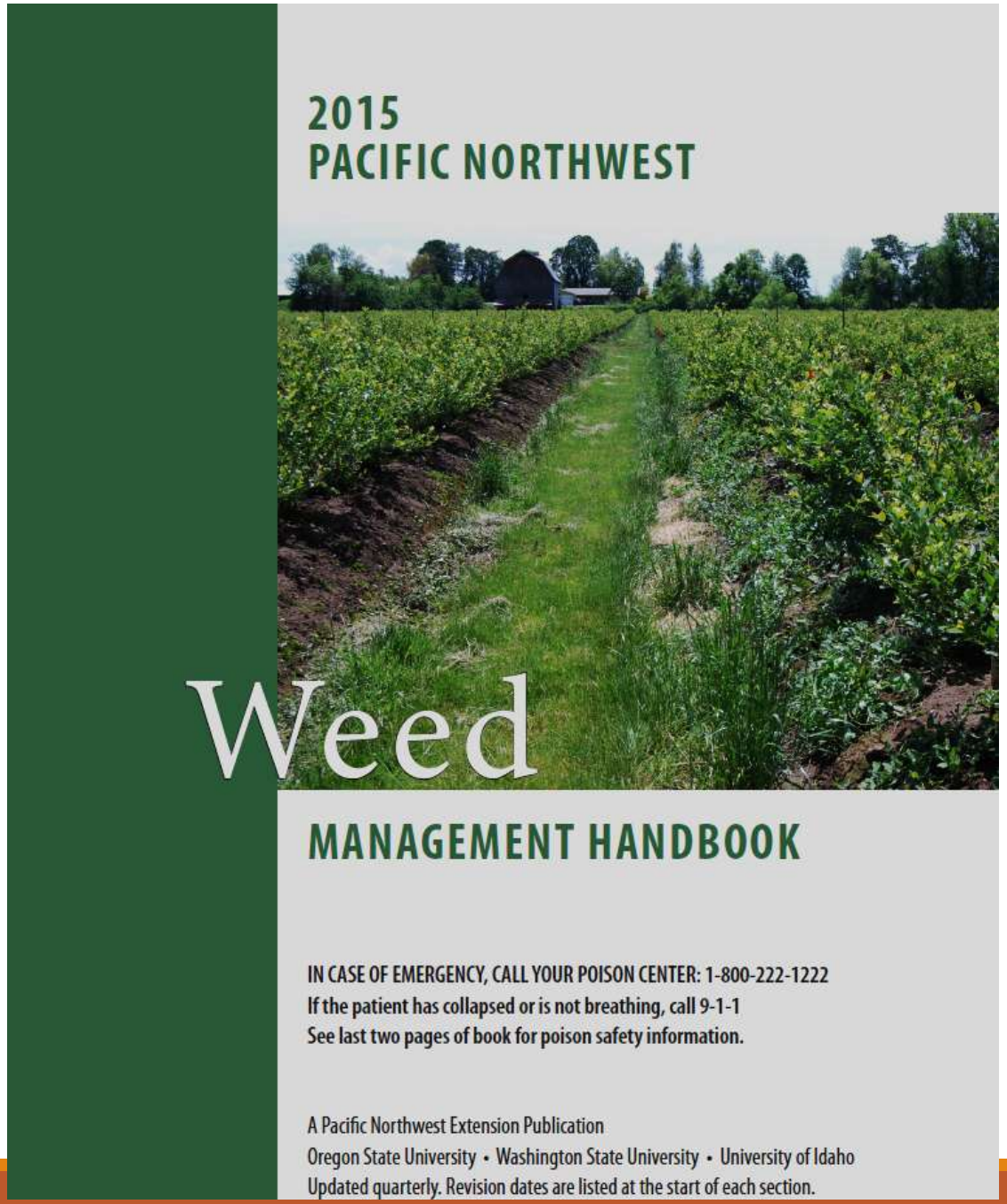
Resources

Agrian website

CDMS website

PNW Weed Handbook

Resources


2015
PACIFIC NORTHWEST
Weed
MANAGEMENT HANDBOOK
IN CASE OF EMERGENCY, CALL YOUR POISON CENTER: 1-800-222-1222
If the patient has collapsed or is not breathing, call 9-1-1
See last two pages of book for poison safety information.
A Pacific Northwest Extension Publication
Oregon State University • Washington State University • University of Idaho
Updated quarterly. Revision dates are listed at the start of each section.

- Back to Top -

Farms Transitions

Biographical Information:

Kelby and Braydon Johnson
Johnson Farms
Johnsonfamilyfarms1@gmail.com

Kelby and Braydon are the 4th generation on the family farm. Both have or are receiving degrees in plant science from Utah State University. Kelby and Braydon both farm full time in Cache Valley raising a variety of vegetable crops, alfalfa and wheat. The farm started over 100 years ago as a dairy and has evolved though the years to a predominately vegetable operation.

Session Description:

An overview and discussion of our farms move from a dairy to vegetable production as well as the successes, challenges etc of such a move and entering the ag world as young beginning farmers.

Johnson Family Farms Produce

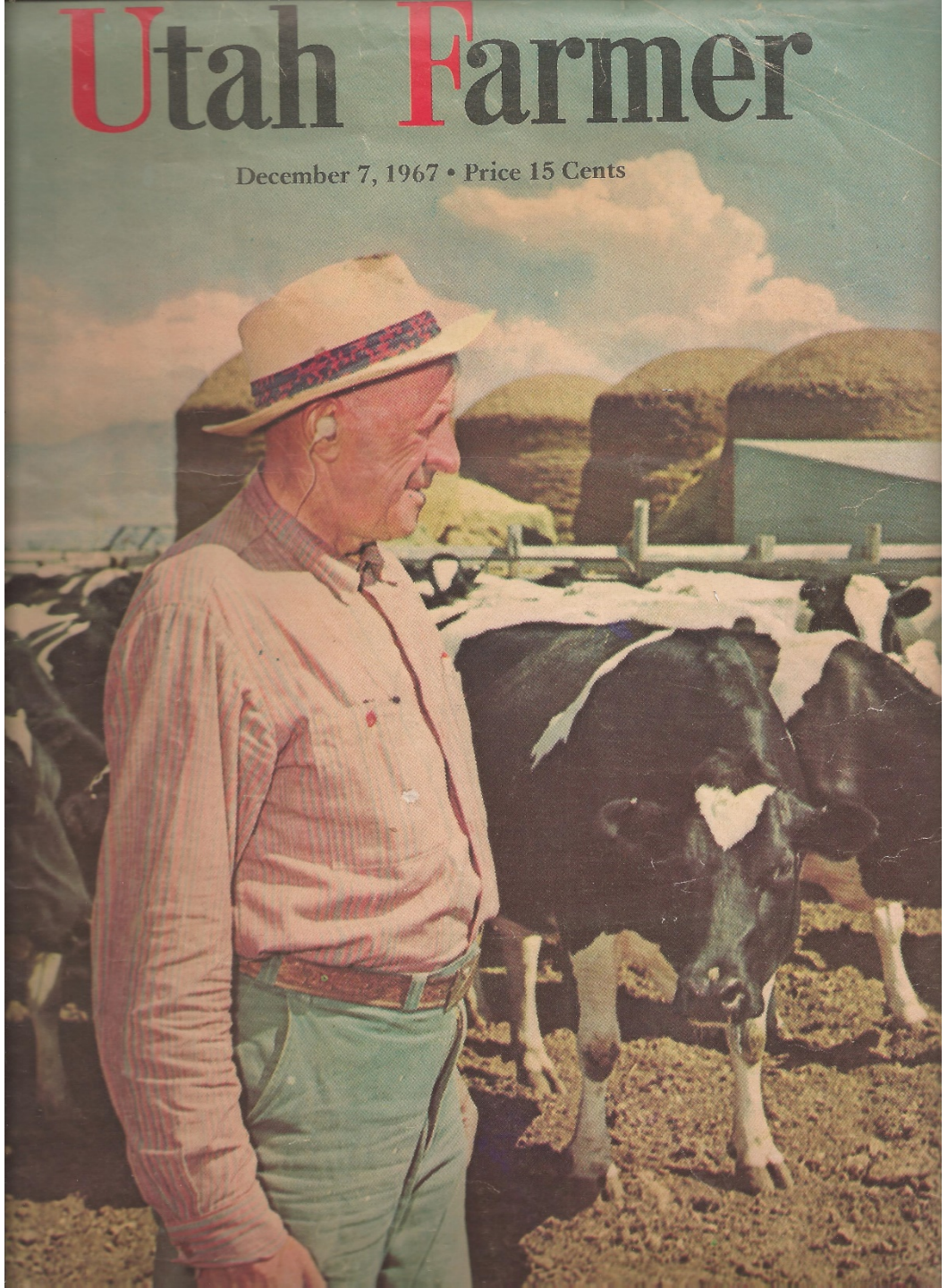
Home Grown Natural Goodness


Our Farm is located in Cache Valley

We are the 4th generation on the farm

We have ALWAYS loved Agriculture

Our farm started 100 years ago when Great Grandpa moved to Cache Valley and started a dairy farm




“Get More Out Of
What You’ve Got’


Pickup Box
Half
Johnson
Family Farms
Produce
Home Grown Natural Goodness
Cache Valley, Utah
(435) 881-3210 (435) 754-5638
CSA
Pickup Box
Full
THIS SIDE UP

We started growing vegetables 9 years ago on 1/10 of an acre


2016 we will plant over
30 acres of vegetables

We grow 49 different vegetable crops

We grow all of our transplants

We sell directly to consumers


As well as to whole sale
customers

We have BS Degrees in Plant Science with additional emphasis and minors


We aren't Organic, and
we aren't completely conventional

We use Common Sense

What has it taken to get to where we are?

What has it taken to get to where we are?

- Tons of hard work
- Hundreds of hours of study out side of our professional degrees
- So much trial and error
- Several degrees from the collage of hard knocks

What has it taken to get to where we are?

- Hours of scouting
- More study

What has it taken to get to where we are?

- Faith and Prayers
- Lots of Tenacity

Current and Past Challenges

- Labor
- Mechanization

Current and Past Challenges

- Weeds

Current and Past Challenges

- Knowledge
- Resources
- Food Safety

UtahStateUniversity

What were currently up to

- Drip
- Fertigation
- Building a personal vegetable data base


Our Education, Sweat and Many Blessings


Have Made

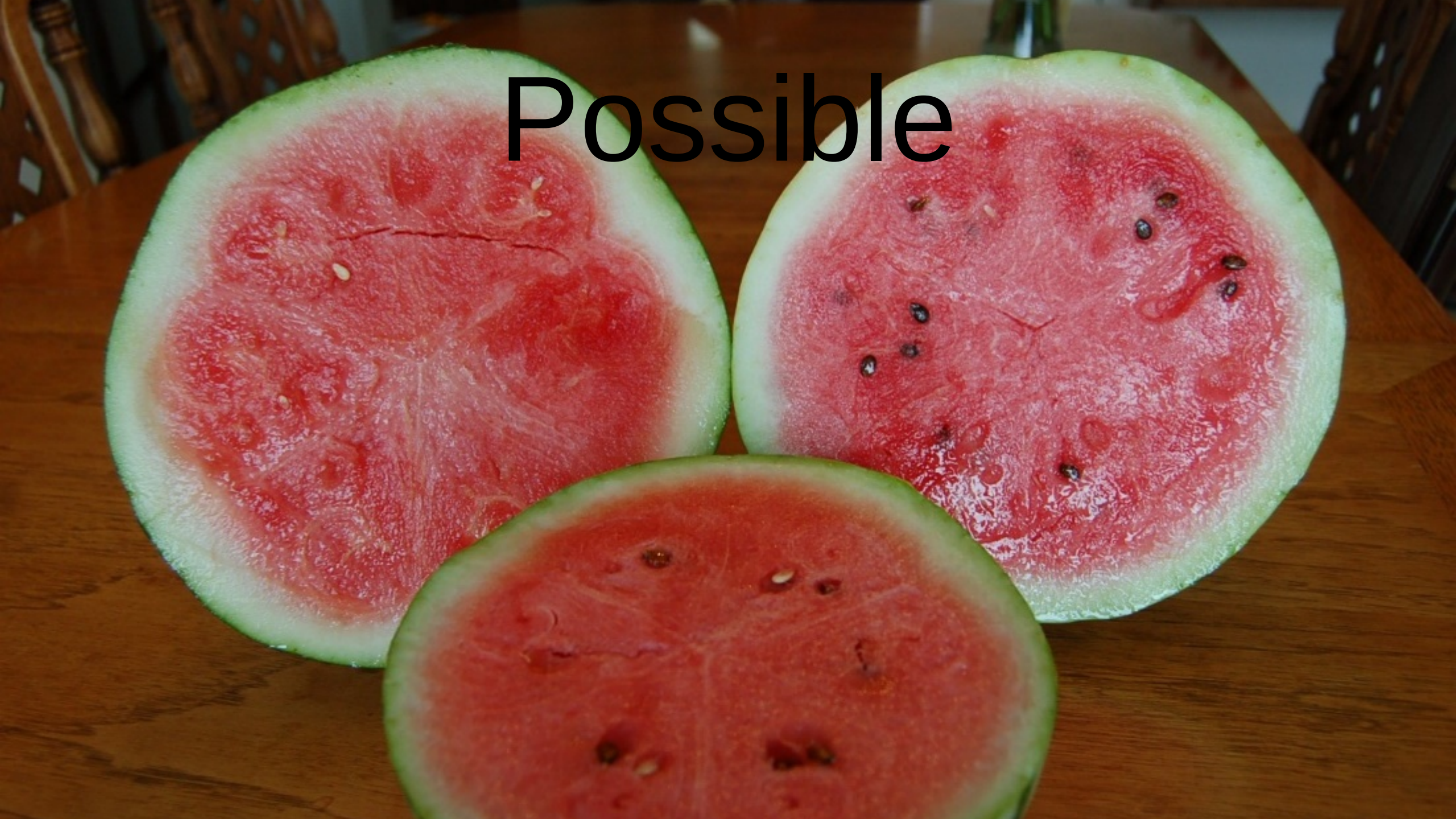

All Of This


All Of This
MXM155
CASE


All Of This


Possible


Possible


Possible


Possible

Thank You

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Vegetable Disease Survey

Biographical Information:

Claudia Nischwitz
Utah State University

Claudia is an Assistant Professor and extension Specialist at USU since August 2010. She works on diseases of plants with focus on vegetable and fruit tree diseases. In addition, she also does diagnostics for the UPPDL lab.

Session Description:

She will talk about vegetable diseases that were found more frequently last year in Utah as well as new vegetable disease.

Vegetable disease survey

Claudia Nischwitz

Assistant Professor and Extension Specialist

Email: claudia.nischwitz@usu.edu

UtahStateUniversity
COOPERATIVE EXTENSION

New or spreading diseases

- Tomato spotted wilt virus
- *Candidatus* Liberibacter solanacearum
- Potato virus Y
- Alfalfa mosaic virus
- Tobacco streak virus
- *Embellisia* skin blotch on garlic
- Russet mites on tomato

Tomato spotted wilt virus


http://www.caes.uga.edu/topics/diseases/tswv/index.html

- TSWV is an important pathogens of tomato, pepper, tobacco and peanut in the U.S.
- The virus is transmitted by thrips
- Thrips have to acquire the virus as larvae to be able to transmit it as adults. Once larvae are infected, thrips carry and transmit the virus throughout their entire lifespan

Tomato spotted wilt virus


http://www.caes.uga.edu/topics/diseases/tswv/index.html

- TSWV is not seedborne
- Plants get infected early in the season
- Symptoms:
  - Necrotic spots on leaves
  - Stunting of plants
  - Necrotic rings on immature fruit
  - Chlorotic ringspots on mature fruit

Tomato spotted wilt virus

Tomato spotted wilt virus

Tomato spotted wilt virus


http://www.caes.uga.edu/topics/diseases/tswv/index.html

- Management:
  - Resistant tomato varieties (Finish Line, Fletcher, Crista, Red Defender, BHN 602 and Picus)
  - No resistant pepper varieties
  - Reflective mulch
  - Insecticides (potential resistance problems)

Candidatus Liberibacter solanacearum

- Most important on potatoes (Zebra chip disease)
- Occurs on tomatoes and peppers in Utah
- Caused by a non-culturable bacterium Candidatus *Liberibacter solanacearum*
- Transmitted by potato psyllid

Liberibacter - symptoms

- Potato plants: red and yellow discoloration of leaves – very similar to nutrient deficiency
- Tomato: light green to yellow discoloration of foliage
- Pepper: light green to yellow leaves, plants are stunted, small fruit

Zebra chip - Liberibacter

Liberibacter - Pepper

Liberibacter - Tomato

Liberibacter and psyllid distribution

- Davis county
- Carbon county
- Washington county
- Cache county (psyllids only)

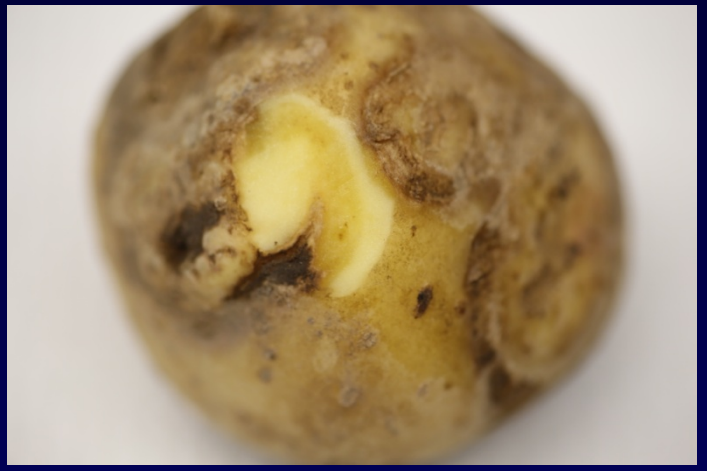
Liberibacter - management

- Scouting for potato psyllids
- Controlling psyllids with imidacloprid starting early in the season
- Good weed management
- Once a plant is infected there is no cure

Potato virus Y - Potato

- Three strains: PVY^{O}, PVY^{N}, PVY^{NTN}
- PVY^{O} cause mosaic symptom on leaves, no tuber symptoms
- PVY^{N} cause necrotic lesions on leaves, no tuber symptoms
- PVY^{NTN} cause necrotic lesions on leaves, and ring spots on tubers that extend into flesh (Yukon Gold very susceptible to tuber necrosis)

Potato virus Y - Potato



Potato virus Y - Potato

- Transmitted by aphids and equipment
- Main spread and introduction to fields: infected seed pieces
- Management:
  - Certified seed pieces (best option but no guarantee)
  - Remove infected plants from field

Alfalfa mosaic virus

- Hosts: Potato, tomato, pepper

Alfalfa mosaic virus

- Transmitted by aphids
- Symptoms:
  - Calico pattern on leaves of tomatoes and peppers
  - Yellow mosaic on potato. Some strains cause stunted plants and tuber necrosis.
- Management:
  - Avoid planting potatoes, peppers and tomatoes near alfalfa

Tobacco streak virus

- Summer squash
- 2nd report in the country
- Other hosts: cowpea, beans, asparagus, tomato, white sweet clover
- Transmission: Pollen spread by thrips???
- Symptoms:
  - Stunting of plants
  - Reduced yield

Tobacco streak virus

Shouan Zhang, UF/IFAS

Tobacco streak virus

- Management:
  - Good weed control

Embellisia skin blotch

- Host: Garlic
- Fungus (*Embellisia allii*) survives in soil, plant debris or infected bulbs
- Symptoms:
  - Dark gray – black spots on outer skin layer of garlic bulb
  - Most of the time symptoms are only superficial, not affecting market value

Embellisia skin blotch on garlic

Bruce Watt, University of Maine, Bugwood.org

Photo by S. Johnson

Embellisia skin blotch

- Prefers temperatures of 78-84F
- Moist soils with manure applications increase disease development
- Management:
  - Red garlic cultivars less susceptible than white ones
  - Remove outer skin of bulb
  - Keep garlic dry in storage

Russet mites on tomato

- Eriophyid mites
- Need a strong hand lens or dissecting microscope to see them
- Cream to pale orange colored

www.omafra.gov.on.ca

Russet mites on tomato

- Other hosts: Potato and pepper but usually not a problem on those hosts
- Symptoms:
  - Bronze discoloration of leaves and stems (russeting)
  - Severe infestations, stems will lose their hairs
  - Fruit: russeting and cracking od fruit, uneven ripening
  - Plants will die from severe infections

Russet mites on tomato

www.growingproduce.com

Russet mites on tomato

- Management:
  - Applications of sulfur or Abamectin
  - Remove alternate weed host like nightshade and morning glory

Caution: Do not compost diseased produce bought at grocery stores

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Pumpkin and Tomato Variety Evaluations

Biographical Information:
Taun Beddes
Mike Caron
USU Extension Utah County
Horticulturists

Taun Beddes and Mike Caron are USU Extension Horticulturists and field faculty based in Utah County. They focus on both horticulture crop field research and public education. Over the last three years, they have field trialed or are trialing pumpkin, radish, grape and tomato cultivars focusing on gardener's market and smaller commercial growers.

Session Description:

Tomatoes and pumpkins are both important crops to many growers. A challenge faced by many includes choosing appropriate cultivars to fit particular growers' needs. We grow vegetable crops for two season or two harvests to gauge yield, fruit size, color and other characteristics.

EVALUATION OF SELECTED PUMPKIN VARIETIES

A two-year yield trial

WHY

- A major vegetable crop in Utah
- Published evaluations have not occurred
- Yields: According to grower practices
- Fruit weight
- Fruit size
- Color
- Stem strength

METHODS – SEEDS FOR 2013

- **Hollar Seeds**
  - Camaro F1
  - Challenger F1
  - Corvette F1
  - Cougar F1
  - Mustang F1
- **Mountain Valley Seed**
  - Howden OP
- **Lockhart Seed**
  - Charisma F1
  - Connecticut Field OP
  - Gladiator F1
  - Magic Lantern F1
  - Magic Wand F1
  - Magician F1
  - New Moon F1
  - Orange Rave F1
  - Racer F1
  - Sorcerer F1
  - Summit F1

METHODS – SEEDS FOR 2014

- **Hollar Seeds**
  - Camaro F1
  - Challenger F1
  - Corvette F1
  - Cougar F1
  - Mustang F1
- **Mountain Valley Seed**
  - Howden OP
- **Lockhart Seed**
  - Magic Lantern F1
  - Racer F1
  - Summit F1

GROWERS METHODS

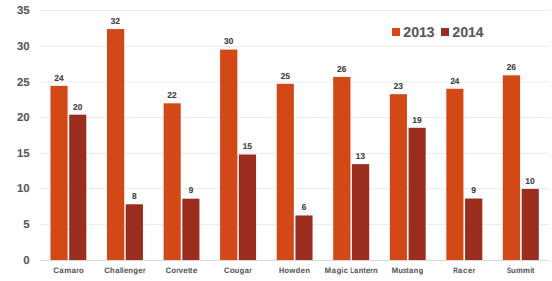
- Plant Spacing:
  - 8 x 8 Centers (681 plants/acre)
- Irrigation
  - Overhead impact sprinklers year 1
  - Drip year 2
- Weed Control
  - Cultivation only
- Fertility
  - Two applications of 16-16-16 at 3 and six weeks past germination
  - 50 units of N per acre per application
  - Side-dressed

Supplier Provided Fruit Data

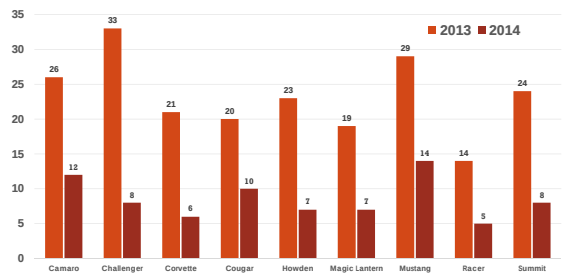
Variety	Avg Fruit Wt (Lbs)	Height (In)	Width (In)
Camaro	20-23	11	12
Challenger	22-27	11	13
Charisma	14-18	-	-
Conn. Field	15-20	-	-
Corvette	12-15	9.5	11
Cougar	10-12	-	-
Gladiator	20-25	12	13
Howden	20-25	13-16	8-14
Magic Lantern	15-25	14	12
Magic Wand	15-25	-	-
Magician	10-16	10-12	10-12
Mustang	22	12	10
New Moon	Up to 45	-	-
Orange Rave	15-25	-	-
Racer	12-16	-	-
Sorcerer	15-25	-	-
Summit	30-40	-	-

METHODS

TONS/ACRE



FRUIT WEIGHT-LBS



CHALLENGER

- Tons Per Acre: 32.4
- Avg. Fruit Weight: 32.7
- Avg. Fruit Size (H x W) 13.5 x 14.7
- Fruit Size Distribution LBS
  - 0-4: 0
  - 5-14: 5
  - 15-25: 17
  - + 25: 76

MUSTANG

- Tons Per Acre: 23.3
- Avg. Fruit Weight: 29
- Avg. Fruit Size (H x W) 14 x 11
- Fruit Size Distribution LBS
  - 0-4: 0
  - 5-14: 3
  - 15-25: 20
  - + 25: 77

CORVETTE

- Tons Per Acre: 23
- Avg. Fruit Weight: 21
- Avg. Fruit Size (H x W) 11 x 12
- Fruit Size Distribution LBS
  - 0-4: 0
  - 5-14: 7
  - 15-25: 80
  - + 25: 13

COUGAR

- Tons Per Acre: 29.5
- Avg. Fruit Weight (LBS): 20.0
- Avg. Fruit Size (H x W): 10.8 x 11.5
- Fruit Size Distribution:
  - 0-4: 5
  - 5-14: 20
  - 15-25: 48
  - + 25: 27

SUMMIT

- Tons Per Acre: 25.9
- Avg. Fruit Weight: 23.7
- Avg. Fruit Size (H x W): 12 X 12.7
- Fruit Size Distribution:
  - 0-4: 0
  - 5-14: 0
  - 15-25: 57
  - + 25: 43

MAGIC LANTERN

- Tons Per Acre: 25.7
- Avg. Fruit Weight: 19.2
- Avg. Fruit Size (H x W): 11 x 12
- Fruit Size Distribution:
  - 0-4: 1
  - 5-14: 12
  - 15-25: 75
  - + 25: 12
- Avg. Color: 4.7
- Avg. Stem Strength: 4.8

HOWDEN

- Tons Per Acre: 24.7
- Avg. Fruit Weight: 21.5
- Avg. Fruit Size (H x W): 11.3 x 12.2
- Fruit Size Distribution:
  - 0-4: 0
  - 5-14: 15
  - 15-25: 57
  - + 25: 21

CAMARO

- Tons Per Acre: 24.4
- Avg. Fruit Weight: 25.7
- Avg. Fruit Size (H x W): 11.5 x 13.0
- Fruit Size Distribution:
  - 0-4: 5
  - 5-14: 36
  - 15-25: 52
  - + 25: 7

RACER

- Tons Per Acre: 24
- Average Fruit Weight: 13.9
- Avg. Fruit Size (H x W): 10.8 x 12.2
- Fruit Size Distribution:
  - 0-4: 2
  - 5-14: 59
  - 15-25: 39
  - + 25: 0

CONCLUSIONS

- First year had ideal conditions
  - Low pests/disease pressure
  - Good irrigation
- Second year had worse conditions
  - More pest/disease pressure
  - Change in irrigation practices to about half the water
  - Plants were significantly water stressed
- Grower yields outside of the study block had yields similar to year 1
  - Due primarily to better irrigation

CONCLUSIONS

- 20 tons/acre is local economic minimum to start being profitable
- Magic Lantern was best for chain-store type
  - 75% of pumpkins within store standards
- Howden was good roadside stand cultivar
  - Inexpensive seed
  - Good yield
  - Open-pollinated
  - Good spread on fruit size

CONCLUSIONS

- Challenger best for large >25 lb. fruits
  - Had highest tons/acre

- Camaro and Mustang performed best under water stress
  - Nearly as productive as year 1
  - Fruit weight was down about 50%
  - Fruits per plant increased

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Utah Vegetable Production and Pest Management Guide Updates

Biographical Information:

Dr. Dan Drost
Utah State University
Department of Plant Soils
and Climate

Dan Drost grew up on a small diversified farm in western Michigan. He graduated from Michigan State University with a BS and MS degrees in Horticulture. In 1983, he moved to New Zealand to teach Horticulture. He returned to the US to pursue his PhD in 1987 which was awarded in 1991 from Cornell University in Vegetable Crops and Plant Physiology. He arrived at Utah State University in January 1992 to work as the Extension Vegetable Specialist for Utah. Dan is interested in small farm production systems, organic agriculture (helped get USU's Organic Program going), focuses on the creation of efficient farm systems, and how intensive land-use management impacts the productivity and economic activities of vegetable farms.

Session Description:

Dan will be talking about the updates in the Vegetable Production and Pest Management Guide.

Utah Vegetable Production and Pest Management Guide 2014

EXTENSION
UtahStateUniversity

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Evaluating a New Farm Business Opportunity

Biographical Information:
Brent Black
Utah State University

Dr. Brent Black is a Professor and Extension Fruit Specialist at Utah State University in Logan Utah. His interests include high-tunnel berry crop production, tart cherry orchard systems, orchard irrigation management, and alternative crops for small acreage diversification. Prior to coming to USU, he studied management systems and practices for strawberry, raspberry and blueberry production at the USDA research station in Beltsville Maryland. A native of southeastern Idaho, Brent completed his undergraduate degree in Plant and Soil Science at USU, a Master's degree in Horticulture at Michigan State University, and a Ph.D. in Plant Physiology at Oregon State University.

Biographical Information:
Ruby Ward
Department of Applied Economics
Utah State University

Dr. Ruby Ward was raised on a fram and ranch in South-eastern Idaho. After graduating from Ricks College, she received a BS in Agricultural Economics and Accounting from Utah State University. From Texas A&M she received an MBA and a PhD in Agricultural Economics. Dr. Ward is a professor in the Department of Applied Economics at Utah State University. Her current assignment involves all three areas emphasized at a land grant University - teaching, research and extension. She teaches agricultural finance and community planning. Dr. Ward has delivered educational programs in Utah and the surrounding region for the last 15 years. Wars was the committee chair for the Diverified Agricultural Conference for 10 years and currently co-chairs the Urban and Small Farms Conference in Utah. Ward is the project leader for the Rural Tax Education Committee. She has given many presentation on Tribal tax and financial issues. Ward works primarily in the area of agricultural entrepreneurship.

Session Description:
This session is designed to cover the basics of evaluating a new farm business opportunity. There are four critical components of successful operations. These include being able to produce a quality product efficiently; finding the labor needed; being able to market the products produced; and baking a profit. All four of these will be examined in this session.
The first part will explain how to inventory your resources and understand what the requirements are to produce various products.
The second part will explore some of the realities of potential markets as well as simple methods to begin evaluating the profit.

October 2014 AG/Small Acreage/2014-01pr

Small Acreage Site Inventory

Factors to Consider in Planning a Small Scale Agricultural Enterprise

Tiffany Maughan, *Research Associate,* and **Brent Black**, *Extension Fruit Specialist*

Introduction

Recent population growth in Utah has resulted in fragmentation of farm land, and an increase in small-acreage land parcels. Agricultural enterprises on these small-acreage land parcels can range from part-time hobby farms to full-time businesses. Options range from high-input high-value horticultural crops to minimally managed pasture. Determining the best crop or crops for your small-acreage farm involves considering a number of factors. This publication is intended to provide a step-by-step guide for taking an inventory of the factors that should guide the decision in what type of small acreage enterprise to pursue. Careful planning before deciding on a crop will help ensure a successful venture.

Climate

Climate is one of the most important considerations for selecting an appropriate crop. The type of crops that can be grown, cultivar selection, and freeze protection needs will vary depending on your specific climate. The most important climatic factors to consider in selecting an appropriate crop are: average coldest winter temperature, average last spring freeze, average first fall freeze, and the length of the freeze-free season. The Utah Climate Center at Utah State University maintains a website, http://climate.usu.edu, with access to current and historic data from weather stations throughout Utah.

Average coldest winter temperature is used in determining cold hardiness zone, a standard used to determine which plants will survive the winter. Average last spring freeze is important in determining how early to plant cool-season vegetables. It is also important in determining which perennial fruit crops might be suitable.

Average first fall freeze will be a good indicator for when the growing season ends and when some fruits and vegetables will need to be harvested. Use the average first and last freeze dates to determine the number of freeze free days you can expect in your climate.

Site

Microclimates are zones that vary from the surrounding area's overall climate. Microclimates can have a large effect on the type of conditions your crop will experience. The slope of the land, as well as the direction it is sloping (aspect) will affect microclimate. A south-facing slope will often warm sooner in the spring than flat ground and may mean fruit trees begin blooming earlier than surrounding areas. However this can result in increased risk of damage from late spring freezes. A north-facing slope delays spring warming and can move bloom and planting time later. Planting crops on a hill sufficiently higher than the surrounding area can help avoid freeze damage to sensitive plants, as the cold air will flow down the hill and settle at lower elevations. Conversely, if your land is at the bottom of a valley it will be more prone to late spring and early fall freezes. Usually an area elevated at least 50 feet above the valley floor will provide some protection during temperature inversions typical of Utah's high mountain valleys. Nearby bodies of water also moderate temperatures, as will buildings or large stands of trees that act as windbreaks. Proximity to canyons, with their typical winds, can dramatically affect the micro-climate of your land. Small automated temperature recorders can be extremely useful in determining microclimate conditions, and for comparing your site to the closest weather station.

Table 1. Salinity tolerance and seasonal water use of common crops grown in Utah.

Crop	Damage Threshold EC[a]	10% yield loss	Tolerance rating[b]	Seasonal water use (inches)
Bean	1	1.5	S	16
Strawberry	1	1.3	S	30
Raspberry	1	1.4	S	28
Onion	1.2	1.8	S	24
Lettuce	1.3	2.1	S	13
Grape	1.5	2.5	S	15
Corn	1.7	2.5	S	22
Potato	1.7	2.5	S	17
Peach	1.7	2.3	S	38
Apple	1.7	2.3	S	33
Alfalfa	2	3.4	MS	28
Tomato	2.5	3.5	MS	22
Spinach	3.7	5.5	MT	12
Squash	3.9	4.9	MT	28
Trefoil	4	6	MT	23
Wheat	4.7	6	MT	18
Oats	5.2	6.7	MT	18
Barley	8	9.6	T	22

[a]Electrical Conductivity in dS/m.
[b]T = Tolerant, MT = Moderately Tolerant, MS = Moderately Sensitive, S = Sensitive

Soil

Knowing the soil characteristics is also important in determining the appropriate crop and associated management practices. The important soil parameters to consider include: pH, texture, drainage, salinity and organic matter. Soil pH is the measure of acidity or alkalinity, which affects the availability of nutrients to the plant. Most soils in Utah are alkaline (pH level above 7), which limits the crops that will grow well. Soil texture will influence water holding capacity, nutrient holding capacity, as well as drainage of excess water and aeration. Heavy soils (high in clay content) will not drain quickly and may be water-logged in the spring. Soils that do not drain adequately may need to be formed into raised beds or have drain tiling installed. Sandy soils drain very quickly and irrigation events will need to be more frequent during the hot summer months. Organic matter is a good indicator of soil health. Organic matter in the soil improves nutrient and water holding capacity and reduces compaction issues. Many fruit and vegetable crops are sensitive to high salinity and if your soil has high saline levels, reclamation action may be needed. Another option would be to plant more salt tolerant crops. See Table 1 for a list of crops and their tolerance to saline soil. Submitting a soil sample for testing is easy and relatively inexpensive. Visit http://usual.usu.edu for more information on getting your soil tested.

Water

Irrigation water is an important consideration in crop selection. There are four basic points to consider for irrigating your crop: quantity required, availability across the season, quality, and cost. The three main sources for irrigation water are city, secondary surface (canals), and well water. Each source has advantages and limitations, and depending on availability and crop needs, you may use one or a combination of the three sources during the growing season.

Quantity: Crops vary in water requirements. Table 1 shows seasonal water requirement in inches for a number of crops. Weekly water requirements will vary by crop with peak water corresponding with the hottest weeks of late summer.

Availability: First, determine which of the three types of irrigation water are available. In Utah's semi-arid climate, it is critical that at least one of the three irrigation methods be available throughout the growing season, as typical rainfall levels are not sufficient to meet plant needs. Second, determine what time of year each source is available. City water is typically available throughout the year. Well water may or may not be available throughout the year, as overtaxed wells can dry up late in the summer. Additionally, some well water rights do not allow the use of the water for extensive irrigation of crops. Secondary surface water is one of the least expensive options, but has some limitations. Surface water may not be available early enough in the spring, or late enough in the fall, depending on when water is put into the canal. In some cases, secondary water is intended for grain crops and is not available after mid-summer. Determine the typical number of weeks you have secondary water available and what time of year.

Quality and cost: City water is typically much more expensive per unit than secondary and well water, but it is available throughout the year and is usually high quality. Well and secondary water are less expensive per unit, but have more limited availability than city. Particularly for saline and alkaline soils, the level of salt and pH in the water can be an important parameter to consider. For city water, check with your local municipality for publically available water test results. Samples of secondary and well water can be submitted through the same service as soil samples (usual.usu.edu). Irrigation companies often test secondary surface water, and make those results available to share-holders. The cost of distributing the water should also be considered. There is a wide variation in cost from simple flood irrigation to filtered, drip irrigation.

Labor Availability

A critical consideration for any farming operation is where the labor will come from. There are many facets to running a small farming operation, often requiring multiple skill sets. It is important to determine the amount of time you have to devote to the operation throughout the season. Be realistic with your expectations, taking into account current employment, health and family obligations. For some growers and for some crops, willing family members or hired labor will be key in a successful operation. Realistically evaluate local labor availability and competitive hourly wages in planning your small acreage enterprise. Remember that high value horticultural crops such as fruit and vegetables are much more labor intensive than a low-input system like pasture.

Economic Considerations

Market: The most bountiful and beautiful harvest is of no value if you do not have a ready market. Determine your target market early in the planning stages. There are several market options available to small acreage growers. Farmers and Gardener' markets are gaining in popularity and can be a great way to find consumers for your product. Other direct sales options include road-side-stands, community supported agriculture (CSA), and pick-your-own (PYO). Direct markets may not result in selling everything produced and require time to build a customer base. Additionally, someone needs to physically be at the stand/market to sell the produce, increasing labor hours needed. Selling to wholesale markets has less return to the grower than direct market sales, and is typically not available to small-acreage producers who cannot meet wholesale volume requirements.

Income expectations/needs: The amount of income generated from your land will vary widely between crops and in some cases, years. Some growers plan on growing simply as a hobby, and others view it as a main or supplemental income source. Determine what amount of income you need to generate from your farm. Knowing the amount of revenue needed each year should be factored into deciding what crop you will grow.

Capital investment: Determine the amount of capital investment you have. Fruit trees do not start yielding a full crop for 3 to 5 years. Pastures will need an establishment year before heavy mowing or grazing, and will require investments in fencing or forage harvesting equipment. Mixed vegetables will yield well the first year, but are highly labor intensive and perishable. No matter the crop, you will need to have enough initial capital to keep the operation running until production begins. Developing a realistic business plan, including equipment, supplies, markets and pricing are all key to identifying the appropriate crop(s) for your small-acreage endeavor.

The worksheet on page 4 will assist you in taking an inventory of the factors discussed above.

This project is funded in part by USDA-Risk Management Agency under a cooperative agreement. The information reflects the views of the author(s) and not USDA-RMA.

Considerations

Climate (visit climate.usurf.usu.edu)

- Average lowest temperature _____ °F
- Average highest temperature _____ °F
- Last Spring freeze _____ °F
- First Fall Freeze _____ °F
- Number of freeze-free days _____ Days

Site

- Slope _____ %
- Aspect (i.e. North-facing) _____
- Low spots (potential frost pockets) _____
- Microclimate factors (windbreaks, shade, etc.) _____

Soil (submit sample at usual.usu.edu)

- Texture _____
- pH _____
- Salinity _____ dS/m
- Organic matter _____ %

Water

- Type (city, secondary, well) _____
- Time period available _____
- Amount _____ inches
- Salinity _____ dS/m
- pH _____

Labor Availability

- Owner hours available per week _____ hours
- Hired hours _____ hours

Economic

- Target market (Wholesale, PYO, Farmer's Market, Road Side Stand)
  - Primary _____
  - Secondary _____
- Capital investment (equipment, establishment) _____ dollars
- Background/Experience _____

UtahState University COOPERATIVE EXTENSION

USDA RMA

Marketing and Finance

Dr. Ruby Ward
Utah State University
Sponsored by USDA-RMA

Outline

- The business planning is from:
- Utah State University Business Outreach Support Services
  - http://extension.usu.edu/boss/
  - We are using:
    - mini-assessment
    - Under the toolkit tab section II assessment and feasibility

Pre-business checklist

- Personal Life
- Your Idea
- Finance

Personal Life

- Do I have a good to excellent credit score?
- Is my personal debt manageable?
- Am I healthy and physically able?
- Do I have great family support?

Your Idea

- Do I have well defined target market?
- Does my idea solve a common problem?
- Do I have training or experience in this area?

Finance

- Do I have personal assets such as a home or savings I am willing to risk?
- Can I start this business without borrowing money?
- Do I have family or partners willing to finance me?
- Do I have a great relationship with my banker?

Business Planning Questions

- What is your big idea? (is there anything unique)
- Why do people “Need” (Want) It?
  - What problem or need does your business address?
- Who will you sell to?
- How will you reach them?

- Who are you competitors?
- What is your comparative advantage (what do you have or can do that others cannot)?
- Who is on your business team (who will help you and what will they do)?
- Where will customers buy your product(s)?
- How much will they pay? How much will it cost you?

- What will you need to buy to get started?
- How much money do you need to get this idea to the point where you can start selling?
- Where will the money come from?
- How soon will you be able to start selling?
- How soon will you be able to make a profit?

Profit

- Revenue – What you sell
  - Quantity sold * Selling price per unit
- Expenses – What it costs to produce your product and run your business
  - Think of stages the products go through and costs associated with each stage
  - Think of general things the business must do these are sometimes fixed costs

Sample Red Raspberry for Retail Fresh-Market Production

Summary of income and expenses for a mature planting for retail marketing.

Item	Quantity	Your Quantity	Unit	Price	Your Price	Total	Calculated Estimate
Receipts							
Raspberries - retail	10,000		1/2 pints	$ 2.50		$ 25,000.00	$ 0.00
Raspberries - wholesale	10,000		1/2 pints	$ 1.50		$ 15,000.00	$ 0.00
Variable costs							
Custom operations							
Fertilizer spreading	1		acre	$ 10.70		$ 10.70	$ 0.00
Plant analysis kit	1		acre	$ 25.00		$ 25.00	$ 0.00
Fertilizer and lime	1		acre	$ 42.00		$ 42.00	$ 0.00
Herbicides	1		acre	$ 183.05		$ 183.05	$ 0.00
Insecticides	1		acre	$ 102.91		$ 102.91	$ 0.00
Fungicides	1		acre	$ 394.75		$ 394.75	$ 0.00
Trellis maintenance	1		acre	$ 82.00		$ 82.00	$ 0.00
Labor							
Operator labor	4.3		hour	$ 15.00		$ 64.50	$ 0.00
Seasonal labor	46		hour	$ 12.00		$ 552.00	$ 0.00
Harvest labor	10,000		1/2 pint	$ 0.70		$ 7,000.00	$ 0.00
Packaging							
Clamshells	10,000		1/2 pint	$ 0.11		$ 1,100.00	$ 0.00
Clamshell flats	834		1/2 pint	$ 0.65		$ 542.10	$ 0.00
Marketing	15%	0.00%	total income	$ 25,000.00		$ 3,750.00	$ 0.00
Fuel	14.4		gal	$ 3.50		$ 50.40	$ 0.00
Repairs and maintenance	1		acre	$ 25.14		$ 25.14	$ 0.00
Additional inputs							$ 0.00
Additional inputs							$ 0.00
Interest on operating capital	1		acre	$ 254.91		$ 254.91	$ 0.00
Total variable costs						$ 14,179.46	$ 0.00
Fixed costs							
Equipment	1		acre	$ 47.94		$ 47.94	$ 0.00
Land	1		acre	$ 200.00		$ 200.00	$ 0.00
Irrigation	1		acre	$ 240.00		$ 240.00	$ 0.00
Additional inputs	1		acre				$ 0.00
Total fixed costs						$ 487.94	$ 0.00
Total costs						$ 14,667.40	$ 0.00
Income - Retail							
Returns over variable costs						$ 10,820.54	$ 0.00
Returns over total costs						$ 10,332.60	$ 0.00
Income - Wholesale							
Returns over variable costs						$ 820.54	$ 0.00
Returns over total costs						$ 332.60	$ 0.00

You should monitor local markets and contact suppliers to determine current prices for all items contained in this sample budget.

Profit

- Revenue
- - Expenses
- = Net income before taxes
- - Taxes
- = After Tax Profit

Using Your Profit

- You cannot take all of the profit out of the business.
  - This is different from a job where you take all your after tax earning home.
- You need to use some of it to run your business
  - Pay principal payments on loans
  - Buy more equipment
  - Increase working capital

Playing What IF

- Change your budget assumptions to see what happens if …
- Easier to lose money on paper
- Gives you a better understanding of how various things affect your business
- Shows combinations of assumptions that make money and those that don’t

Resources

- DiverseAg.org
  - The resource tab lists various websites with help
  - The production Hort website is one of them.

Self Employment Tax

- Salary and wages paid to you
  - Employer deducts 7.65% for FICA and medi-care
  - Employer matches 7.65% for a total of 15.3%
- Self Employed individual pays both sides as self-employment tax
  - Do not need to pay if SE profit less than $400
  - 12.4% on the first $110,000 of profit for FICA
  - 2.9% on entire profit for medicare

Self Employment Tax

- Often more than income tax, because it is paid on every dollar of profit
-

Example 1: John and Lucy Farmer are married and have two children (10 and 12). Lucy is not employed during 2010. John grows vegetables and sells them at a local market. During 2010, John's net profit was $45,000. John did not sell any equipment and John and Lucy had no other source of income.

For 2010, the Farmer's have $1,582 of income tax liability and have a $6,358 SE tax liability. The Making Work Pay credit of $800 and the earned income credit of $747 will reduce this by $1,547 leaving a balance due of $6,393.

Hobby Loss Rules

- To be able to deduct expenses greater than receipts (losses) farmers must be engaged in a business for profit.
- Profit = Revenue (receipts) – expenses
- Not a hobby if profits are made in 3 of 5 consecutive years.
- 2 of 7 years for equine operations
- If profit test not met, allows IRS to look into it.
- IRS does not automatically look, but it allows them to.

Hobby Loss Rules

- IRS has 9 guidelines they can look at to determine if it is a hobby or a business
- These include
  - Is it carried out in a business like manner
    - Keep track of receipts and expenses, separate checking account, etc.
  - If additional knowledge and education is pursued (this course)
  - Expertise of producer
  - Time and effort spent by the producer

Budget for Small Farm

Revenue	Unit	Price	Quantity	Total	% of Reveue
Product					
Individual product	*size of unit*	*price per unit*	*number sold*	*Total revenue*	
		2	3	6	100%
				0	0%
				0	0%
				0	0%
				0	0%
Total Revenue				**6**	100%

Expenses	Unit	Price	Quantity	total	
Soil Preparation					
				0	0%
				0	0%
				0	0%
				0	0%
				0	0%
Total Soil Prep.				**0**	0%
Planting					
				0	0%
				0	0%
				0	0%
				0	0%
Total Planting				**0**	0%
Maintenance					
				0	0%
				0	0%
Total Maintenance				**0**	0%
					0%
Harvest					0%
				0	0%
				0	0%
				0	0%
Total Harvest				**0**	0%

Packaging

				0	0%
				0	0%
Total Packaging				**0**	0%

Labor

				0	0%
				0	0%
				0	0%
				0	0%
Total Labor Costs				**0**	0%

Marketing

				0	0%
				0	0%
				0	0%
				0	0%
				0	0%
Total Marketing Costs				**0**	0%

Fixed Costs

				0	0%
				0	0%
				0	0%
					0%
Total Fixed costs				**0**	0%

Total Expenses		**0**	0%
Net income before taxes (revenue minus expenses)		**6**	100%
Income and self employment taxes	30%	1.8	30%
Net profit		**4.2**	70%

Note: Net profit must be used to pay principal part of loans, purchase new equipment, add to working capital and withdrawals for owners.

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Soil Health & NRCS Cover Crop Programs

Biographical Information:
Danny McBride
USDA- Natural Resource Conservation Service

I am an Area Resource Conservationist for the NRCS. I have worked with NRCS for the past 8years and worked with the Utah Association of Conservation Districts before that. I work closely with farmers and ranchers helping them put conservation on the ground. I focus on agronomic principles; Nutrient and Manure Management, Irrigation, Soil Health, Cover Crops, Pest management, and grazing. I grew up on farm in Southern Idaho and graduated from Utah State University with a degree in soil and water science. I love agriculture and enjoy spending time with my beautiful wife and 3 kids.

Session Description:

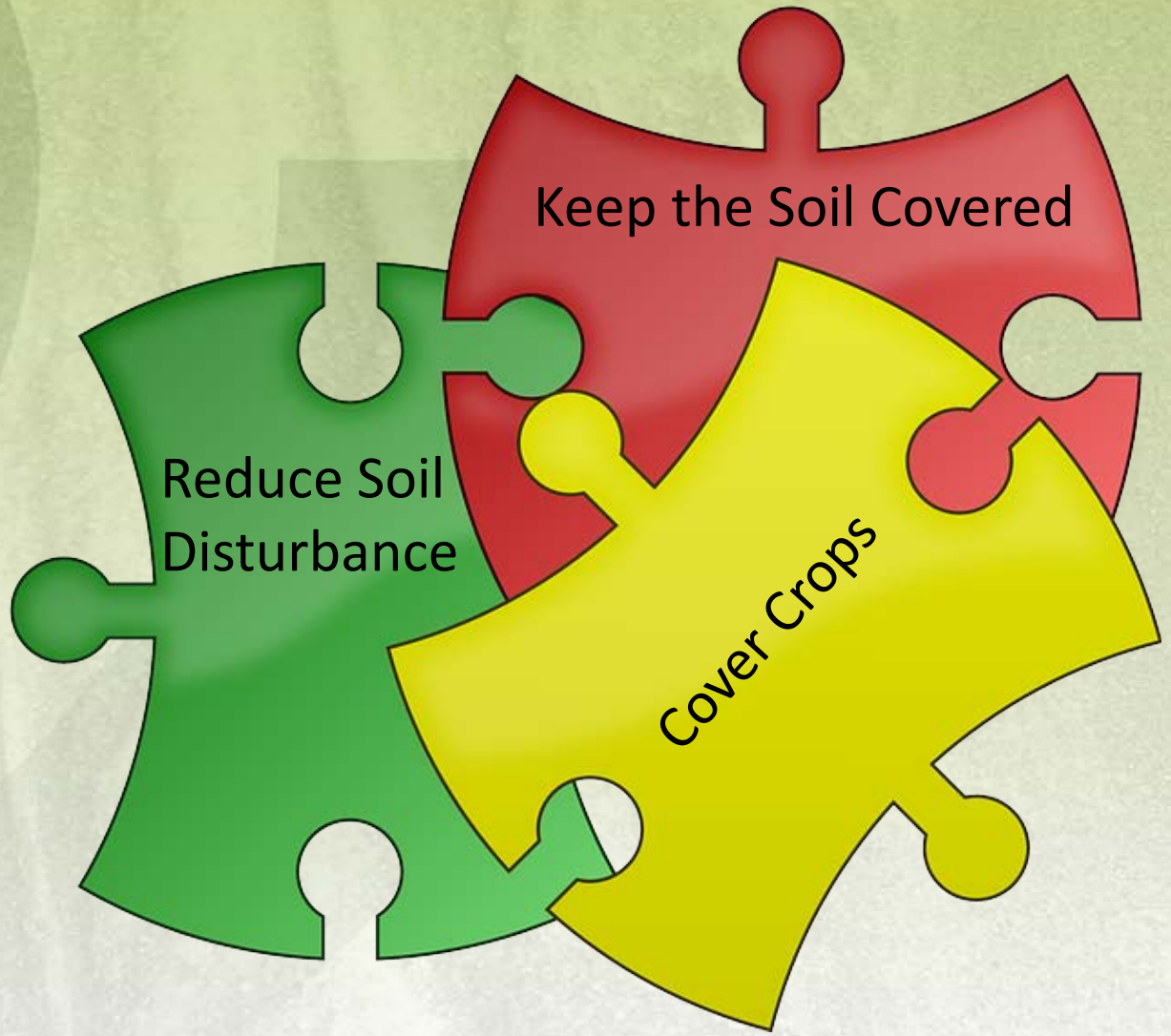
NRCS across the nation is focusing on the importance of soil health and cover crops. Cover Crops play an important part of 5 key factors in improving soil health. 1. Keep the Soil covered at all times with plants and plant residues, 2. Minimize Disturbance of the Soil, 3. Keep Living Roots in the soil as much as possible, 4. Maximize Diversity of plants in rotation/cover crops, 5. Incorporate Livestock when all

Urban and Small Farms Conference 2016
Soil Health and Cover Crops

Danny McBride

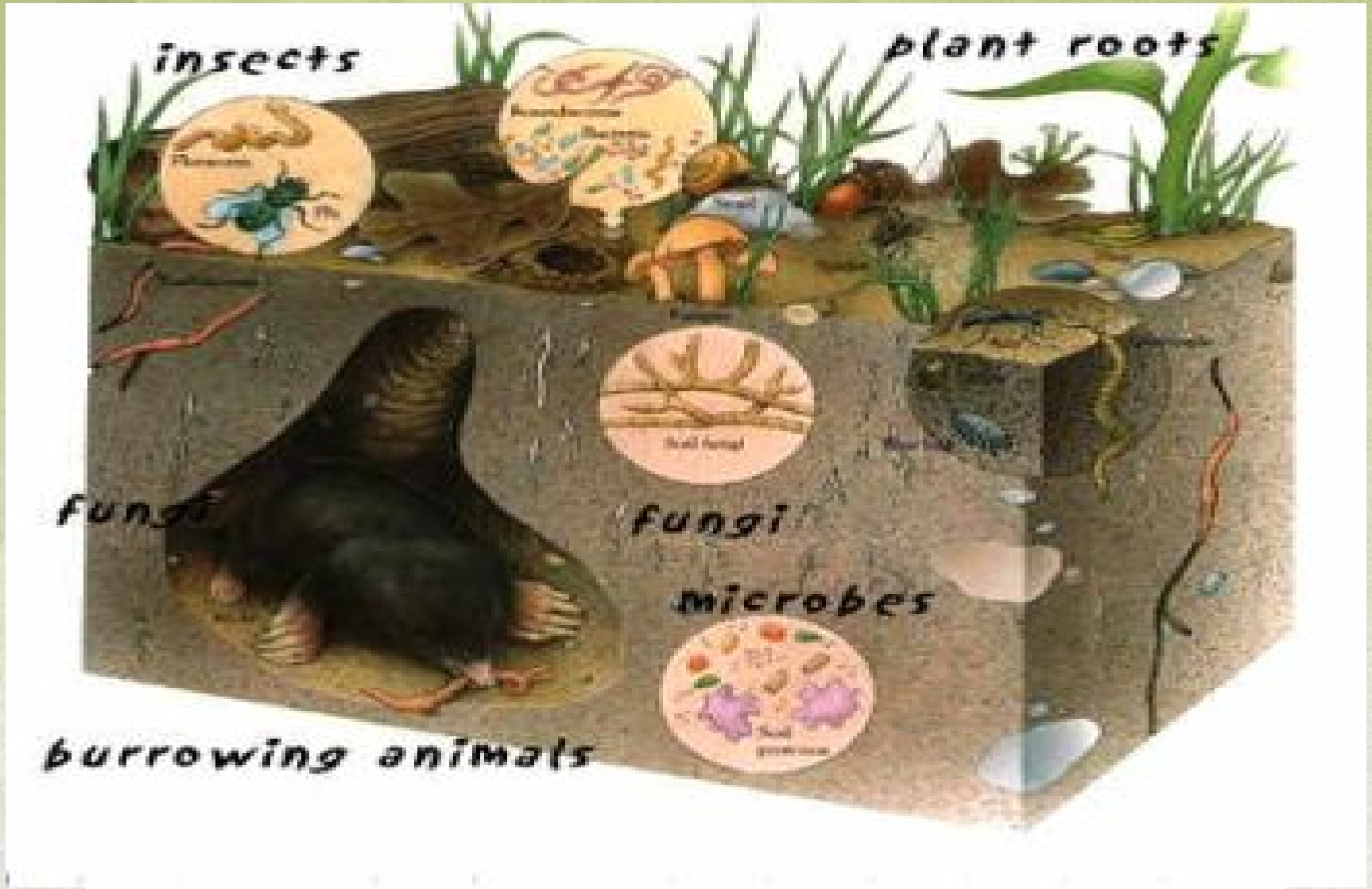
North Area Resource Conservationist, NRCS

Cover Crops……only one piece of the puzzle



Where do we start?

Soils 101 - How does soil ~~form~~ function?



Plant & Soil Interaction
(It's all about the Carbon!)

- Photosynthesis
  - Plant's convert the sun's energy into simple sugars and carbohydrates.
  - The plants use water and carbon dioxide from the air and combine them to form carbohydrates and oxygen.
  - Plants release oxygen and utilize the carbohydrates.
  - Pushes roots and growth into the soil (rhizospehere) release sugars, amino acids,

Soil Microbiology

- Plant & Soil Interaction - Photosynthesis
- Actinomycetes - Generate the smell of “healthy soil,” and are important in decomposing cellulose.
- Bacteria - Microscopic, single-celled organisms. They include the photosynthetic cyanobacteria and actinomycetes Bacteria break down easy to-use organic material (sugars, proteins, carbohydrates), retain nutrients, like N, P, and K in the soil and combat disease causing organisms.
- Fungus - Multi-celled, non-photosynthetic organisms. Fungi break down the more difficult-to-decompose, organic matter (like newspaper, cardboard, bark, sawdust, corn stalks) and retain those nutrients in the soil as fungal biomass
- Nematodes
- Protozoa
- Micro-arthropods (Collembola)
- Earthworms
- Insects/Animals

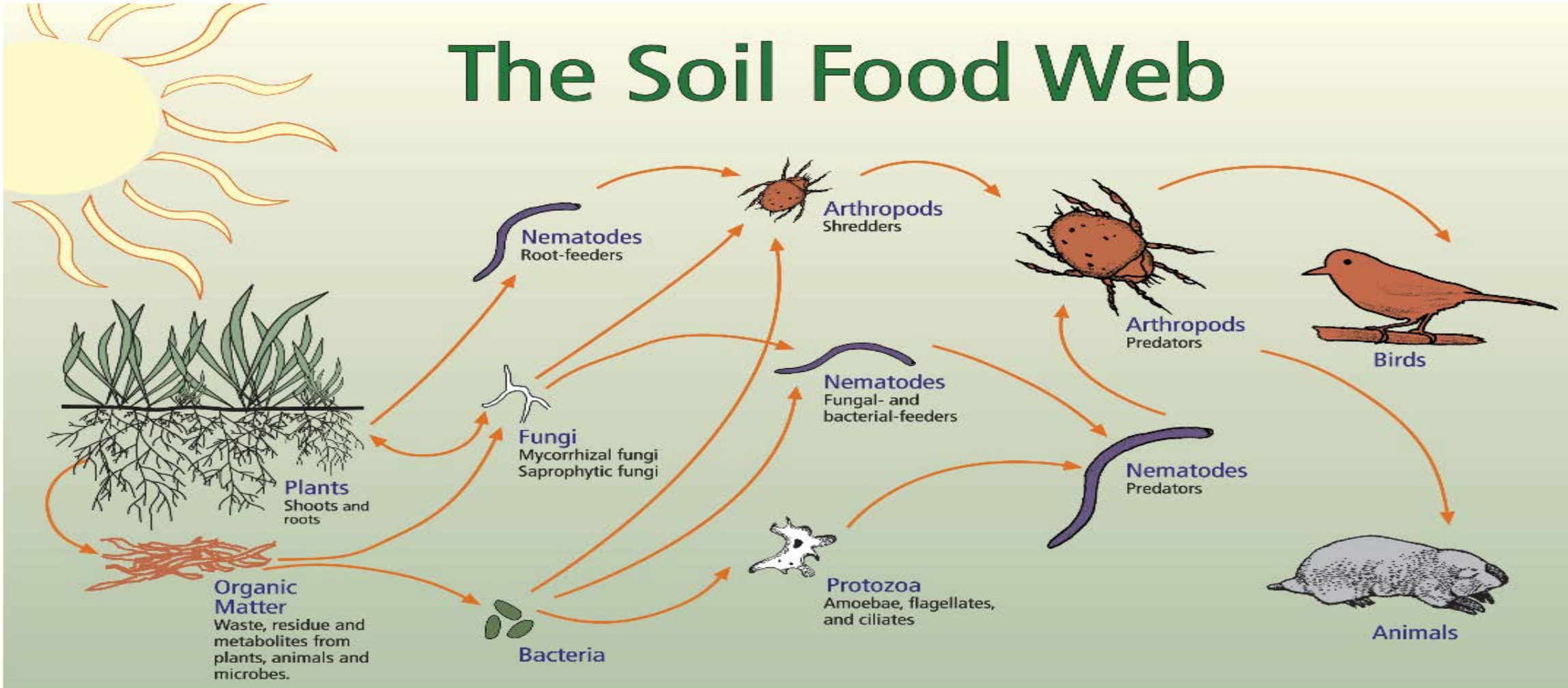
Soil Fungi

- **Glomalin** is a glycoprotein produced abundantly on hyphae and spores of arbuscular mycorrhizal (AM) fungi in soil and in roots.
- **Glomalin** was discovered in 1996 by Sara F. Wright, a scientist at the USDA Agricultural Research Service.
- **pol·y·sac·cha·ride** is a carbohydrate (e.g., starch, cellulose, or glycogen) whose molecules consist of a number of sugar molecules bonded together.

Habitat for Microbes

- Mychorrizal fungi, bacteria, protozoa, nematodes, and earthworms exude polysaccharides, glomalin, organic acids, and amino acids.
- These combine with exudates released by the plant roots to work as glue to bind the soil particles.

The Soil Food Web



First trophic level:	Second trophic level:	Third trophic level:	Fourth trophic level:	Fifth and higher trophic levels:
Photosynthesizers	Decomposers Mutualists Pathogens, Parasites Root-feeders	Shredders Predators Grazers	Higher level predators	Higher level predators

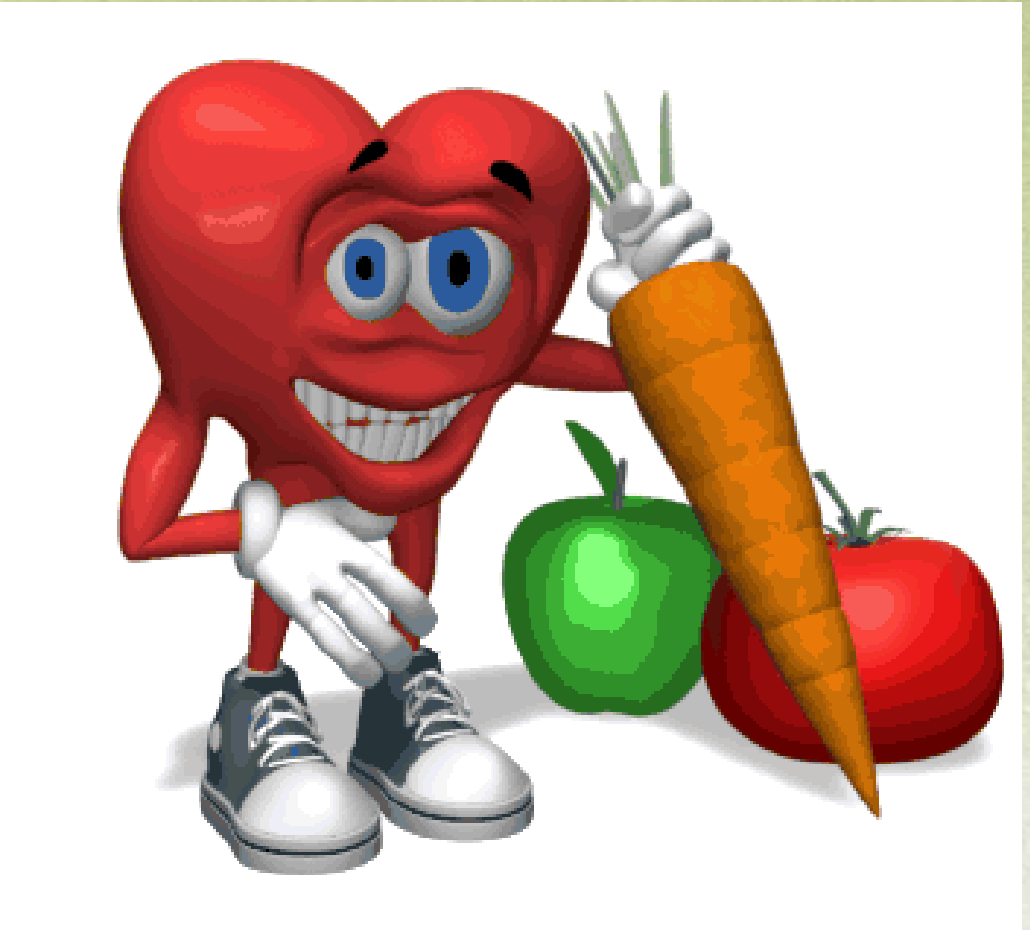
http://www.groedibles.com/2012/01/whats-in-a-teaspoon-of-soil-the-care-and-feeding-of-your-precious-soil-food-web/

So, Soil Health is What?

- The continued capacity of the soil to function as a vital living ecosystem that sustains plants, animals, and humans
  - Nutrient cycling
  - Water (infiltration & availability)
  - Filtering and Buffering
  - Physical Stability and Support
  - Habitat for Biodiversity

Is your cart “soil” functioning…
if not how do we get there?

How can you make your soils healthier?



Managing for Soil Health

1. Keep the soil covered at all times with plants and plant residues
2. Minimize Disturbance of the soil
3. Keep Living Roots in the soil as much as possible
4. Maximize Diversity of plants in rotation/ cover crops
5. Incorporate Livestock when all possible

Create the most favorable habitat possible for the soil food web….It's all about the Carbon.

Management of the Soil

unlock the SECRETS IN THE SOIL

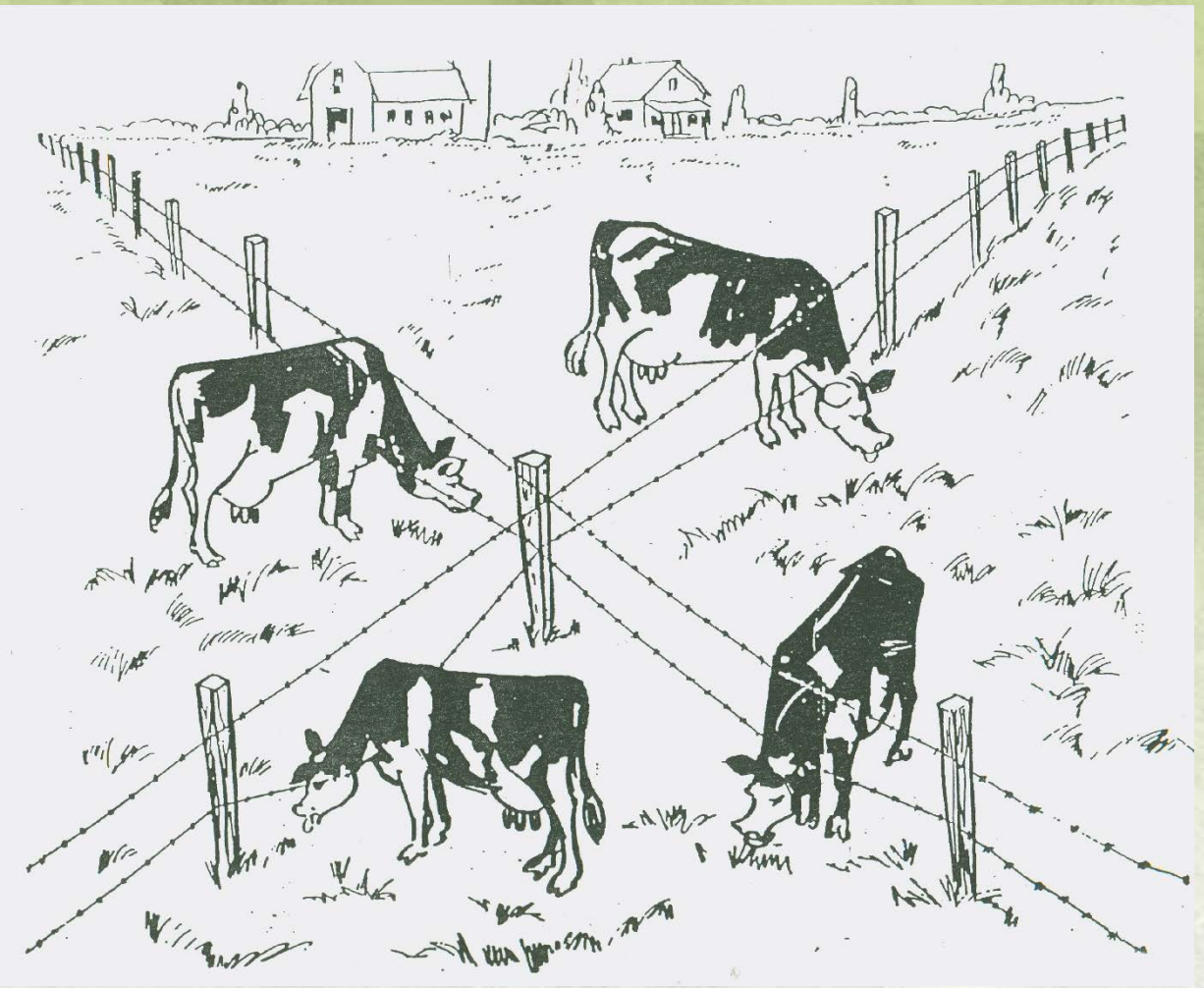
Soil is a Living Factory

Reduce or Eliminate Tillage

(Eliminate Recreational Tillage)

No till Equipment

Proper Grazing



Keep the Soil Covered

Cover Crops

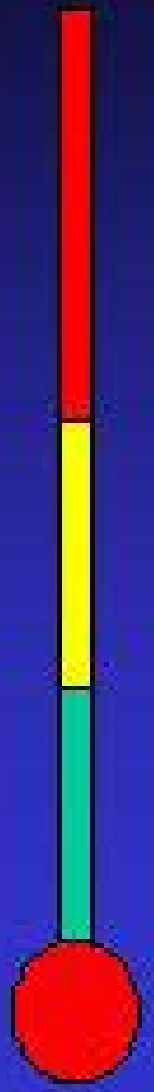
- Site specific (Soils, Crop Rotation, Climate)
- Conservation objective specific
  - Weed Suppression
  - Compaction Control
  - Erosion Prevention
  - Nutrient Cycling
  - Increase O.M.
  - Salinity Control

Cover Crop Myths and Realties

- Are cover crops stealing moisture?
- Do Cover crops pay?

Burleigh County Soil Conservation District
Soil temperatures

When soil temperature reaches...



140 F	Soil bacteria die
130 F	100% moisture is lost through evaporation and transpiration
100 F	15% of moisture is used for growth 85% moisture lost through evaporation and transpiration
70 F	100% moisture is used for growth

J.J. McEntire, NVAC, USDA SCS, Kerrville TX, S-68 4-R-12 198. 1956

Cover Crops in a Salinity Area?

They do exist! 5 way cover crop mix in a field Northeast of Roosevelt

Cereal Rye, Annual Rye, Winter Pea, Tillage Radish, Turnips, and (Volunteer Wheat)


nlock the
ECRETS
SOIL

Andrew Wallace, Soil Con teaching Dan Larsen, landowner about benefits of each cover crop species

Andrew explaining the benefits of peas and Nitrogen Fixation

Austrian Winter Pea with nodules forming

Soil that had no biological activity now shows signs of life (Earthworms)

2 years of Crop residue in the soil 2013 – corn, 2014 – Wheat
(with Cover Crops planted Mid-August 2014 after harvest)

Tillage Radish and Turnips dug from the field to show growth amount in 2 months

Tillage Radish is 12 inches long under ground 21 inches total growth

Andrew Wallace, NRCS and Dan Larsen, landowner showing off cover crops in Roosevelt, UT

Benefit of Grazing Cover Crops

Beef Cows and Horses love the Tillage Radish and Turnips.
Provides stock piled forage for cattle while improving soil health!

Economics of Cover Crop Grown in the Basin on 44 Acres

Cost:

- $900- Seed 26 lbs./ac x 44 acres x $1.27 lb.
- $660- Planting Cost: $15/ac. x 44 acres
- $110- Electricity for pump and pivot irrigation.
- **Total Cost= $1,670**
- **Cost Per Acre= $37.96**

Benefit:

- $1,920- 6 months grazing of 14 beef cows and 2 horses. $320/month x 6 months
- $ 1,557.75- Savings in nitrogen according to current soil test from spring '15. Requiring 27 lbs. N/ac. as per before applying 90-100 lbs. N/ac for Oat production according to soils report! (Cost of Urea 46-0-0 at $517/ton x 63)
- Soil OM gain, increased microbe activity, potential additional unaccounted N from decomposing cover crop???
- **Total Tangible Returns on 44 Acres: $3,477.75**
- **Net Gain: $1,807.75**
- **Net Gain Per Acre: $41.09**

Data Provided by producer with permission to use for NRCS purposes and training.

Cover Crop Weber County

Blair Hancock – Weber County Cover Crops

- Cover Crop was planted November 28, 2014 following corn silage. The silage was harvested, manure applied, field was disked, and cover crop planted.
- Cover Crop did not germinate until March of 2015.
- <u>Cover Crop Seed Mix</u>
- Purple Top Turnip 3 lbs./ac.
- Tillage Radish 3 lbs./ac.
- Hairy Vetch 3 lbs./ac.
- Tritacle 25 lbs./ac.

Cover Crop Weber County

March 11, 2015

Cover Crop Weber County

Blair Hancock May 11, 2015

Cover Crop Weber County

- Harvested Cover Crop May, 11, 2015 removed 105.25 Tons of material from a 12 acre field.
- ~8.7 Tons/Ac.

Uintah Basin Master Gardener Uses Cover Crops to Increase OM & Reduce Pests & Weeds

Producers Pumpkin Production, Center Pumpkin is Current Reg. Pumpkin State Record.

Three Weeks Growth of Annual Ryegrass to outcompete weed growth and increase/maintain OM. <u>OM=17.2%</u>

Photo used with permission by the producer for NRCS use and education. USDA-NRCS Utah, Uintah Basin Team

Cattle grazing Cover Crops in Summit County

No Till Morgan County

Corn (Silage) planted in Oat residue

No Till Box Elder County

Box Elder County Cover Crops

(Turnips, Kale, and volunteer wheat, grazing livestock)

Tillage Radish grown in Cache County 2015

Peas in Grain Stubble Cache County

What is NRCS doing?

- Soil Health Campaign
  - Educating and re-educating our NRCS staff on Soil Health Principles
  - Educating landowners across the nation at every event possible on soil health and its importance.
  - Developing a library of resources, information, and networking farmers across the nation.
  - Supporting sustainable agricultural practices and providing financial assistance through farm bill programs for implementation.
- NRCS Soil Health Website:

http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/soils/health/

Improve your profit margin, increase fall forage supply, and decrease inputs by applying soil health principles.

Come learn about these soil health principles:

- Disturb the soil as little as possible
- Crop rotations and cover crop diversity
- Keep a living root in the soil
- Keep the soil covered
- Incorporate livestock where practical

Learn more benefits at the . . .

$oil Health Workshop

Attend a workshop at one of these locations. Workshops run from 9 am to 3:30pm

Workshop is *free! Lunch will be provided by your local Conservation Districts*

- **February 23 - Logan, UT** - BATC, West Campus, 1410 N. 1000 W. Room 1970, Logan, UT
  Contact: Jon Hardman, NRCS District Conservationist 435-753-5616
- **February 24 - Ogden, UT** - Weber County USU Extension, 1181 N. Fairgrounds Dr. Ogden, UT
  Contact: Danny McBride, NRCS Area Resource Conservationist 801-629-0575 ext. 118
- **February 25 - Richfield, UT** - Sevier County Fairgrounds, 410 E. 200 S. Richfield, UT
  Contact: Lee Woolsey, NRCS Area Resource Conservationist 435-896-6441 ext. 140

(RSVP recommended but not required)

Special Guest Speakers:

- **Jay Fuhrer,** Soil Health Specialist, NRCS, Bismarck, ND
- **Jerry Doan,** Manager, Black Leg Ranch, Bismarck, ND
- **Local Producer Perspectives & Panel Q&A Session**

Workshop sponsors:

USDA NRCS Natural Resources Conservation Service

Extension UtahStateUniversity

Utah Conservation Districts

UDAF

Western SARE Sustainable Agriculture Research & Education

Come Early (8:00 a.m.) for hands on soil health demonstrations

NRCS Programs

NRCS's natural resources conservation programs help people reduce soil erosion, enhance water supplies, improve water quality, increase wildlife habitat, and reduce damages caused by floods and other natural disasters. Public benefits include enhanced natural resources that help sustain agricultural productivity and environmental quality while supporting continued economic development, recreation, and scenic beauty.

- Environmental Quality Incentives Program (EQIP)
  - General (Irr. Cropland, Dry Cropland, Range, Pasture, Forestry, Riparian, AFO/CAFO)
  - Initiatives (High Tunnels, Sage Grouse, Salinity, Wildlife, Drought, Energy, Organics)
- Agricultural Management Assistance Program (AMA)
- Conservation Stewardship Program (CSP)
- Agricultural Conservation Easement Program (ACEP)
  - Agricultural Land Easement (ALE)
  - Agricultural Land Easement Grasslands (ALE-GSS)
  - Wetland Reserve Easement (WRE)

Where is the nation?

- The faces of Soil Health….

- Profiles in Soil Health across the nation:

http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/health/?cid=stelprdb1083183


Ray Styer -NC


Dave Brandt -
OH


Brendon
Rockey -CO


Gabe Brown -ND


Ray McCormick -IN

Burleigh County Soil Conservation District

http://www.bcscd.com

unlock the SECRETS IN THE SOIL

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Soil Health and Cover Crops Philosophy

Biographical Information:

Ron Patterson
USU Extension, Carbon County

Ron is a USU Extension faculty member in Carbon County with a horticulture background. He organizes and manages the High Desert Grower's Farmers' Market in Price, Utah. He also operates a CSA in Carbon County in addition to his other tasks.

Session Description:

Will cover soil health basics, especially as they apply to organic matter and cover crops.

EXTENSION
UtahStateUniversity

Soil Health

The Foundation of Life

Ron Patterson
USU Extension—Carbon County

Amendments

- What is the single most important amendment you can add to Utah soils?

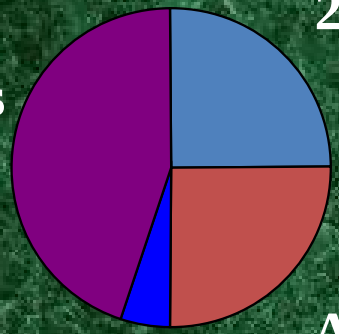
- Organic Matter

Soil—dirt by any other name

- Soil contains
  - Minerals
    - Sand
    - Silt
    - Clay
  - Air
  - Water
  - Organic matter
  - Living organisms

(primary soil particles and nutrients for plants)

(water for transpiration and nutrient transport)



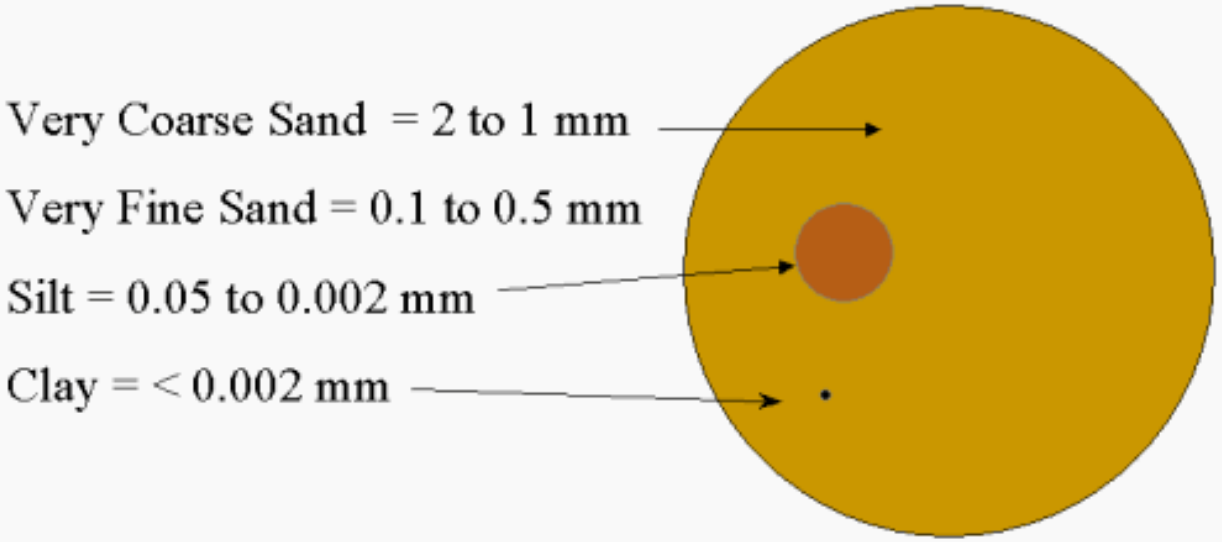
(soil structure and nutrients for plants)

(oxygen to roots)

Mineral Component

Soil Properties: Texture

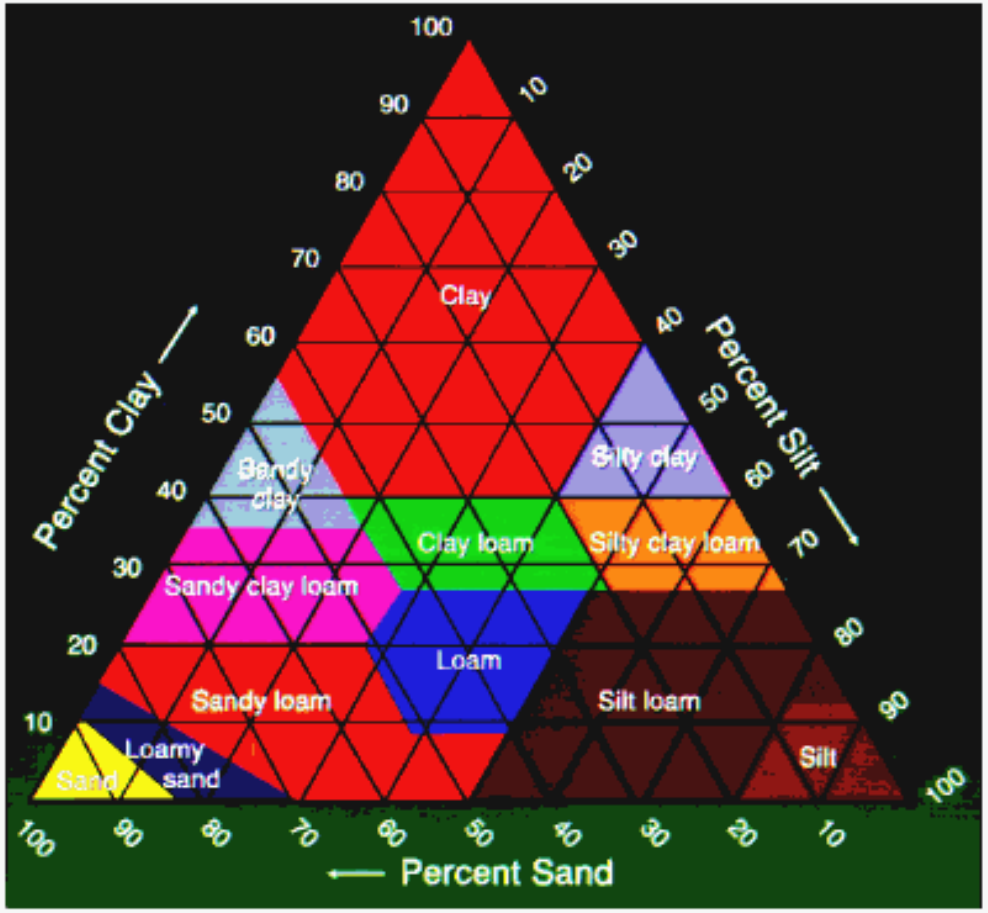
Soil Texture: The relative proportions of sand, silt, and clay particles in a mass of soil (material less than 2mm in size).



Soil Texture Triangle

-Lab data needed

-Percent by weight of fine earth fraction



Soil Texture—Who cares?

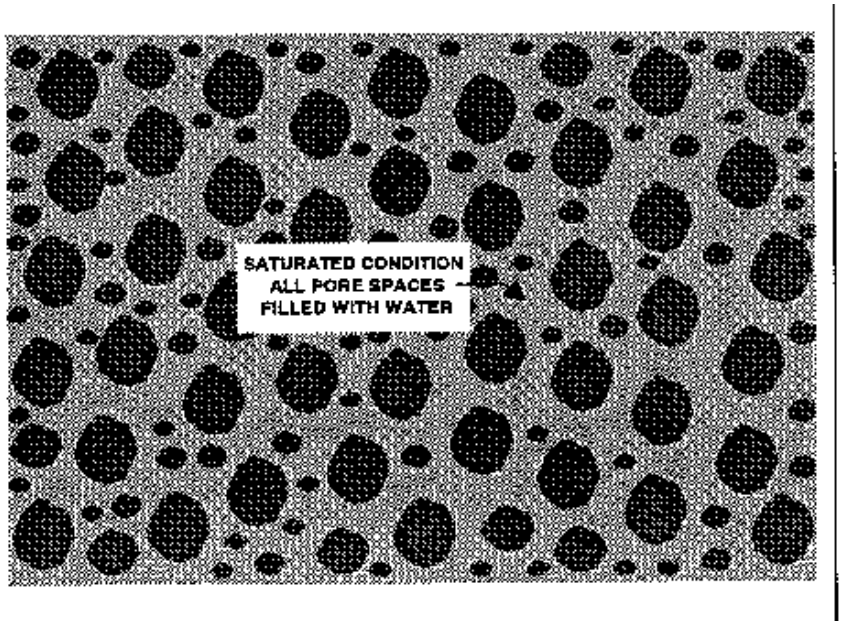
- Soil texture determines how much water soil will hold
  - Clay soils hold more water than silt or sand
- Soil texture determines how quickly water can move into soil
- Soil texture determines how easy soil is to work

Soil Textural Class	Water Holding Capacity, inches/foot of soil
Coarse sands	0.25 – 0.75
Fine sands	0.75 – 1.00
Loamy sands	1.10 – 1.20
Sandy loams	1.25 – 1.40
Sandy clay loams	1.50 – 2.00
Loams	2.20 – 2.50
Silty Loams	2.00 – 2.50
Silts	1.50 – 2.00
Clay loams	1.50 – 2.00
Silty clay loams	1.80 – 2.00
Silty clays	1.50 – 1.70
Clays	1.20 – 1.50

How soil holds water

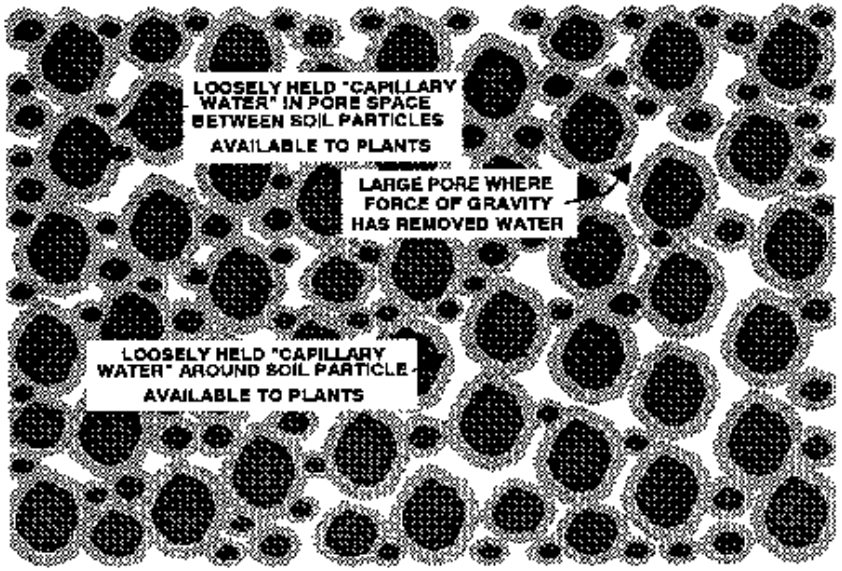
- Sand, silt and clay particles have small negative charges
- The positive end of water molecules “sticks” to soil particles because of their negative charge
- Organic material in soil is also charged and will hold water molecules

Soil water terms--Saturated



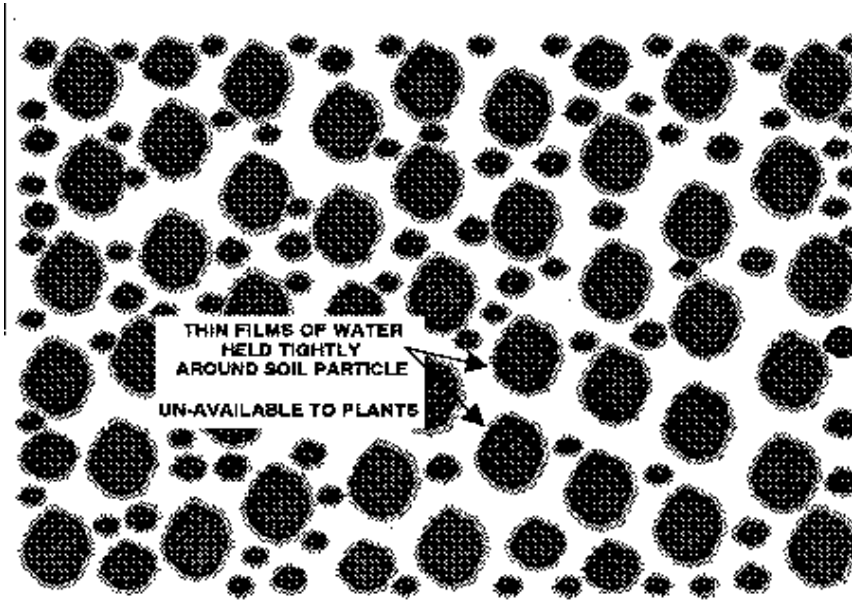
- Saturated—soil pores are completely filled with water
  - Unless you have a drainage problem, saturation is temporary
  - Gravity causes water to move downward, which opens up saturated pores
  - Plant roots can't get oxygen from saturated soils
  - Saturated soils are the cause of "scald" in melons

Soil water terms—Field



- Field Capacity happens about 24 hours after irrigation, when excess water has drained away
  - Soil pores have air in them again, but water clings to the soil particles

Soil Water Terms—Wilting Point



- Wilting Point—The point at which plants can no longer extract water from the soil
  - Water remains in the soil at wilting point, but it is held so tightly by the soil particles that plants can't remove it
  - At wilting point, plants will wilt and not recover

Soil Organic Matter (SOM)

- “The most complex and least understood component of soils” Magdoff & Weil

Soil Organic Matter (SOM)

- Organic matter vs organic material
- What affects SOM amount
  - Temperature
  - Moisture/humidity
  - Soil texture
- Active fraction vs stable fraction
- % SOM

Advantages Soil Organic Matter

- Lighter soil—resist compaction
- Increased aggregate stability
- Increased water holding capacity—drought resistance
- CEC—less nutrient leaching
- Less erosion
- Increased biological activity

Soil Organic Matter & Water

- Reduce water runoff—slow water movement
- Increase water holding capacity
- Increase drought resistance
- Slow rate of evaporation
- Break force of rainfall—crop residue

Soil Organic Matter & CEC

- Cation Exchange Capacity affects
  - Ability to hold on to nutrients
  - Reduces potential for nutrient leaching
  - 10x more CEC than mineral component
- Stable fraction--humus

Soil Organic Matter & Soil Structure

- Aggregate formation
- Erosion control
- Biological activity

Organic Matter Reduction

- Biomass removal
- Tillage

Increase Organic Matter

- Leave crop residue—reduce or better-time tillage
- Rotate crops w/pasture or perennials
- Add organic residues—manure, litter, etc.
- Cover crops—grow & incorporate

- Key—add every year

Cover crops

- Nutrient cycling
- Combat weeds
- Biodiversity
- Reduce erosion
- Reduce compaction

- Healthy Soil = Better Production

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Questions?

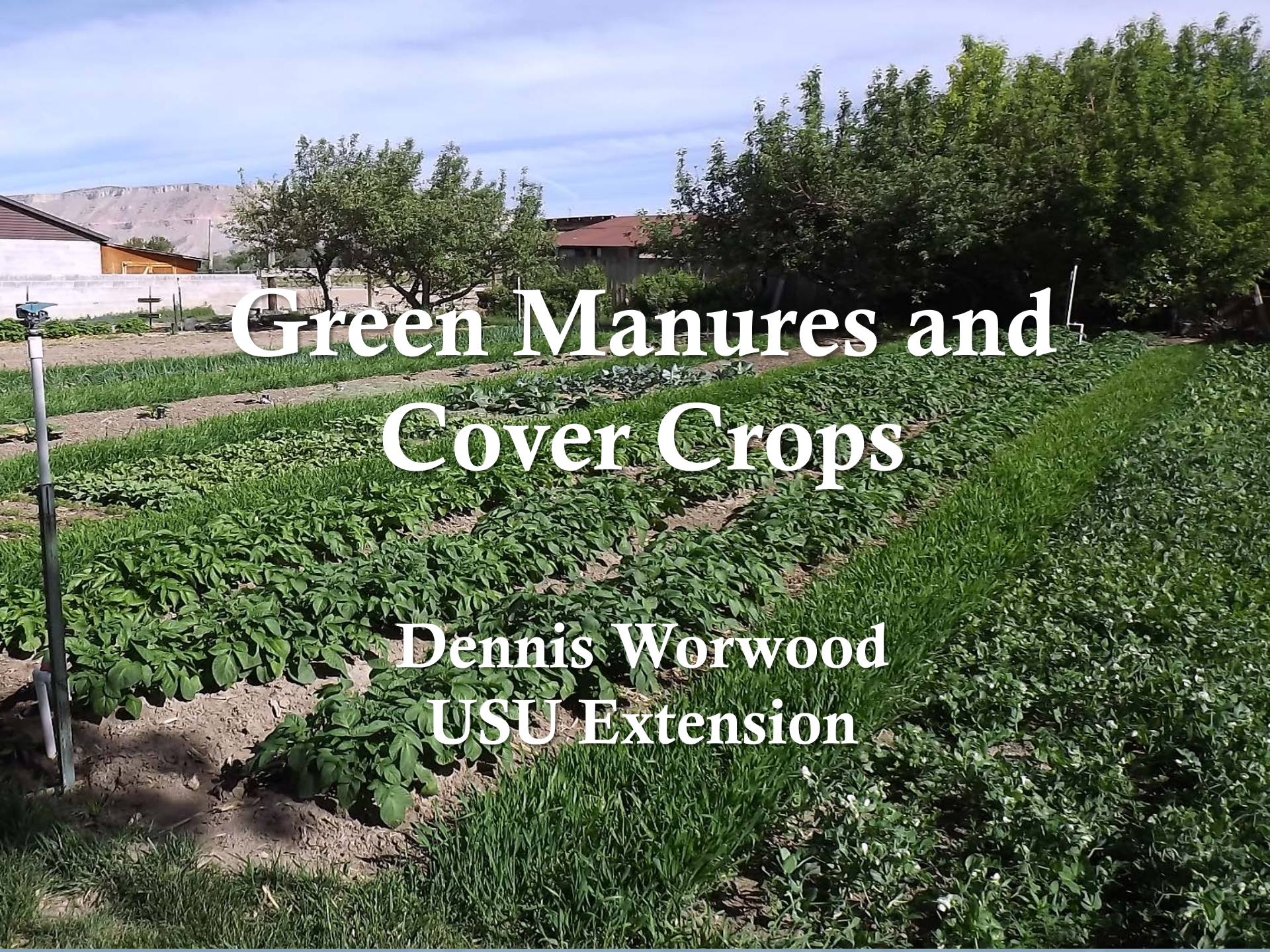
- Back to Top -

Cover Crops in Practice

Biographical Information:
Dennis Worwood
Utah State University
Extenstion Emery County

Dennis Worwood has degrees in Horticulture and Plant Science from BYU and USU, respectively. He has worked for USU Extension in Emery County for 34 years. He has conducted field trials of many cover crops and green manures and published a fact sheet on using small grains as cover crops in vegetables.

Session Description:
Cover crops can suppress weeds, increase soil organic matter, improve soil structure, and may supply nitrogen for following crops. Grasses, broadleaves, legumes, annuals and perennials can be used as cover crops to fill particular needs. This presentation will demonstrate how cover crops and green manures have performed in Eastern Utah trials.



Green Manures and Cover Crops

Dennis Worwood
USU Extension

Different Crops for Different Needs

- To add organic matter to soil
- To suppress weeds
- To add Nitrogen (Legumes)
- To capture Nitrogen
- To attract or harbor beneficial insects
- To minimize compaction and mud in walkways and driveways
- To minimize erosion

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Some Basic Categories

- Perennials
- Annuals
  - Spring and Summer planted
    - Cool season Warm Season
  - Fall planted
- Monocots
  - Grains Grasses
- Dicots
  - Legumes Non-legumes

Perennial Grasses

- Can be used where permanent cover is desired, such as a field driveway
- Choose a bunch grass to minimize spread
  - Perennial Ryegrass Tall Fescue
- Problems:
  - May have “lawn” weeds like dandelions
  - May spread if allowed to seed, or if contaminated with Bluegrass

Perennial Ryegrass

- Establishes quickly
- A bunch grass
- May have lawn weeds that harbor Lygus bugs or other pests
- Lives 3-5 years; (Tall Fescue is longer-lived)
- May re-seed if not mowed

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Annual Grasses

- Used for green manure, to scavenge N, to curb erosion, for forage, weed suppression or for temporary pathways
- Both cool and warm season grasses available
  - Cool season: Grains, annual ryegrass
  - Warm season: Corn, Sorghum & Sudangrass
- Provide livestock feed
- Can become weedy if allowed to re-seed
- Easy to grow

Fall Planted Annual Grasses

- Plant in fall (Aug to Oct)
- Winter cover & spring windbreak
- Suppresses weeds
- Kill before seed matures
- Grains:
  - Wheat, Barley, Triticale, Rye
- Annual (Italian) ryegrass

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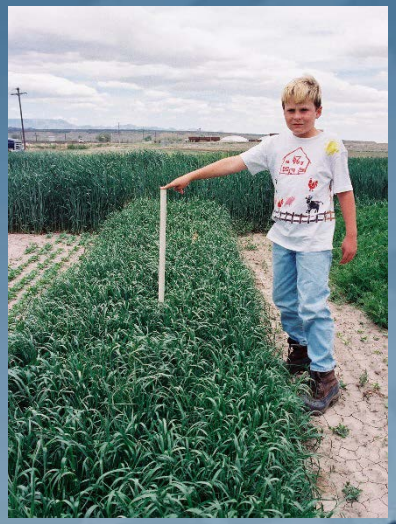
Fall-Planted Grains and Annual Ryegrass the Following Spring



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Spring Yield of Fall-Planted Grasses (100% Dry Matter)*

Forage Species	Tons /Acre
Triticale	4.0
Cereal Rye	4.3
Winter Wheat	3.1
Italian Ryegrass	2.1

*USU Extension trials in Carbon & Emery Counties by D. Worwood & M. Winger

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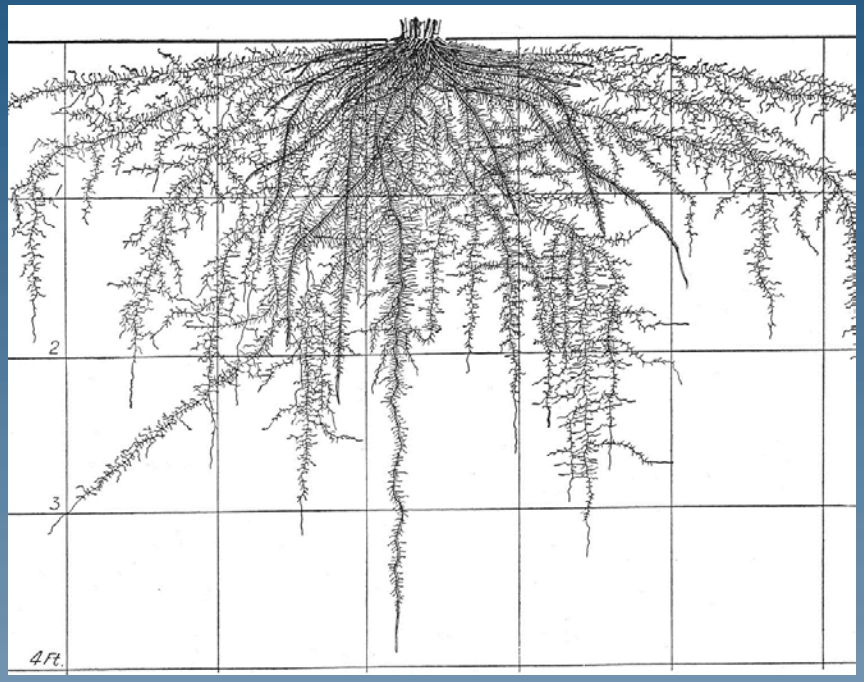
Roots Also Add Organic Matter



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In the Spring…

- Graze, cut, till or kill before seed matures
- Standing strips can serve as windbreaks for crops
- Can be left on soil surface as a mulch
- Avoid Cereal Rye in wheat growing areas (weedy)

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Grain Flowering Habits…

- "Spring" grains are planted in the spring and flower and produce seed that growing season.
- "Fall" or "Winter" grain plants need cold treatment to flower. They are planted in fall; plants overwinter and produce seed the next summer.
- "Facultative" grains behave like fall grains if planted in the fall and like spring grains if planted in the spring.

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Spring-Planted Fall Grain

- Produces few, if any seed heads -- plants don't get required cold treatment when planted in spring or summer
- Use for walkways, driveways and weed suppression.
- Plan ahead and buy seed in late summer; may not be available in the spring
- Winter Barley is the best choice
  - As a rule, produces fewer seed heads than spring-planted fall wheat, triticale or rye.
  - Schyler, Kold, Scio and Strider are suitable varieties for this use. Avoid facultative varieties like Sprinter.

Spring-Planted Fall Barley

- Produces a dense turf that doesn't spread
- Competes well with weeds if planted thickly (will still have some weeds)
- Can be mowed or left to grow – won't get very tall

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Spring Planted Fall Barley

- Drill; or scatter on soil surface and lightly till or drag to incorporate seed
- Works best under sprinklers, but may grow without irrigation once established if timely precipitation occurs

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Spring-Planted Fall Barley

Legumes

- Work with Rhizobium bacteria to fix nitrogen
  - To get this benefit, make sure legume seed has been inoculated with the proper bacteria
- Annual legumes are often used as cover crops
  - Spring-planted
  - Fall-planted
- Some may be used as feed for humans or livestock

Garden Peas

- Large-seeded cool season legume
- Can be broadcast or drilled
- Plant thickly so plants cover soil completely when mature
- Seeds and/or forage can be harvested
- Can be double cropped
  - Plant in early spring
  - Plant mid to late summer

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Beans

- Large seed
- Warm season legume
- Usually drilled in rows
- Make sure drill doesn't damage seed
- Can be double-cropped
  - Plant late spring
  - Plant mid-summer

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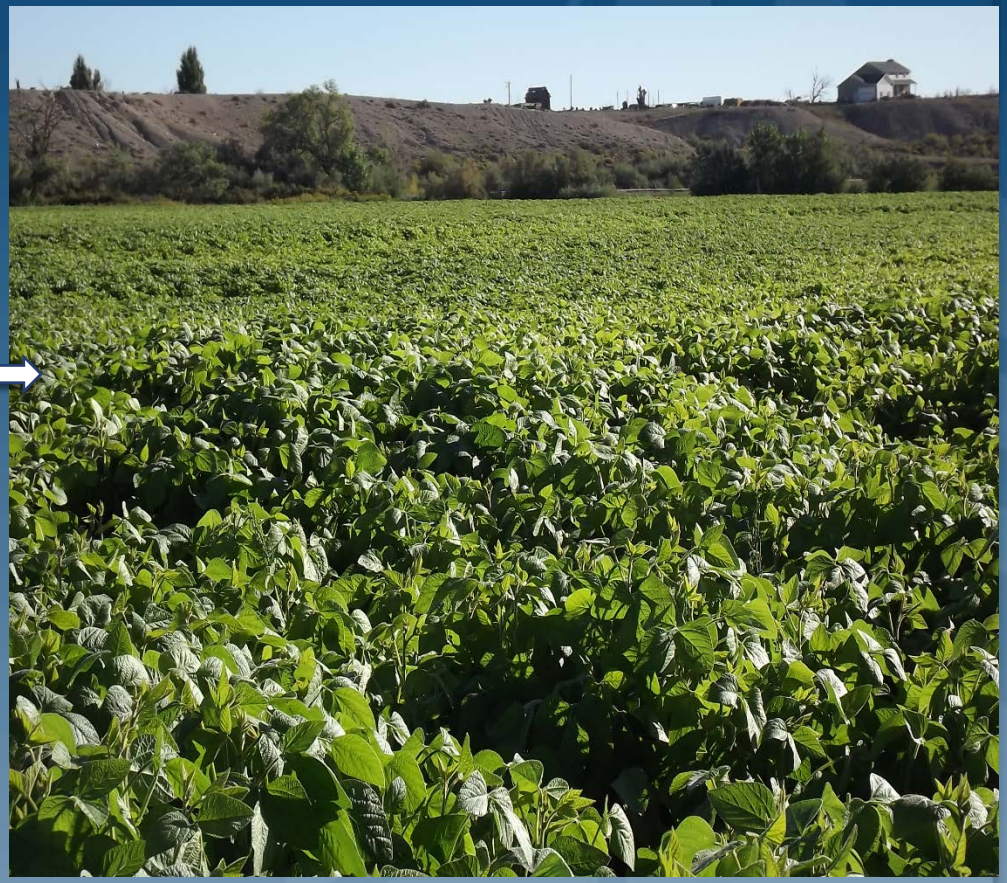
Beans

Soybeans

- Warm Season Legume
- Can be grazed, cut for forage, or seeds harvested
  - 4 tons/acre dry weight of forage
- Very attractive to deer



Edamame or green soybeans for human consumption

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Fall-Planted Peas

- Austrian Winter Peas are a common variety
- May not overwinter in all locations
- Can be grazed or cut for forage

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Hairy Vetch

- Small seeded legume
- Not for forage (photosensitivity)
- Plant in spring, late summer or fall
- Vegetables can be seeded or transplanted through a mat of dead vetch

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Spring Yield of Fall-Planted Legumes (100% Dry Matter)*

Forage Species	Tons /Acre
Austrian Winter Peas	3.6
Hairy Vetch	2.3

*USU Extension trials in Carbon & Emery Counties
by D. Worwood & M. Winger

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Berseem Clover

- Annual clover from Egypt
- Fixes up to 200 lbs N/acre
- Warm season (won't stand much cold)
- Can be cut or mowed several times
- Be sure to inoculate seed
- Good for grazing or hay; non-bloating

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Non-Legume Dicots (broadleaved plants)

- Cool season and warm season species
  - Some will overwinter
- Some may have soil fumigant properties (mustards)
- Some known for rapid growth (Buckwheat)

Mustard Family

- Turnips, kale, rape, canola, tyfon, radish, etc.
- Small seeded annuals; some can be planted in fall
- Till under before seed matures
- Some mustards are being sold as natural soil fumigants

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Canola

Young canola growing between rows of unmowed spring-planted fall barley

- Also sold as kale and rape
- Spring and fall varieties available
- Produces a thick cover
- Many varieties can be used for livestock forage; some can't

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Spring Yield of Fall-Planted Mustards (100% Dry Matter)*

Forage Species	Tons /Acre
Rape	5.1
Kale	4.5

*USU Extension trials in Carbon & Emery Counties by D. Worwood & M. Winger

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Turnips

- Very cold hardy— will grow early in spring and late into fall
- Seed readily available
- Low seeding rate (3 lbs/acre)
- Can be grazed

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Buckwheat

- Warm season dicot
- Grows very fast; smothers weeds
- Hollow stems are easily tilled or killed
- Goes from seed to mature in 4 to 5 weeks
- Not for forage (photo-sensitivity)

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Buckwheat blossoms provide nectar and pollen for bees and beneficial insects.

Buckwheat should be killed before blossoms mature seed

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Buckwheat has hollow stems that are easily rolled or turned under

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Using Cash Crops and Cover Crops to Build Soil

- August 15: Early sweet corn on right has been harvested

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Stalks are shredded (couldn't graze in this setting)

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Buckwheat seed is broadcast on August 15

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Ten days after planting

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Eighteen days after planting

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Tilling under Buckwheat on September 21, five weeks after planting

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Winter barley was planted on September 23; sprouted 7 days later

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Barley 14 days after planting

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Barley 30 days after planting.

Plants will produce more organic matter if they survive the winter.

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August 15 to October 31: Three Shots of Organic Matter*

* Plus, soil was protected from erosion and weed growth prevented. Any residual N from corn was captured.

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Summary

- Bare ground is an invitation for weeds and erosion—cover it
- Cover crops help build good soil structure
- Use your imagination

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Questions or Comments?

Small Farms Conference 2016
Cover Crop Websites and Publications

Managing Cover Crops Profitably
http://www.sare.org/Learning-Center/Books/Managing-Cover-Crops-Profitably-3rd-Edition

Purdue University Cover Crop Publications
https://ag.purdue.edu/agry/extension/Pages/cover_crops.aspx

Penn State Cover Crop Publications
http://extension.psu.edu/plants/crops/soil-management/cover-crops

Michigan Cover Crops Publications
http://www.covercrops.msu.edu/

Iowa Cover Crop Publications and Links
https://www.extension.iastate.edu/alternativeag/covercrops.html

Cover Crops for Utah Gardens
https://extension.usu.edu/files/publications/publication/HG-521.pdf

Using Winter Grain for a Cover Crop
http://extension.usu.edu/files/publications/publication/Horticulture_Home_2012-01pr.pdf

Washington State University Cover Crops
http://county.wsu.edu/spokane/agriculture/crops/Pages/CoverCrops.aspx

Cover Crops and Green Manures – University of Vermont
https://www.uvm.edu/vtvegandberry/factsheets/covercrops.html

Cover Crops and Green Manures – Colorado State University
http://www.ext.colostate.edu/mg/Gardennotes/244.html

Cover Cropping in Organic Farming Systems
http://articles.extension.org/pages/59454/cover-cropping-in-organic-farming-systems

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Protecting your Vegetable Crops from their Wild Relatives: Diversifying Selection Pressures and Preventing Weed Shifts

Biographical Information:

Ed Peachey
Oregon State University
Department of Horticulture

Ed is an associate professor in the OSU department of horticulture with an extension and research assignment. I have been working in weed management (veggies and berries) and vegetable production at OSU for about 25 years. Prior to that I worked as an ag extension agent for 3 years in Bangladesh. Vegetable crops that get most of my attention now are irrigated crops grown for processing, vegetable seed crops, and some fresh market vegetables in the Willamette Valley of OR with a Mediterranean type climate and very dry summers. I also do applied research in berry and nut crops. Currently we are evaluating interseeding as a way to improve establishment and survival of cover crops in crops such as sweet corn.

Session Description:

This session will give a broad overview of factors to consider if attempting to control weeds in Vegetable crops. Topics discussed will include how weeds harm crops, the biology of weeds, how biology influences the response of weeds to different selection pressures, and finally how to control them. Control techniques discussed will be the use of stale and false seed beds, mechanical strategies, and herbicides, both organic and conventional.

Protecting you crops from their wild relatives

*Diversifying **selection pressures** and preventing weed shifts while maintaining **selectivity***

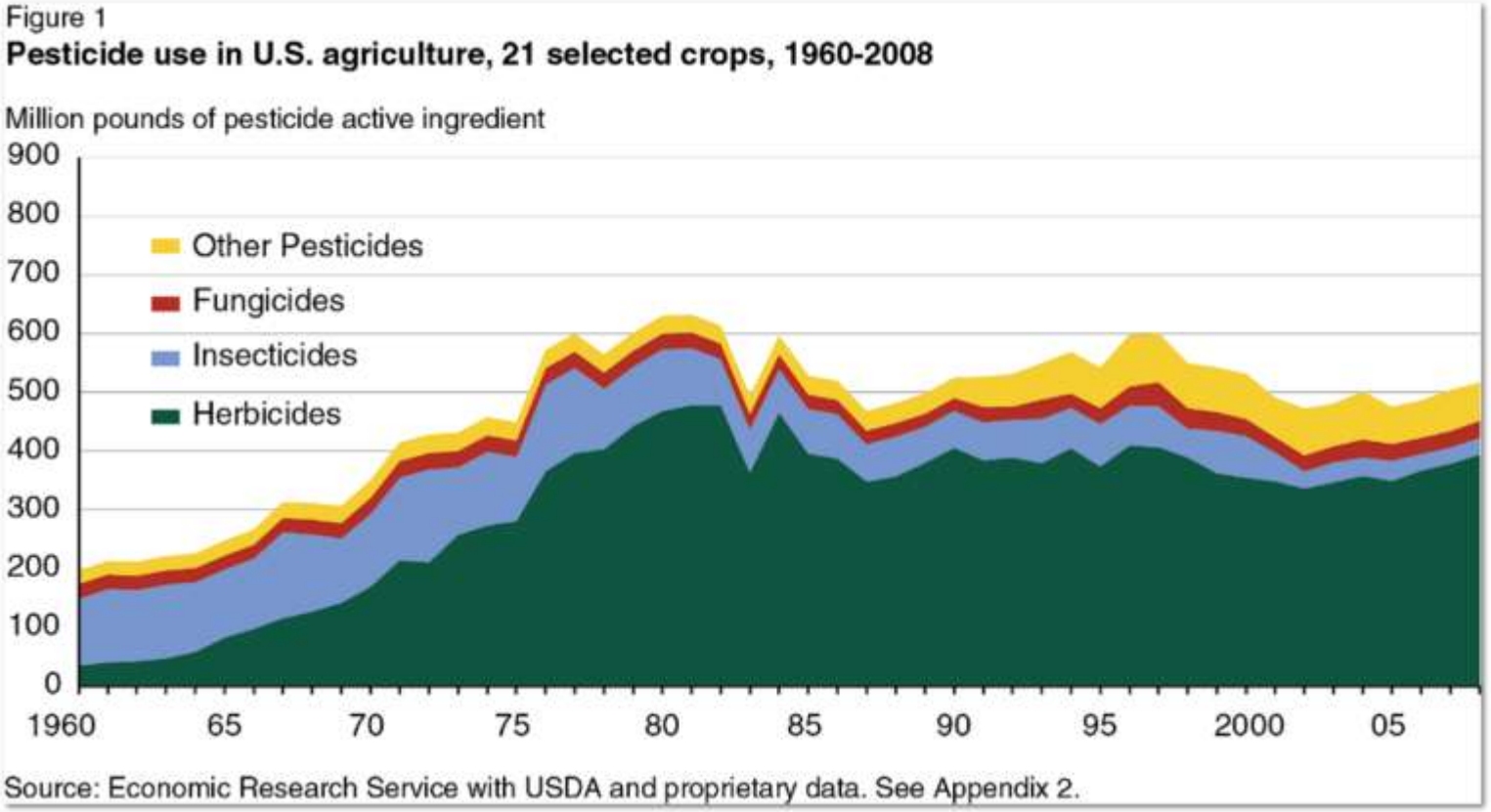
Ed Peachey
Horticulture Department
OSU

- The problem of weeds
- Rules of the game
- Weed biology and the connection to selectivity
- Tools of the trade
  - Mechanical
  - Biological
  - Herbicidal

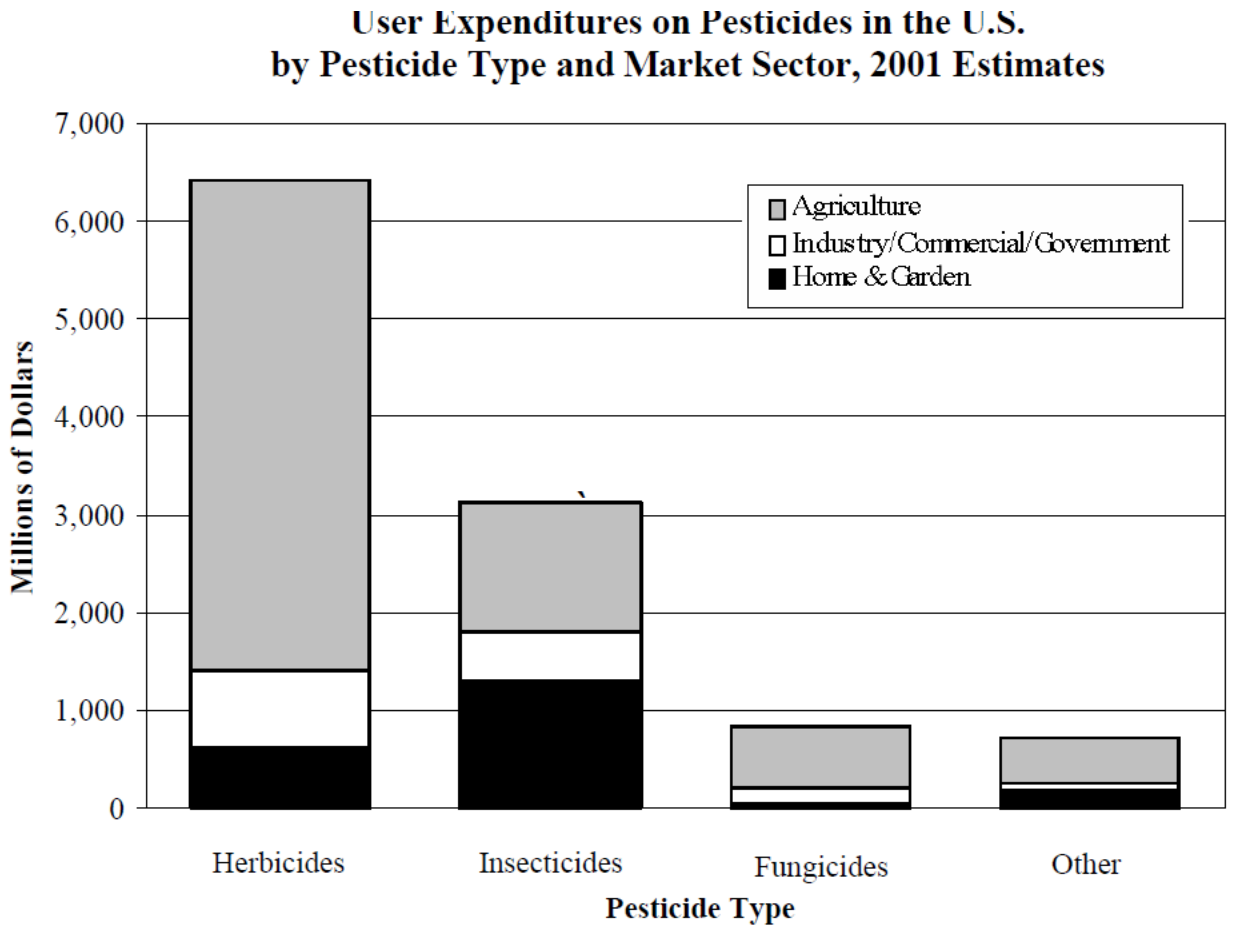
The problem with weeds

CONS AND PROS (?)

You are not alone



Pesticide expenditures in US



Weeds suck……

THE LIFE OUT OF YOUR

Compete with plants for water and nutrients

Wild proso millet in sweet corn

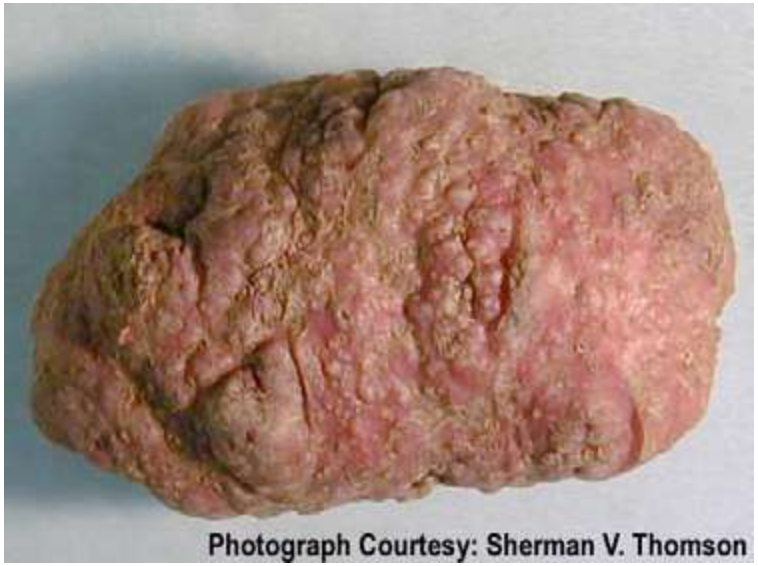
Millet going to seed in processing squash

Puncturevine contaminating snap beans

Liverwort

Weeds host other pests

- Tubers 'resistant' to Columbia root knot nematode were damaged when grown in the presence of hairy nightshade.



***Rick A. Boydston**,*
USDA, WA, 2008

Livestock Poisoning

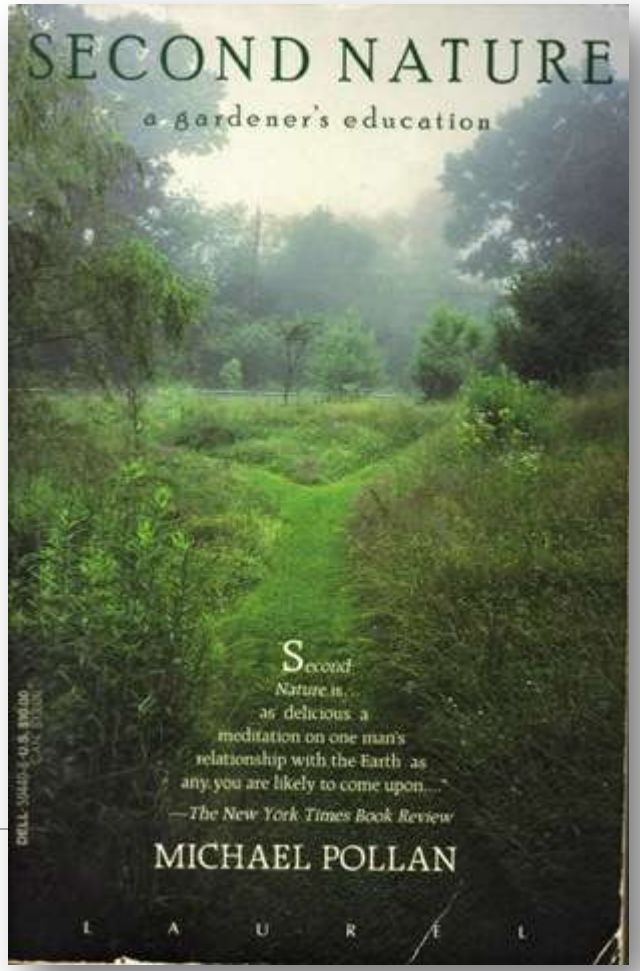
- Hay contaminated with toxic weeds
- Toxic weeds in pastures

- Allergies
- Fire hazard
- Reduced land values
  - Limit ability to get loans
  - Affect lease rates
- Lessened value of ecosystem services

The pros of weeds?

WEED OUT OF PLACE

(THOREAU, EMERSON)



Weeds R Us

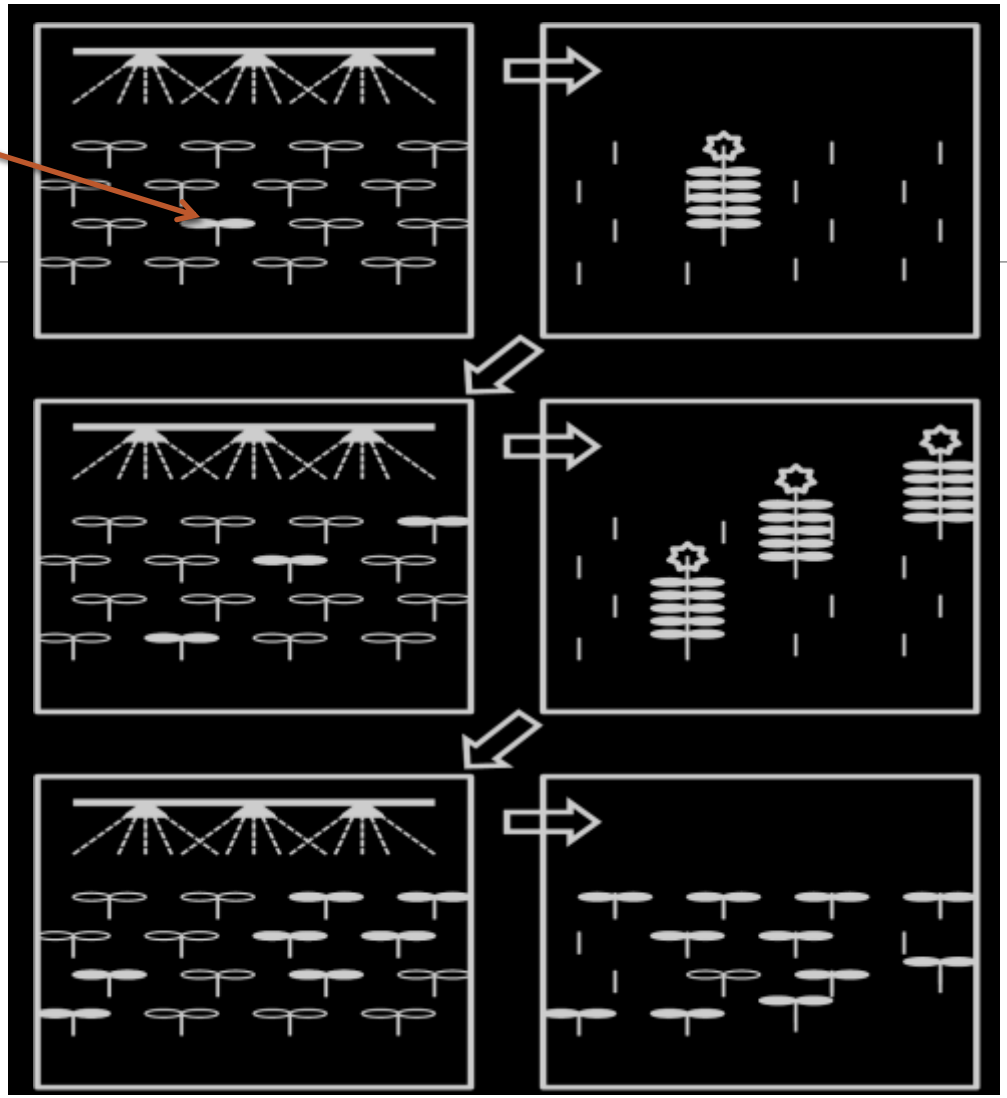
POLLAN'S EVOLUTION IN THOUGHT

Rules of the Game

ALL ABOUT SELECTIVITY

KILLING WEEDS AND NOT YOUR CROP

A few weeds of one species survive



UC Davis, Weed Science

Selectivity, Selection Pressure and Weed Shifts

Weed Shifts: Cost of reduced tillage

Weed shifts: Permanent Ag = perennial weeds

A weed shift in row crops (98% black nightshade)

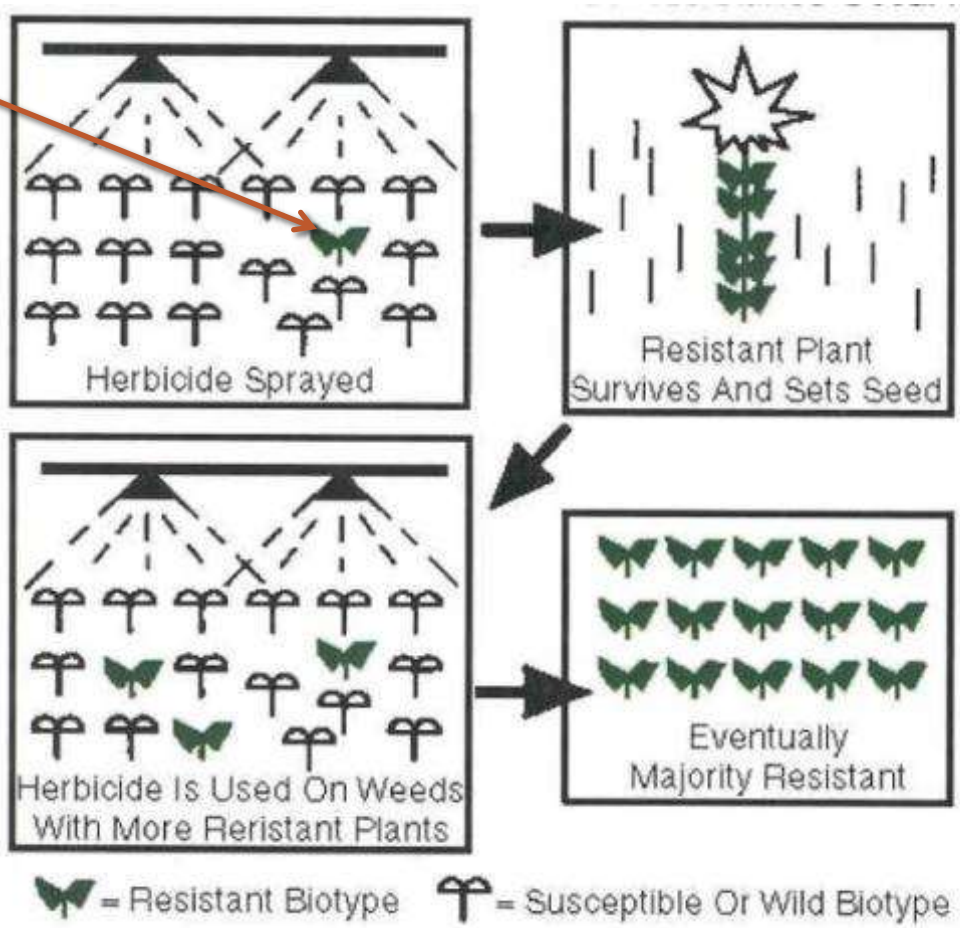
Monolithic use of one herbicide mode of action

Herbicide selectivity in table beets

A unique individual of one species survives

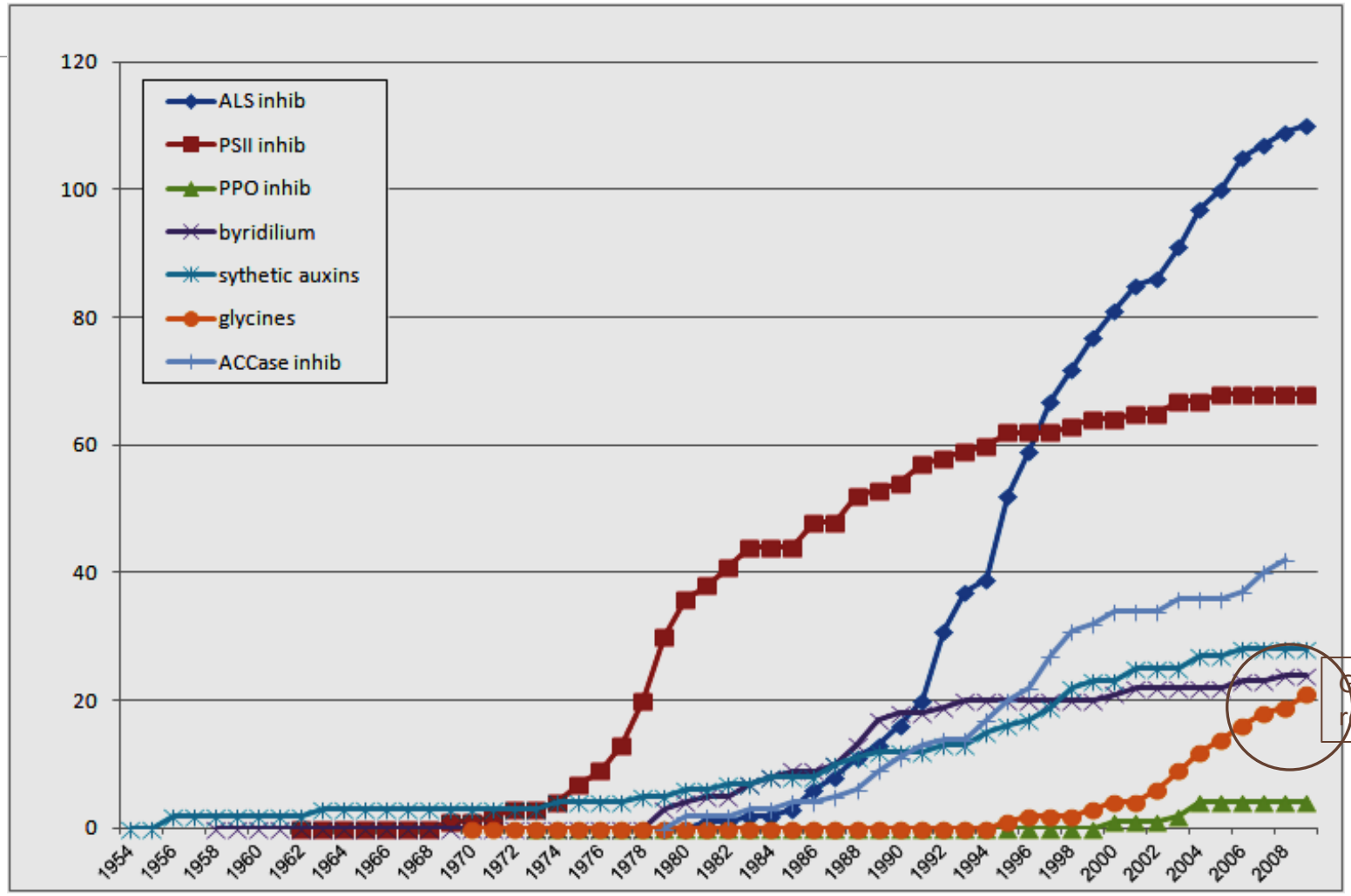
Selection Pressure *and*

Herbicide Resistance



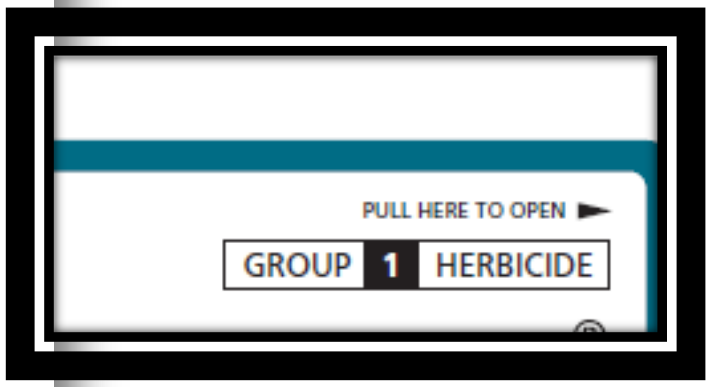
UC Davis, Weed Science

Herbicide Resistance Worldwide



Adapted from
www.weedscience.org

Diversify herbicide use



Weed biology:

THE BASIS FOR SELECTIVE REMOVAL FROM CROPS

Weed ID

- KNOW AND UNDERSTAND THE FOE
- THIS IS THE LINK TO SUCCESSFUL SELECTIVITY

Weed biology

Perennial vs annual

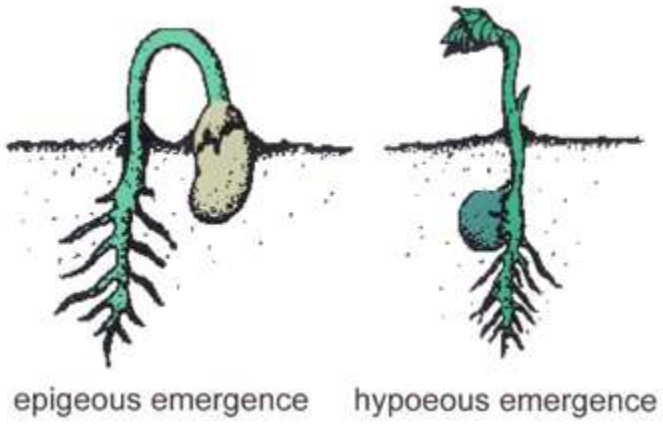
Spring vs summer

Deep rooted vs shallow rooted

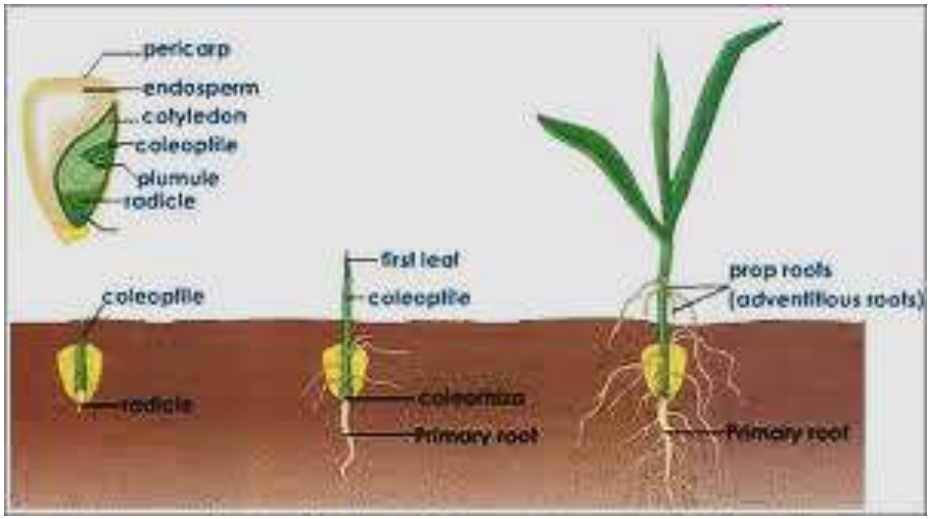
Lots of seeds vs few seeds

Example: flaming to kill weeds

BROADLEAF WEED



GRASS WEED



Barnyardgrass in rice

Rice and barnyardgrass are vegetatively similar in rice growing areas

BYG introduced into rice fields during transplanting?

Crop mimicry (Vavilovian mimicry)

Normal barnyardgrass

Rice seedlings

Tools of the trade

STRATEGIES TO MANAGE WEEDS

I. Prevention

II. Cultural

STALE SEEDBEDS

IRRIGATION: DRIP VS. OVERHEAD

FERTILIZATION

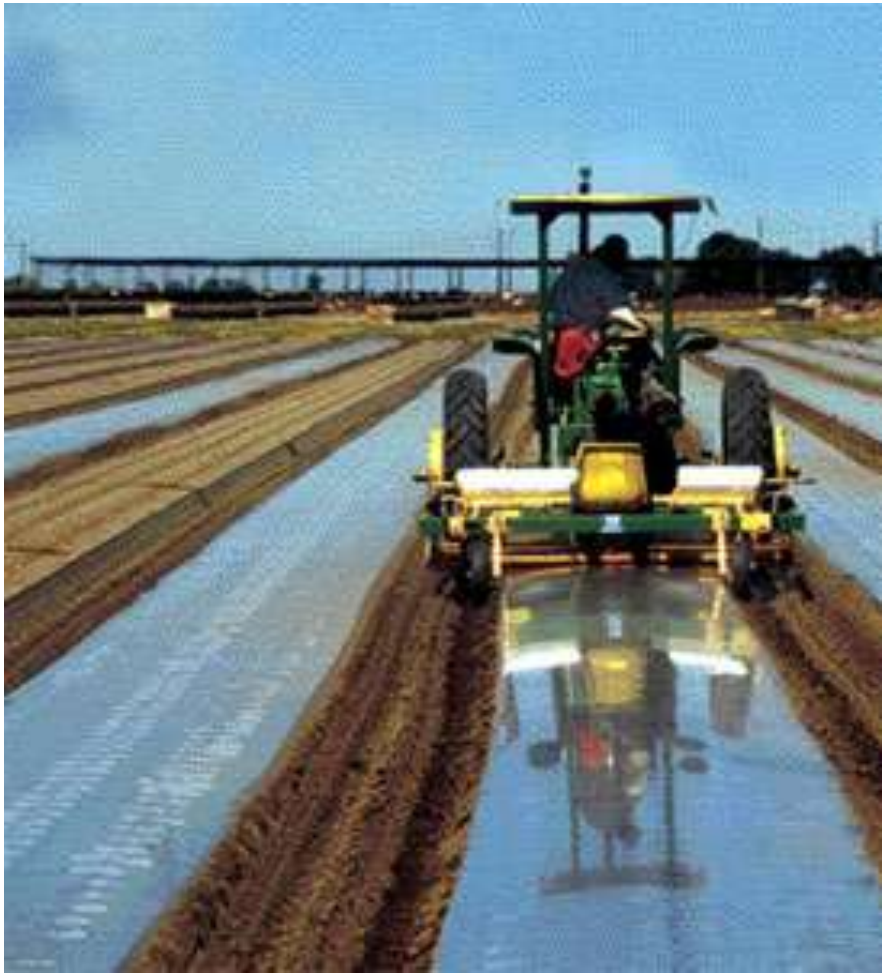
Diversifying selection pressure with Crop rotations

Winter vs Summer
Irrigated vs non-irrigated
Brassica vs Cucurbit
Monocot vs Dicot

Mulches for Weed Control

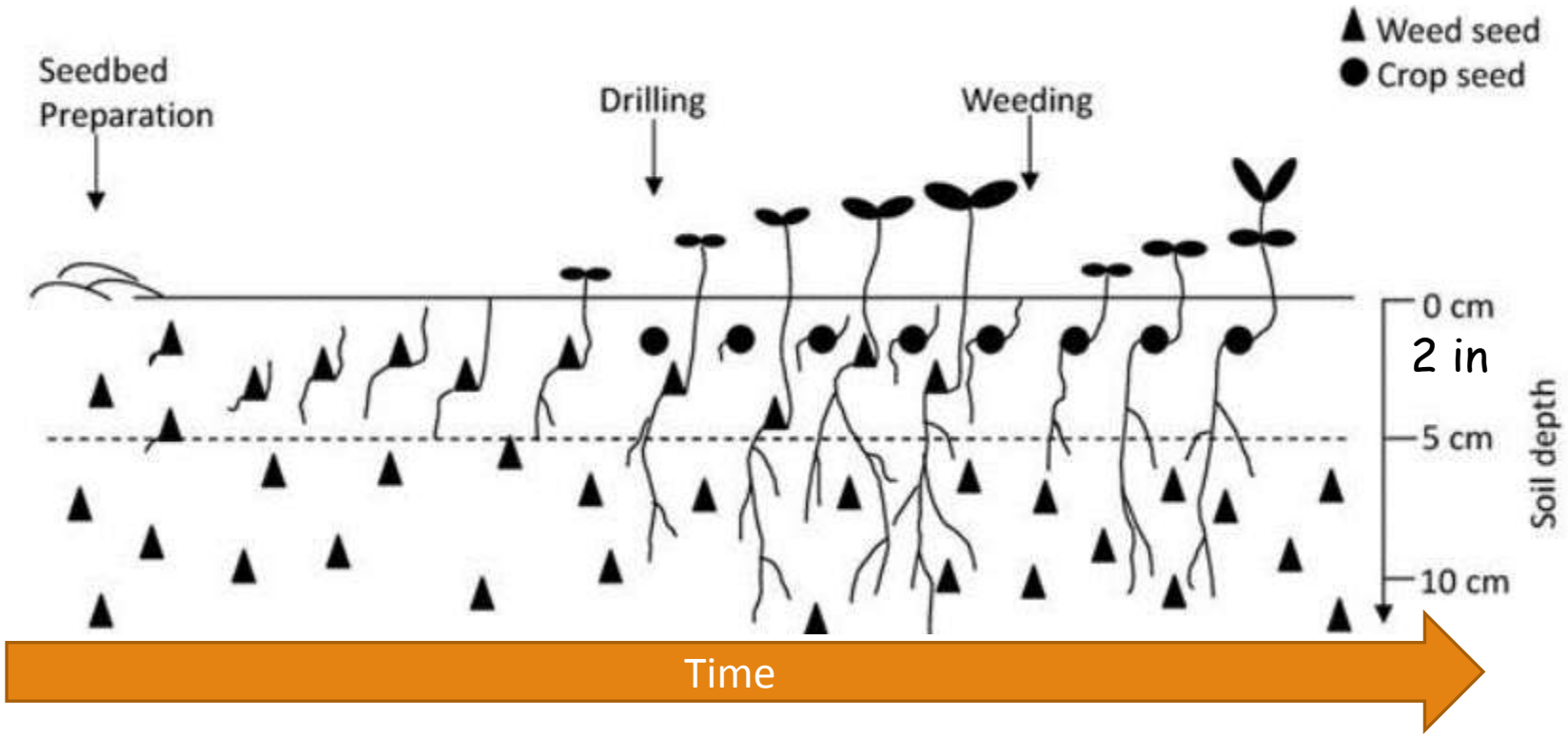
Solarization

- 6 weeks of midsummer solarization
- 95% control of annual bluegrass to 2 inch depth.



Stale seedbeds

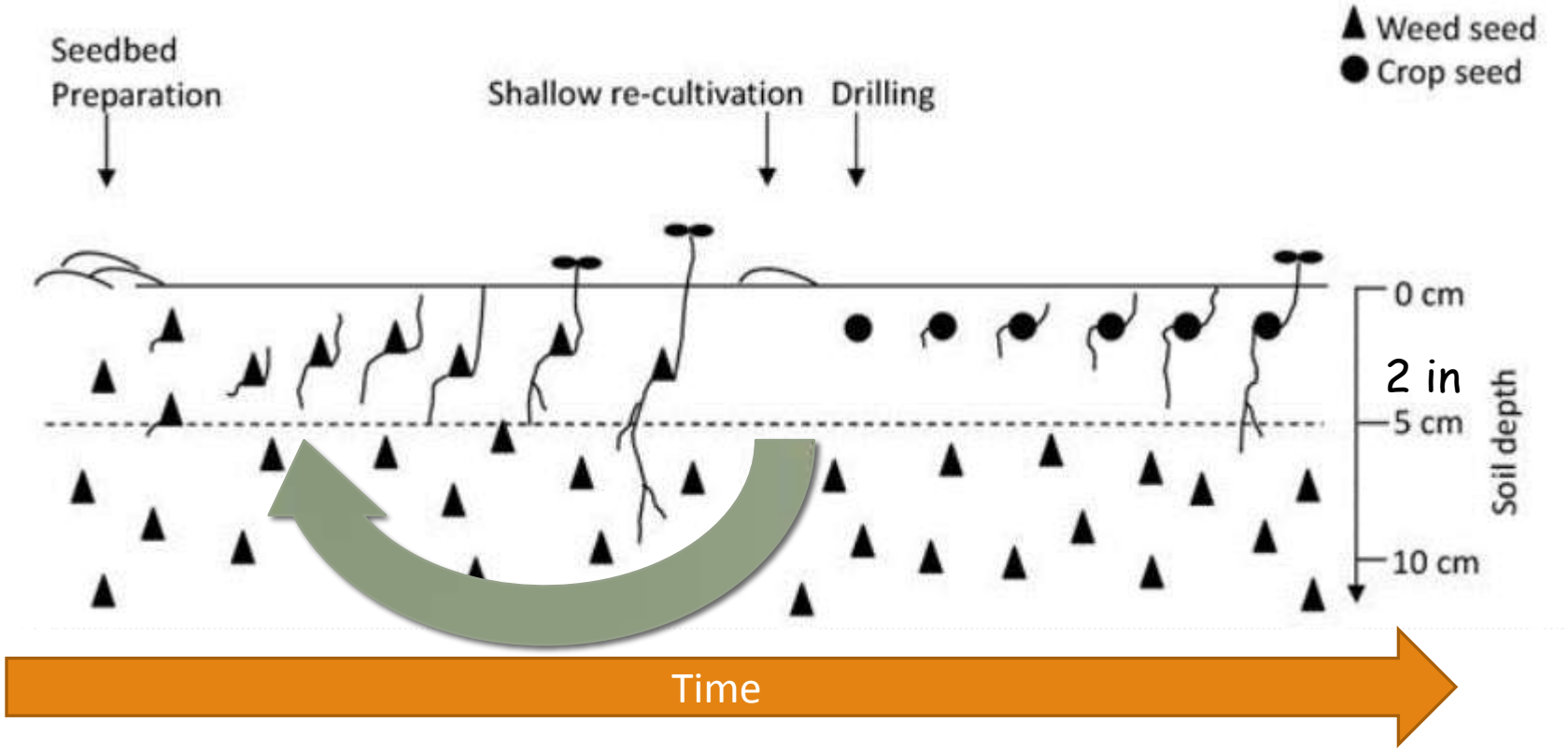
Remove weeds with flaming, herbicides or cultivation



Used by permission, Merfield 2012

False seedbeds

Cultivation, flaming, herbicides



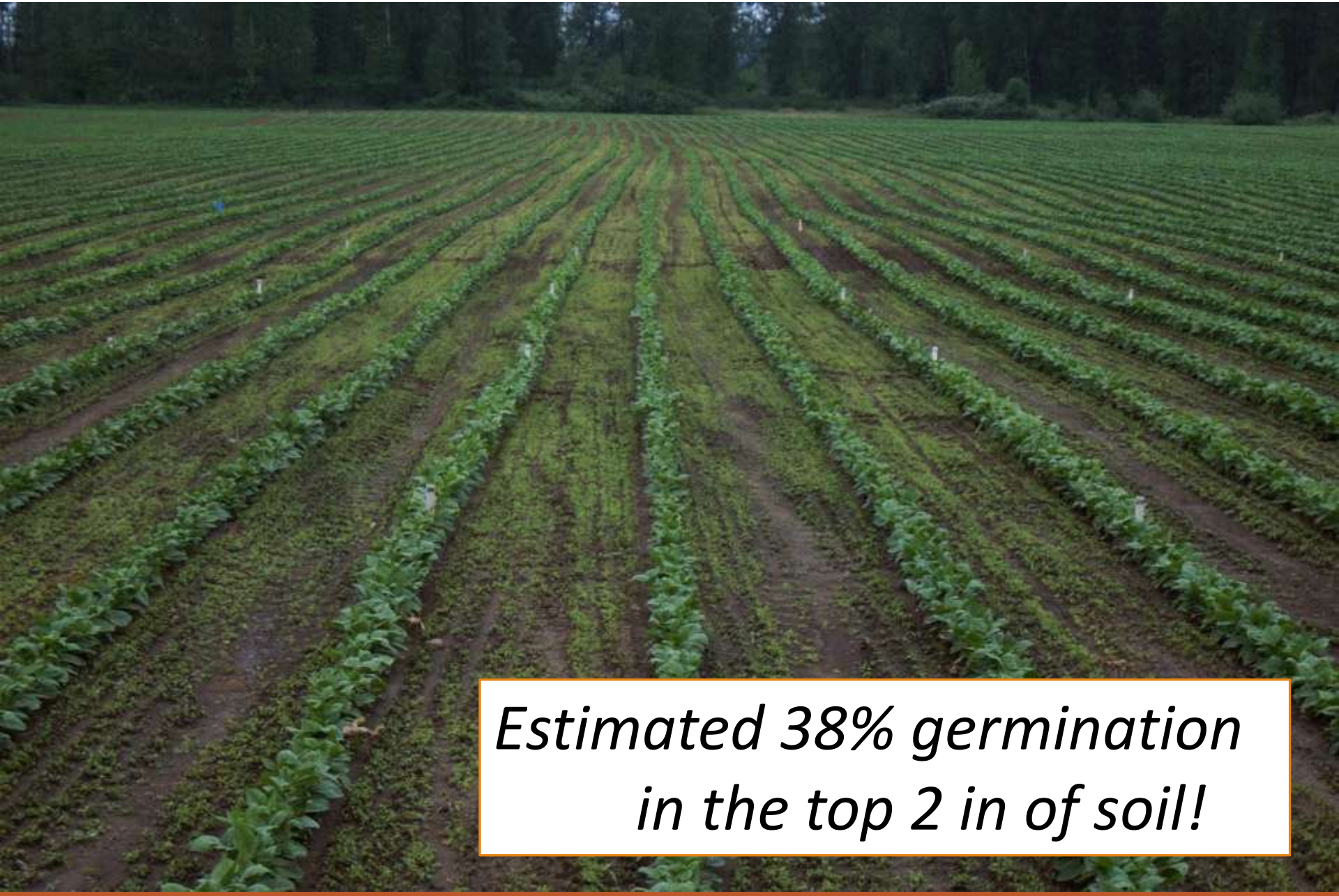
Used by permission, Merfield 2012

Why false/stale seedbeds work

1. Most weed seeds are dormant

Only 5 to 10 % germinate at a time

Estimated 38% germination in the top 2 in of soil!


Estimated 38% germination
in the top 2 in of soil!

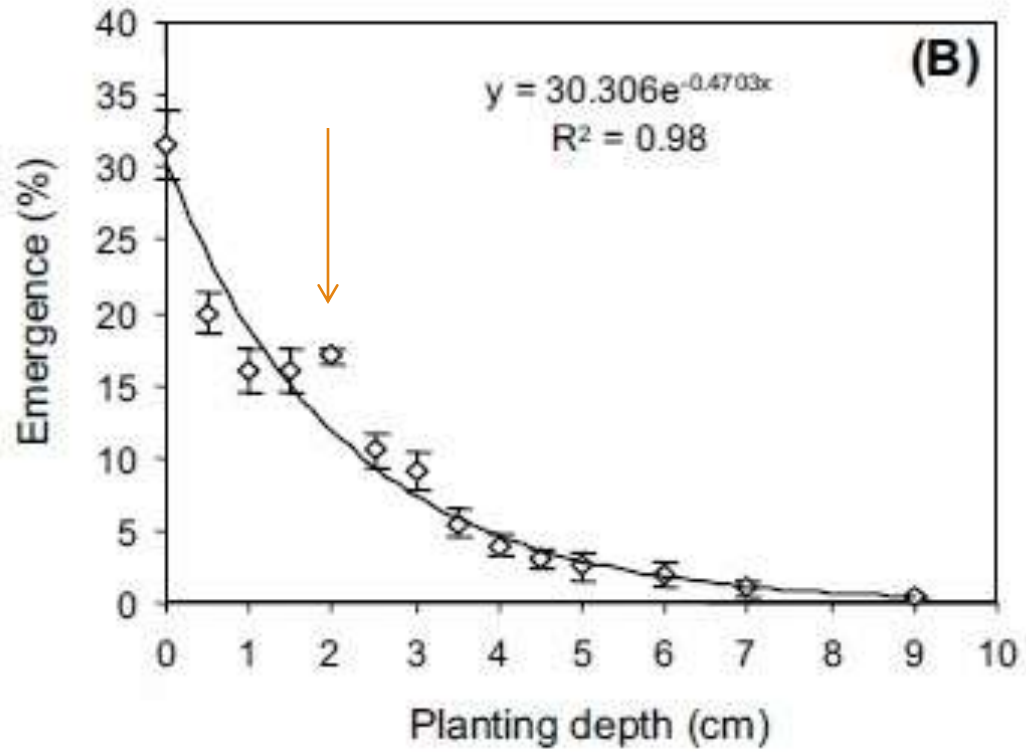
Why false/stale seedbeds work

2. Tillage is the most effective means of germinating weed seeds

Why false/stale seedbeds work

3. Most weeds only emerge from the top ¾ in of soil.

Barnyardgrass (Sadeghloo etal 2013)



The downside

- Springtime weather and soil temperatures
- Weed shifts
  - Grasses flourish
  - Growing point on grasses is below ground
  - On broadleaves it is above ground

III. Mechanical

Weed Em and Reap

ALEX STONE, OREGON STATE HORTICULTURE

Manual Cultivators

(From Univ. of Maine Weed Ecology Group)

Wheel Hoes

Patented: Merfield, NZ

Precision cultivation with Bezzerides spyders

Tine weeders

http://www.garford.com/products_robocropinrow.html

Rotary Hoe

Flame weeding

Merfield, NZ

Roller under-cutter

Rod weeder

Merfield, NZ

Flaming onions

Merfield, Lincoln Univ., NZ

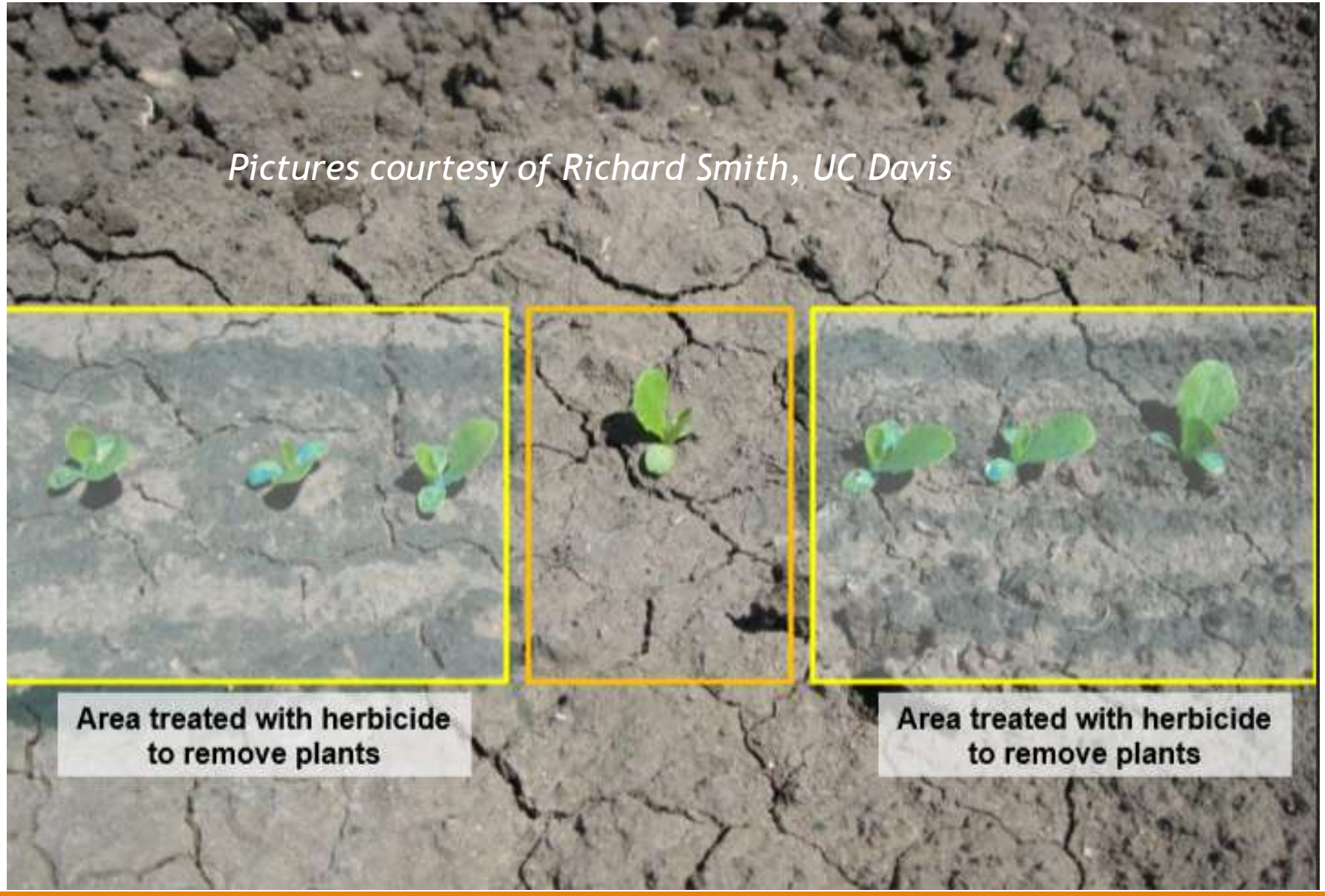
Row flamer

The Bourquin Organic Weed Puller

https://www.youtube.com/watch?v=vFjYHZIrKfY

Precision spray systems

Pictures courtesy of Richard Smith, UC Davis


Pictures courtesy of Richard Smith, UC Davis
Area treated with herbicide to remove plants
Area treated with herbicide to remove plants

Broadcast soil heating to kill weeds and pests

Band steaming in the row

2000 KW bed steamer with 13 tines

Robotics

Robotics


The IAW is a four-wheel steered and
four-wheel driven autonomous platform
WAGENINGEN UNIVERSITY
WAGENINGEN UR
TYKER TECHNOLOGY


DeepField Robotics
a Bosch Start-up
BOSCH

Robotic Steamer

Biological

CLASSICAL BIOLOGICAL CONTROL

USING BIOLOGY TO DESTROY WEED SEEDS

Geese controlling weeds in an Australian Orchard

Hogs have been used to control perennial weeds such as nutsedge on fallow ground

Biological controls: Field Bindweed

Attacking the weed seed bank

- Weed seed placement
  - Keep on surface (shorter lived)
  - Bury deep (live longer)
- Encourage Predation
  - carabid beetles, mice, birds
- Encourage germination
  - Stale and False seedbeds

Weed Seed Predation

Carabid beetles eating wild proso millet seed

Pterostichus melanarius

Pterostichus melanarius

Ground beetle (carabid)

Generalist predator

Improving habitat does not always mean more seed predation

Conservation tillage

More to eat, and weed seeds may not be a preferred menu item

Herbicidal

Herbicidal Weed Control

Application of chemical agents that kill plants

- Organic and conventional
- All ‘shapes’/‘sizes’

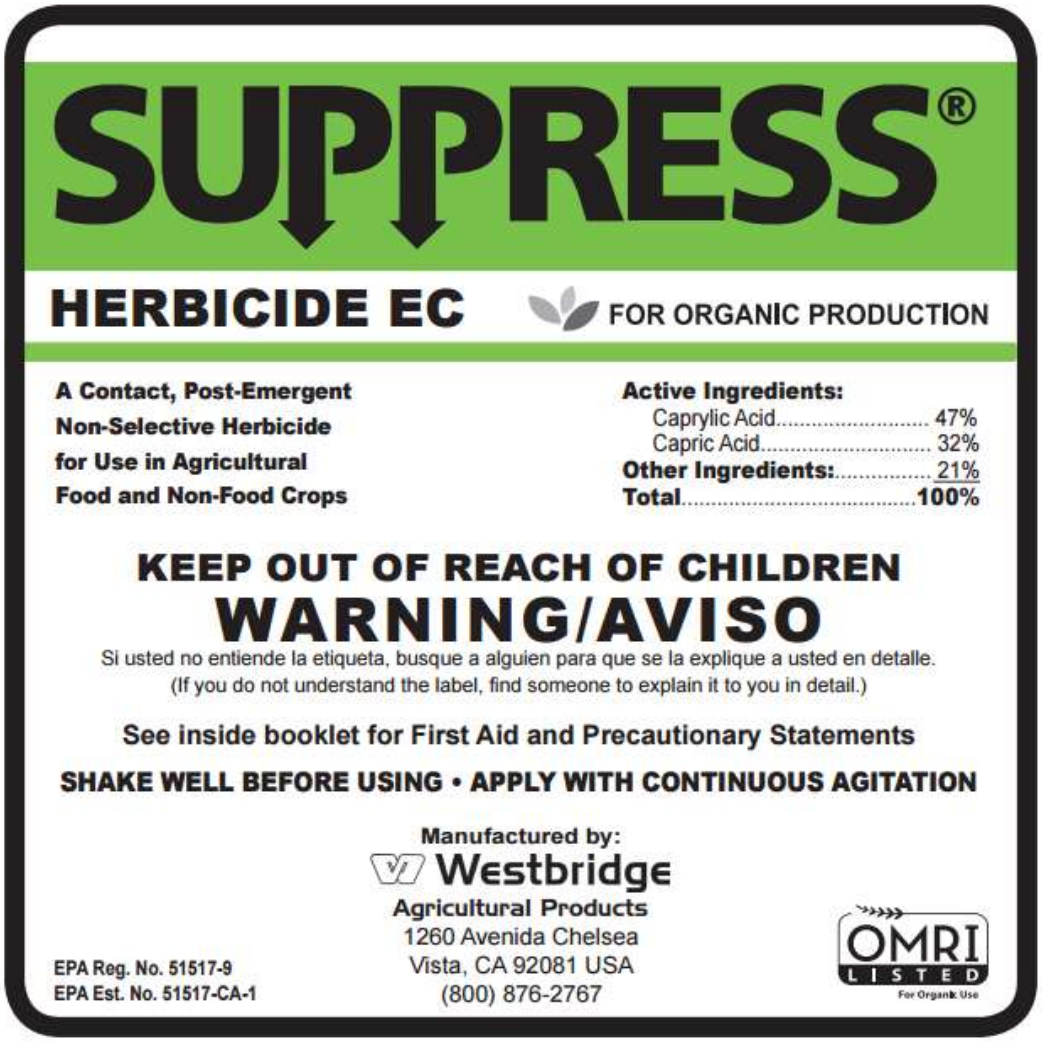
Requires:

- Precise calculation
- Suitable equipment
- Careful application

Foliar- Contact vs Foliar-Translocated vs Soil Active

Foliar applied, contact

Organic Contact Herbicides



SUPPRESS®

HERBICIDE EC

FOR ORGANIC PRODUCTION

A Contact, Post-Emergent
Non-Selective Herbicide
for Use in Agricultural
Food and Non-Food Crops

Active Ingredients:
Caprylic Acid..... 47%
Capric Acid..... 32%
Other Ingredients:..... 21%
Total.....**100%**

KEEP OUT OF REACH OF CHILDREN

WARNING/AVISO

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle.
(If you do not understand the label, find someone to explain it to you in detail.)

See inside booklet for First Aid and Precautionary Statements

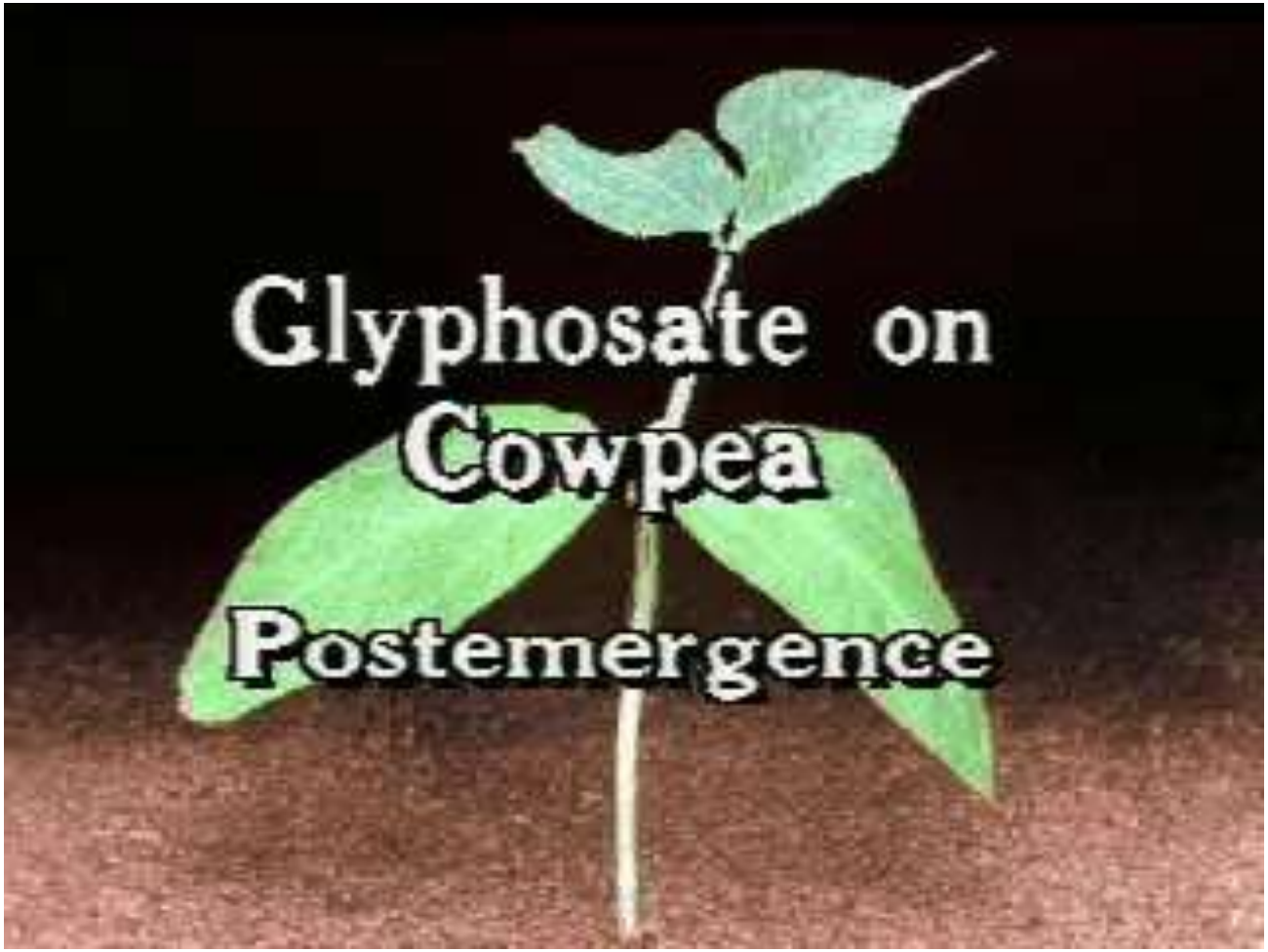
SHAKE WELL BEFORE USING • APPLY WITH CONTINUOUS AGITATION

Manufactured by:
Westbridge
Agricultural Products
1260 Avenida Chelsea
Vista, CA 92081 USA
(800) 876-2767

EPA Reg. No. 51517-9
EPA Est. No. 51517-CA-1

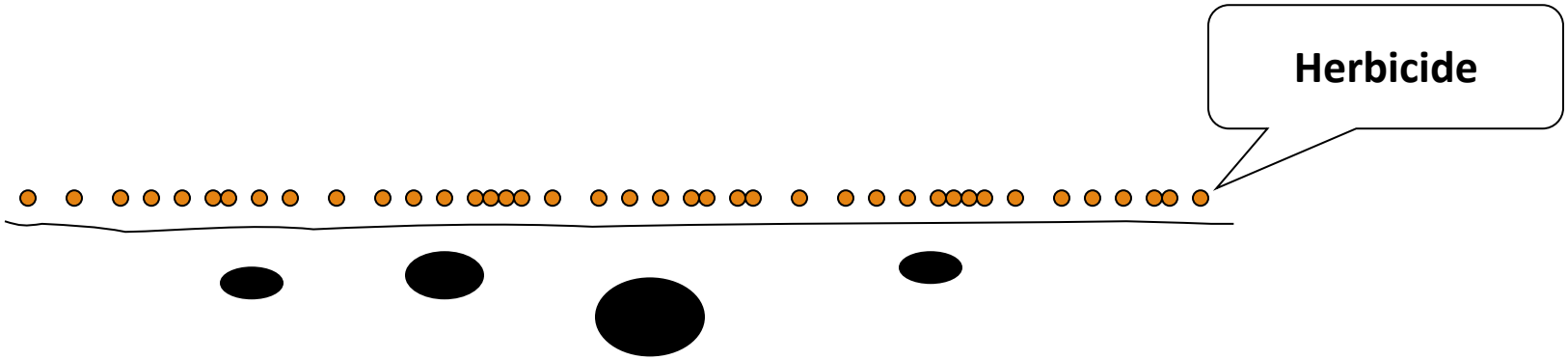
OMRI LISTED
For Organic Use

Roundup, Foliar translocated

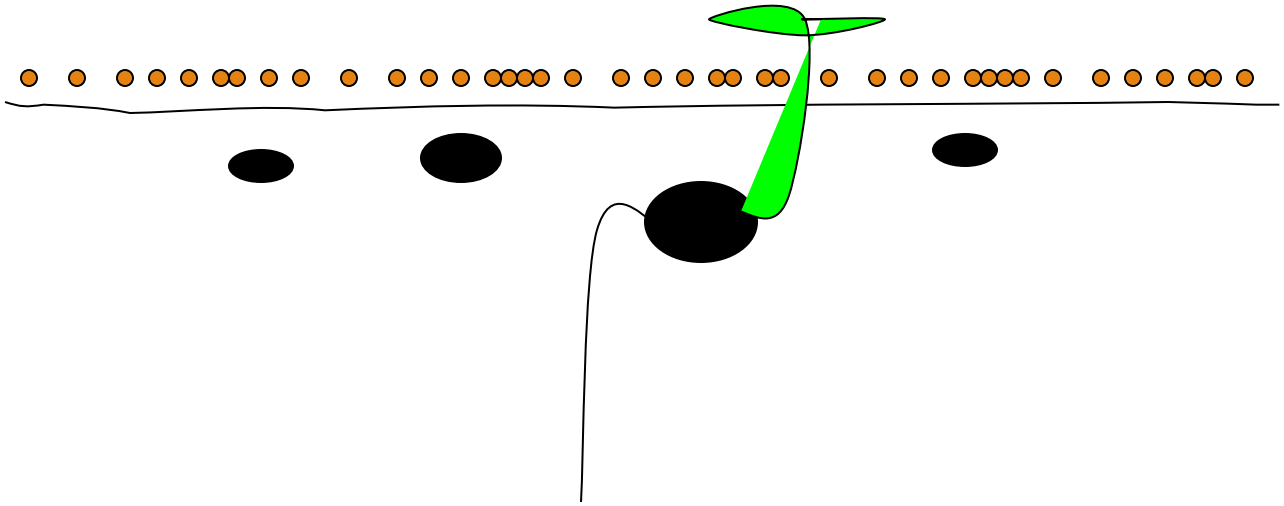


Soil active herbicides

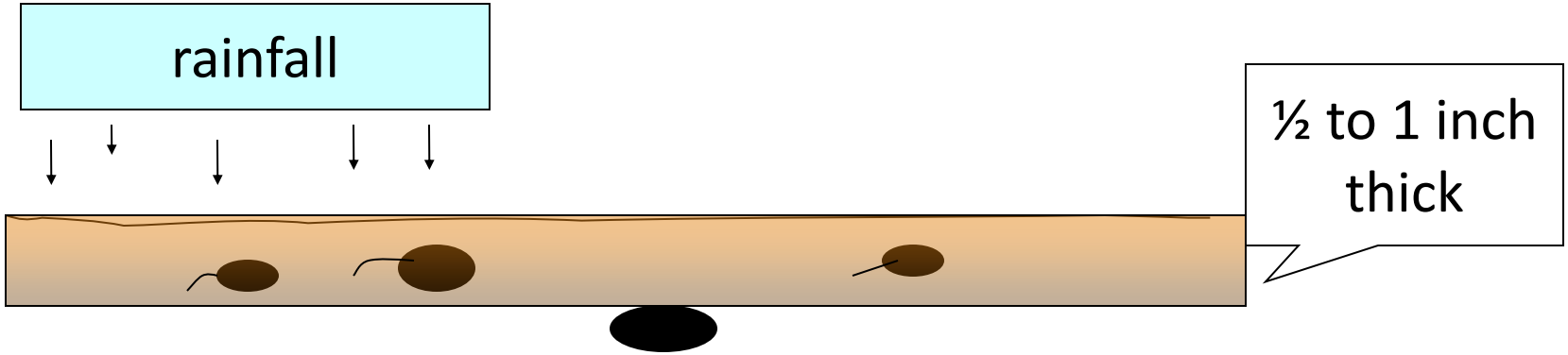
Establishing an herbicide barrier



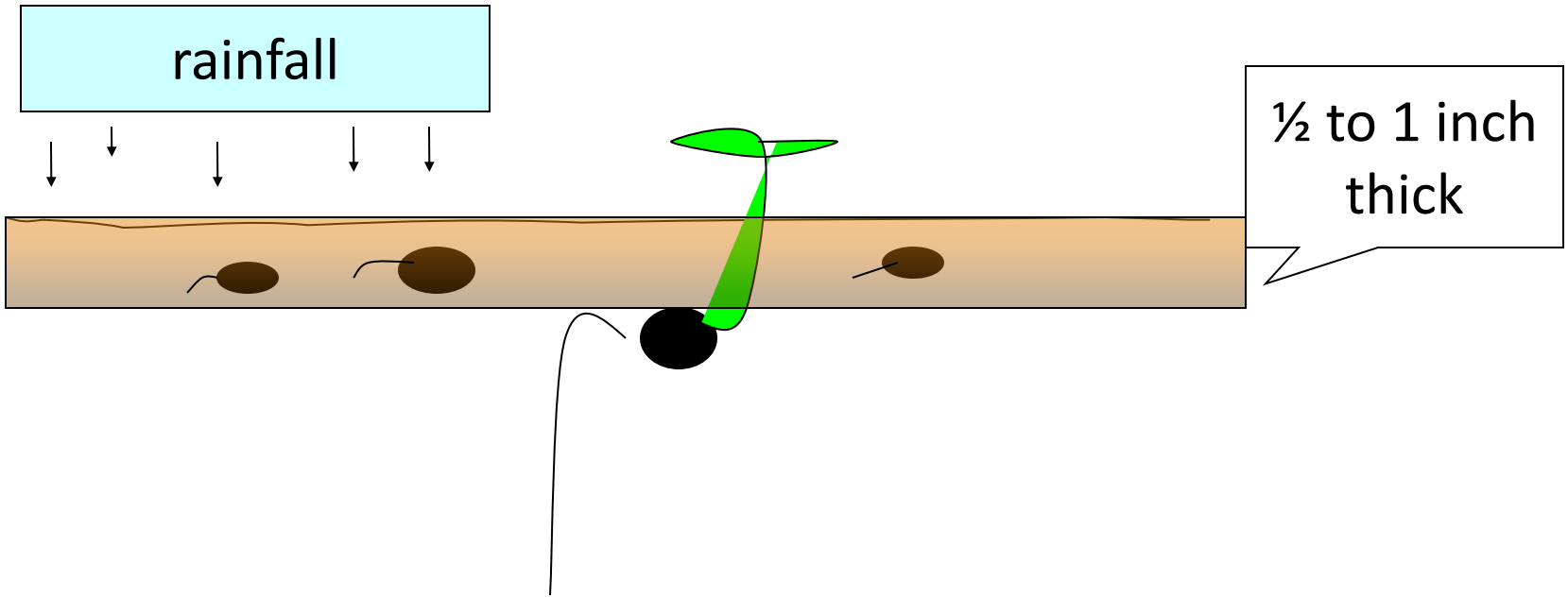
Establishing an herbicide barrier



Establishing an herbicide barrier



Establishing an herbicide barrier



- The problem of weeds
- Rules of the game
- Weed biology and the connection to selectivity
- Tools of the trade
  - Mechanical
  - Biological
  - Herbicidal

Additional reference

Mohler, Cornell
Weed em and Reap, Stone
E-organic


Questions?
Fertilizer art in agriculture

- Back to Top -

USDA – NRCS Program Basics Targeted to the International Rescue Committee

Biographical Information:
Danny McBride
USDA- Natural Resource Conservation Service

I am an Area Resource Conservationist for the NRCS. I have worked with NRCS for the past 8years and worked with the Utah Association of Conservation Districts before that. I work closely with farmers and ranchers helping them put conservation on the ground. I focus on agronomic principles; Nutrient and Manure Management, Irrigation, Soil Health, Cover Crops, Pest management, and grazing. I grew up on farm in Southern Idaho and graduated from Utah State University with a degree in soil and water science. I love agriculture and enjoy spending time with my beautiful wife and 3 kids.

Session Description:

This session will cover the basics of the United States Department of Agriculture – Natural Resource Conservation Service. It will explain what technical assistance and financial assistance is available for those involved with the New Roots Program – IRC. We will review some of the basic projects and practices that we can help educate and financially assist with when those that graduate from the New Roots program are ready to look for their own property to buy or lease.

Urban and Small Farms Conference

February 18, 2016

Conservation Planning &
USDA Farm Bill Programs

Danny McBride
NRCS North Area Resource Conservationist &
Civil Rights Committee Chair

NRCS Background and Purpose

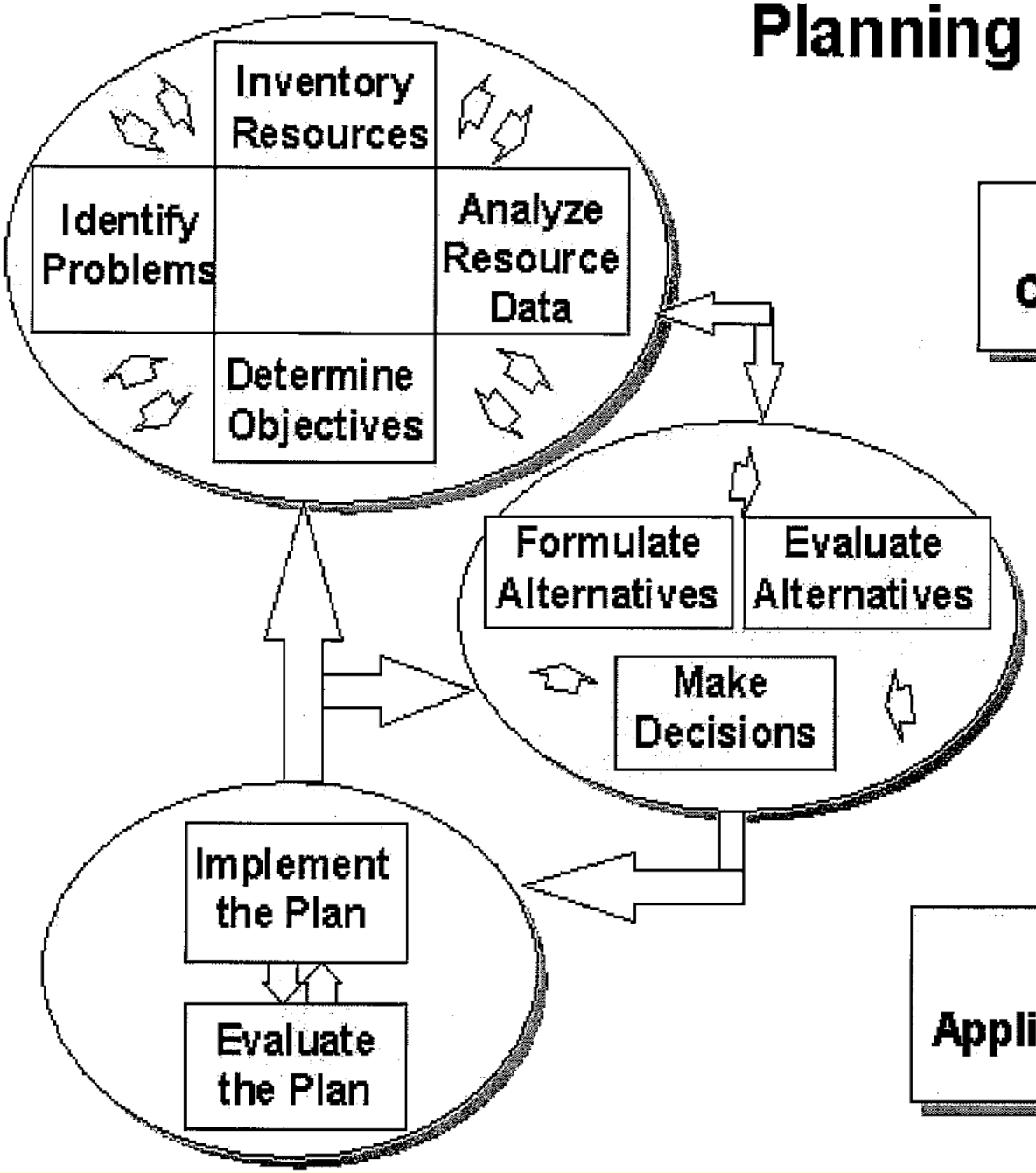
Conservation Plan

What is it?

Who needs one?

EVERYONE!

Planning Process



I.
Collection & Analysis

II.
Decision Support

III.
Application & Evaluation

Components of the Plan

- Soils
- Water
- Air
- Plants
- Animals
- Energy
- Human Interaction

Sustainable & Productive Soils

Quality (Erosion, Nutrients, Contaminants)

Clean & Abundant Water

Quality (Nutrients, Pathogens, Petroleums, Salinity)
Quantity (Irrigation, Drought, Water Flow)

Air

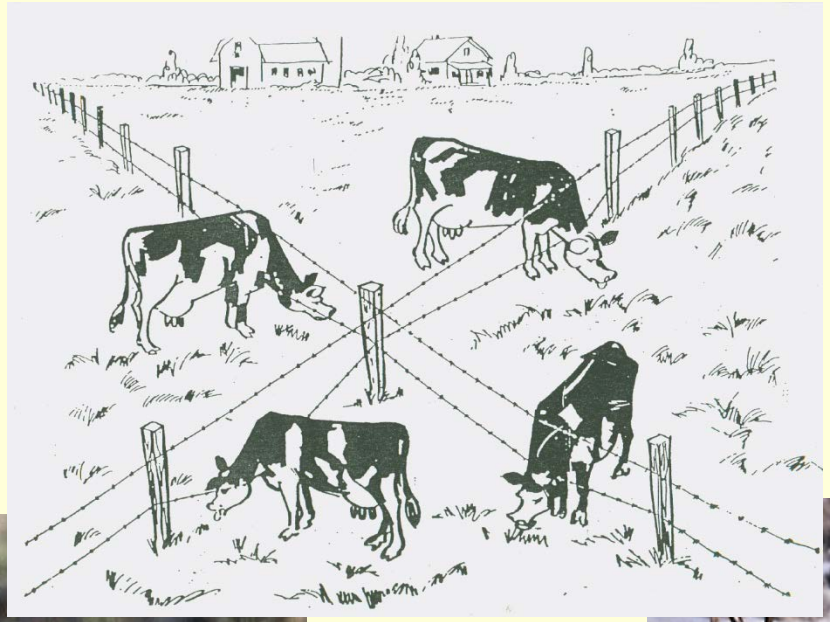
Quality (Odor, Particulate Matter, Reduced Visibility)

Plants

Condition (Invasive Weeds, Wildfire, T&E Species)

Animals

Wildlife (Habitat, Food, Cover, Shelter)
Domestic (Water, Forage Quality, Grazing, Manure Management)



Adequate Energy Supply

Fuel, Alternative, Power

Human

Economics, Sustainability, Cultural Resources, Traditions

NRCS Programs

NRCS's natural resources conservation programs help people reduce soil erosion, enhance water supplies, improve water quality, increase wildlife habitat, and reduce damages caused by floods and other natural disasters. Public benefits include enhanced natural resources that help sustain agricultural productivity and environmental quality while supporting continued economic development, recreation, and scenic beauty.

- Environmental Quality Incentives Program (EQIP)
  - General (Irr. Cropland, Dry Cropland, Range, Pasture, Forestry, Riparian, AFO/CAFO)
  - Initiatives (High Tunnels, Sage Grouse, Salinity, Wildlife, Drought, Energy, Organics)
- Agricultural Management Assistance Program (AMA)
- Conservation Stewardship Program (CSP)
- Agricultural Conservation Easement Program (ACEP)
  - Agricultural Land Easement (ALE)
  - Agricultural Land Easement Grasslands (ALE-GSS)
  - Wetland Reserve Easement (WRE)

Composting Facility
Code 317

DEFINITION:
A facility to process raw manure or other raw organic by-products into biologically stable organic material.

Cover Crop
Code 340

DEFINITION :

Grasses, legumes, forbs, or other herbaceous plants established for seasonal cover and conservation purposes.

Fence
Code 382

DEFINITION:
Enclosing or dividing an area of land with a suitable permanent structure that acts as a barrier to livestock, wildlife or people.

Irrigation Ditch Lining
Code 428

DEFINITION:

A lining of impervious material or chemical treatment, installed in an irrigation ditch, canal, or lateral.

Irrigation Pipeline
Code 430

DEFINITION:

A pipeline and appurtenances installed to convey water for storage or application, as part of an irrigation water system.

Irrigation System Microirrigation Code 441

DEFINITION:

An irrigation system for frequent application of small quantities of water on or below the soil surface: as drops, tiny streams or miniature spray through emitters or applicators placed along a water delivery line.

Irrigation System Sprinkler
Code 442

DEFINITION:
An irrigation system in which all necessary equipment and facilities are installed for efficiently applying water by means of nozzles operated under pressure.

Pasture and Hayland Planting Code 512

DEFINITION:
Establishing native or introduced forage species.

Pipeline
Code 516

DEFINITION:
Pipeline having an inside diameter of 8 inches or less.

Pumping Plant
Code 533

DEFINITION:

A facility that delivers water at a designed pressure and flow rate. Includes the required pump(s), associated power unit(s), plumbing, appurtenances, and may include on-site fuel or energy source(s), and protective structures.

Residue Management
Code 329

DEFINITION:

Managing the amount, orientation and distribution of crop and other plant residue on the soil surface year round while limiting soil disturbing activities to only those necessary to place nutrients, condition residue and plant crops.

Seasonal High Tunnel System for Crops
Code 798

DEFINITION:

A seasonal polyethylene covered structure with no electrical, heating, and/or mechanical ventilation systems that is used to cover crops to extend the growing season in an environmentally safe manner.

Watering Facility
Code 614

DEFINITION:

A permanent or portable device to provide an adequate amount and quality of drinking water for livestock and or wildlife.

Conservation Crop Rotation Code 328

DEFINITION

Growing crops in a recurring sequence on the same field.

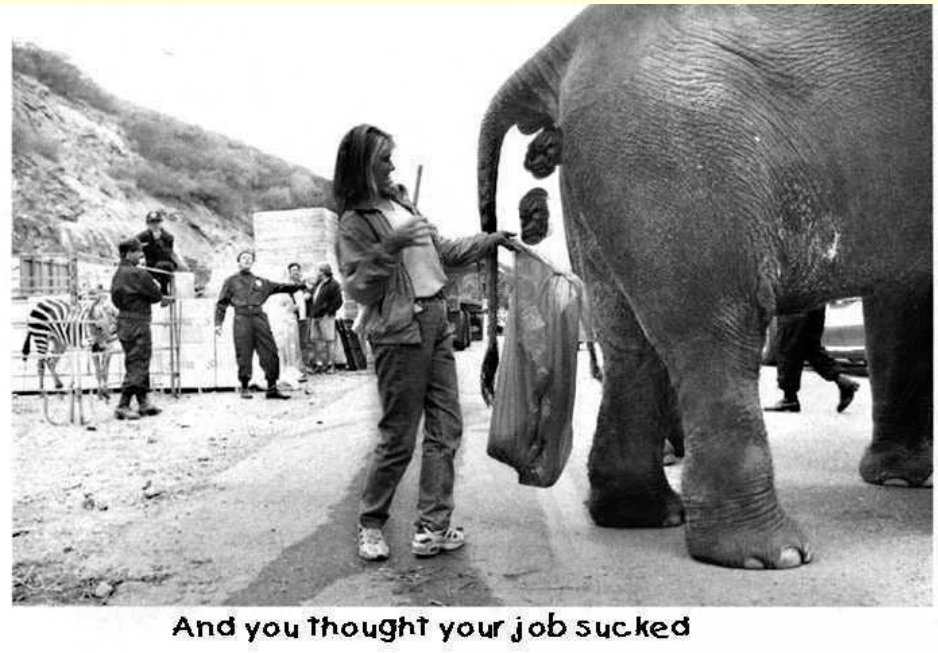
Irrigation Water Management
Code 449

DEFINITION

The process of determining and controlling the volume, frequency and application rate of irrigation water in a planned, efficient manner.

Nutrient Management
Code 590

DEFINITION:
Managing the amount, source, placement, form and timing of the application of plant nutrients and soil amendments.

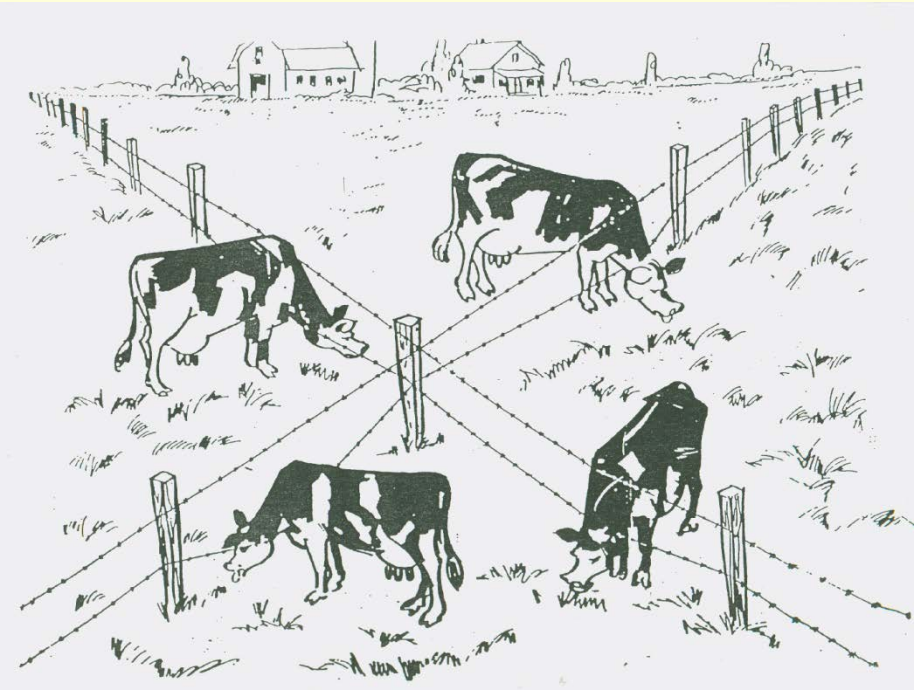


Pest Management
Code 595

DEFINITION:
Utilizing environmentally sensitive prevention, avoidance, monitoring and suppression strategies, to manage weeds, insects, diseases, animals and other organisms (including invasive and noninvasive species), that directly or indirectly cause damage or annoyance.

Prescribed Grazing
Code 528

DEFINITION:
Managing the harvest of vegetation with grazing and/or browsing animals.



Forage Harvest Management
Code 511

DEFINITION:
The timely cutting and removal of forages from the field as hay, green-chop, or ensilage.

Upland Wildlife Habitat Management Code 645

DEFINITION:
Provide and manage upland habitats and connectivity within the landscape for wildlife.

Utah NRCS Civil Rights Committee

- 2014 – Working on a Beginning Farmer Focus Report on Transitioning into Agriculture http://www.nrcs.usda.gov/wps/portal/nrcs/main/ut/about/outreach/slbfr/
- Provide NRCS staff with information and resources to help with outreach
- Provide New and Beginning Farmers with resources on a variety of subjects; land, machinery, loans, grants, BF groups and associations, etc.

New USDA Beginning Farmer Website

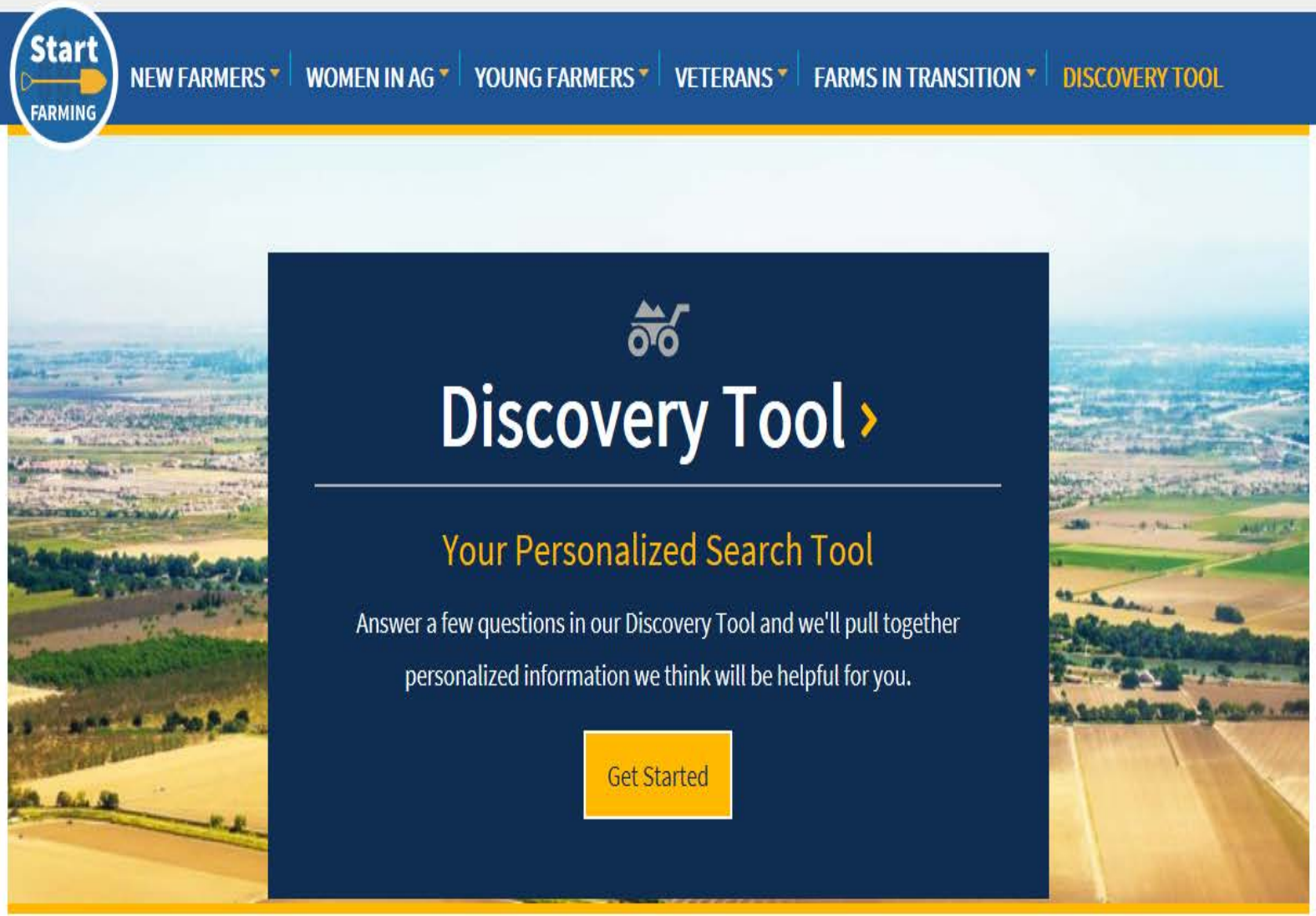
- https://newfarmers.usda.gov/

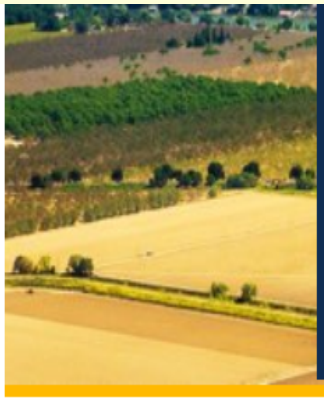
New Farmers

Discover it here.

Agriculture is full of exciting and rewarding opportunities. Farming is a tough job, but at the heart of it all, you'll see a vibrant community contributing to the future of our nation's health and food security.

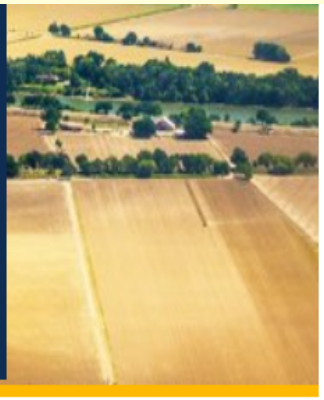
Find the resources you need to get started or personalize your search with our Discovery Tool.


Start FARMING
NEW FARMERS
WOMEN IN AG
YOUNG FARMERS
VETERANS
FARMS IN TRANSITION
DISCOVERY TOOL
Discovery Tool ›
Your Personalized Search Tool
Answer a few questions in our Discovery Tool and we'll pull together personalized information we think will be helpful for you.
Get Started



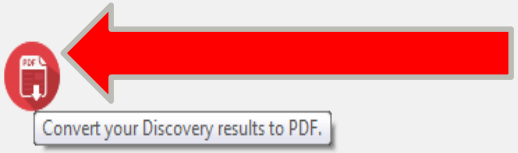
Answer a few questions in our Discovery Tool and we'll pull together personalized information we think will be helpful for you.

Start Over



Results

Disclaimer: This customized information is not intended to be comprehensive of all USDA can offer a new and beginning farmer; it is merely a guide to help focus your initial review of resources. We encourage new farmers and ranchers to come to a USDA office near you to learn more.



Utah

Utah State University, Extension

The Cooperative Extension System, in partnership with NIFA, is a nationwide, non-credit educational network that addresses public needs by providing non-formal higher education and learning activities to farmers, ranchers, communities, youth, and families throughout the nation

The End

Natural Resource Conservation Service

Danny McBride – Area Resource Conservationist &
Civil Rights Committee Chair

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FSA Program Basics

Biographical Information:
Roberta Wheeler
Farm Service Agency

I am a Farm Loan Specialist for the Farm Service Agency. I help the county offices do their job of servicing the farming and ranching communities of Utah. FSA, in Utah, loans in the neighborhood of $60 million annually. The people who are financed by FSA are the ones that are not eligible for financing from the local lending institutions, usually because they are just beginning or have suffered a setback in their operations. I have been with the agency for 26years in Idaho, Washington, California, and now Utah for 8 years.

Session Description:
I will describe the programs that FSA provides, loans, NAP(a type of crop insurance)

FARM LOANS

UNITED STATES DEPARTMENT OF AGRICULTURE
FARM SERVICE AGENCY

2014 FARM BILL
FACT SHEET

November 2014

Farm Loan Information Chart

The following chart summarizes FSA farm loan information. Additional details are available at local FSA offices and on FSA's website: www.fsa.usda.gov.

Program	Maximum Loan Amount	Rates and Terms	Use of Proceeds
Direct Farm Ownership (FO)	$300,000	• Rate based on agency borrowing costs • Term up to 40 years	• Purchase farm • Construct buildings or other capital improvements • Soil and water conservation • Pay closing costs
Direct Farm Ownership (FO) Participation	$300,000	• Rate is direct FO rate less 2% with a floor of 2.5% if at least 50% of loan amount provided by other lender • Term up to 40 years	Same as Direct FO
Direct Down Payment Farm Ownership Program	The lesser of: • 45% of the purchase price, • 45% of the appraised value, • $300,000	• Rate is direct FO rate less 4% with a floor of 1.5% • Term of 20 years • Down payment of at least 5%	• Purchase of farm by a beginning or socially disadvantaged farmer
Direct Operating (OL)	$300,000	• Rate based on agency borrowing cost • Term from 1 to 7 years	• Purchase livestock, poultry, equipment, feed, seed, farm chemicals and supplies • Soil and water conservation • Refinance debts with certain limitations
Direct Operating Microloan (ML)	$50,000	Same as Direct OL	Same as Direct OL
Direct Emergency	100% actual or physical losses $500,000 maximum program indebtedness	• Rate is based on the OL rate plus 1% • Term from 1 to 7 years for non-real estate purposes • Term up to 40 years for physical losses on real estate	•Restore or replace essential property • Pay all or part of production costs associated with the disaster year • Pay essential family living expenses • Reorganize the farming operation • Refinance debts with certain limitations
Guaranteed Operating	$1,392,000 (Amount adjusted annually for inflation)	• Rate determined by the lender • Term from 1 to 7 years • Loan guarantee fee is 1.5%	• Same as direct OL
Guaranteed Farm Ownership	$1,392,000 (Amount adjusted annually for inflation)	• Rate determined by the lender • Term up to 40 years • Loan guarantee fee is 1.5%	• Same as direct FO except loan may be used to refinance debts
Guaranteed Conservation Loan (CL)	$1,392,000 (Amount adjusted annually for inflation)	• Rate determined by the lender • Term not to exceed 30 years, or shorter period, based on the life of the security • Loan guarantee fee is 1.5% • Eligibility requirements expanded to include large and financially strong operations	• Implement any conservation practice in an NRCS approved conservation plan • May be used to refinance debts related to implementing an NRCS approved conservation plan
Land Contract (LC) Guarantee	The purchase price of the farm cannot exceed the lesser of: • $500,000 • The current market value of property	• Rate cannot exceed the direct FO interest rate plus 3% • Amortized over a minimum of 20 years with no balloon payments during the first 10 years of loan • Down payment of at least 5%	• Sell real estate through a land contract to a beginning or socially disadvantaged farmer • Guarantee is with the seller of the real estate

Farm Service Agency

Our mission is to deliver timely, effective programs and services to America's farmers and ranchers to support them in sustaining our Nation's vibrant agricultural economy, as well as to provide first-rate support for domestic and international food aid efforts.

Types of Assistance

- Disaster Relief
- Insurance on Crops not insured by Risk Management Agency
- Programs to aid commodity producers – MILC – LFP, etc
- ARC/PLC – another type of insurance based on crop history
- Financing to Farmers and Ranchers who cannot get financing from a lender at reasonable rates and terms.

TYPES OF FSA FINANCING

- Direct Farm Operating Loans – 1 to 7 years
- Direct Farm Ownership Loans – up to 40 years
- Guaranteed Farm Operating and Farm Ownership Loans
  - Working with your other lender to provide financing
- Conservation Loans – both Direct and Guaranteed.
- Emergency Loans

MICROLOANS

USDA

FARM SERVICE AGENCY

ELIGIBILITY CRITERIA

- Not larger than a family-sized farm
- Satisfactory history of meeting credit obligations
- Unable to obtain credit elsewhere at reasonable rates and terms
- Meet all other loan eligibility requirements
- Total outstanding Agency debt at time of loan closing will be $50,000 or less.

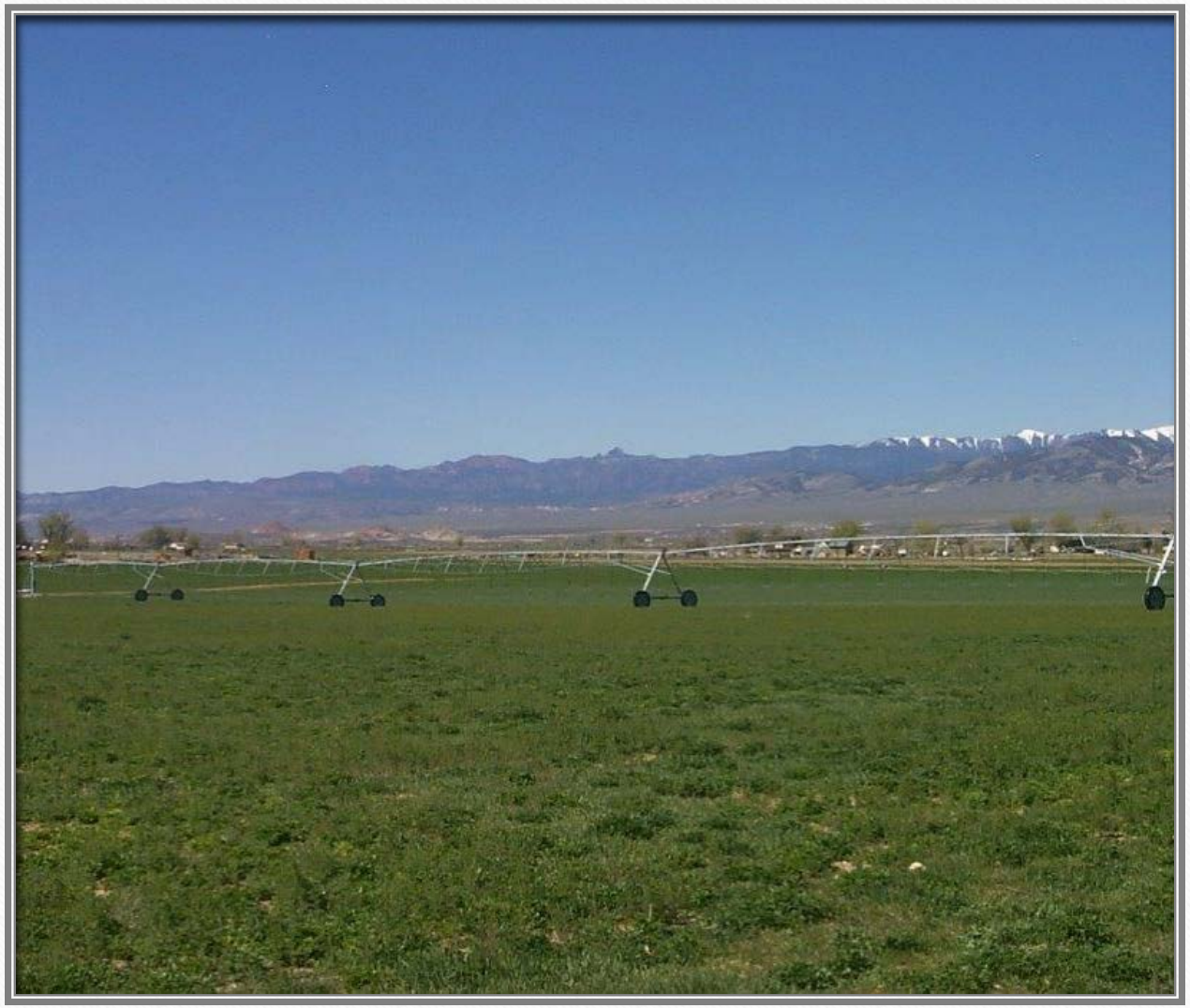
TYPES OF MICROLOANS

OPERATING MICROLOANS

FARM OWNERSHIP MICROLOANS

Operating Microloans
Approved Expenses

- Initial start-up expenses
- Annual expenses such as seed, fertilizer, utilities, land rents
- Marketing and distribution expenses
- Family living expenses
- Purchase of livestock
- Farm equipment and materials
- Minor farm improvements
- Hoop houses
- Irrigation



Farm Ownership Microloans

- Purchase a farm or farm land
- Enlarge an existing farm
- Construct new farm building
- Improve existing farm buildings
- Pay closing costs
- Implement soil and water conservation & protection practices

Simplified Application Process

- Less Paperwork
- Modified Managerial Experience
- Accommodate veterans, smaller farm operations and beginning farmers

Simplified Application Process (cont)

- Successful youth loan repayment counts as managerial experience
- Military experience acceptable
- One year business management experience

SECURITY REQUIREMENTS

- First Lien on farm property or Ag products
- Security value of at least 100%
- Farm ownership microloans secured by real estate being purchased or improved

RATES and TERMS

- Up to $50,000 (maximum owing at closing)
- Annual operating term 12 months or when commodities produced are sold
- Term Operating repayment not to exceed 7 years
- Farm ownership microloans not to exceed 25 year term
- Interest rates are regular FSA FO or OL rates in effect at time of approval or closing.

Obtaining Forms & Submitting Application

- Microloan Application forms available at FSA office
- Download and print from USDA website at

  www.fsa.usda.gov/microloans
- Local FSA office can aid in completing forms
- Submit application forms to local FSA office
- Find local FSA office at **http://offices.usda.gov**

FOR MORE INFORMATION

www.fsa.usda.gov/microloans

http:/offices.usda.gov

www.fsa.usda.gov/farmloans

UNITED STATES DEPARTMENT OF AGRICULTURE
FARM SERVICE AGENCY

Farm Loans
FACT SHEET

January 2016

Microloans

OVERVIEW

The Farm Service Agency (FSA) developed the microloan program to better serve the unique financial operating needs of new, niche and small to mid-sized family farm operations.

Microloans offers more flexible access to credit and serves as an attractive loan alternative for smaller farming operations, like specialty crop producers and operators of community supported agriculture (CSA). These smaller farms, including non-traditional farm operations, often face limited financing options.

TYPES OF MICROLOANS

Two types of microloans are available: Farm Operating Loans and Farm Ownership Loans. The microloans are issued to the applicant directly from the USDA FSA.

- Operating microloans can be used for all approved operating expenses authorized by the FSA Operating Loan (OL) Program, including but not limited to: initial start-up expenses; annual expenses such as seed, fertilizer, utilities, land rents; marketing and distribution expenses; family living expenses; purchase of livestock, equipment and other materials essential to farm operations; minor farm improvements such as wells and coolers; hoop houses to extend the growing season; essential tools; irrigation; and delivery vehicles.
- Ownership microloans can be used for all approved operating expenses authorized by the FSA Farm Ownership (FO) Loan Program, such as to purchase a farm or farm land, enlarge an existing farm, construct new farm buildings, improve existing farm buildings, pay closing cost and implement soil and water conservation and protection practices.

SIMPLIFIED APPLICATION PROCESS

The microloan application process is simpler, requiring less paperwork to complete, consistent with a smaller loan amount. Requirements for managerial experience and loan security have been modified to accommodate veterans, smaller farm operations and beginning farmers.

- Microloan applicants for operating loans will need to have some farm experience; however, FSA will consider an applicant's small business experience as well as any experience with a self-guided apprenticeship as a means to meet the farm management requirement. This will assist applicants who have limited farm skills by providing them with an opportunity to gain farm management experience while working with a mentor during the first production and marketing cycle.
- Microloan applicants for ownership loans need to have three years of farm experience out of the last 10 prior to the date of the application being submitted. One of the years can be substituted with any of the following experience:
    - Post-secondary education, that is at least 16 semester hours in agriculture business, horticulture, animal science, agronomy or other agriculture-related fields
    - Significant business management, that is at least one year of management experience in a non ag-related field where the applicant's day-to-day responsibilities included direct management experience, such as personnel decisions, payroll and inventory ordering; however, not an individual who is a manager in title only
    - Military leadership or management that is, as a general rule, any officer or E5 or above will have completed an acceptable military leadership course
    - If an applicant has successfully repaid an FSA youth loan, the term of that loan may be used towards the three years of management experience required for an ownership loan.

SECURITY REQUIREMENTS

Operating microloans for annual operating expenses must be secured by a first lien on a farm property or agricultural products having a security value of at least 100 percent of the microloan amount, and up to

150 percent, when available. Operating microloans made for purposes other than annual operating expenses must be secured by a first lien on a farm property or agricultural products purchased with loan funds and having a security value of at least 100 percent of the microloan amount.

Ownership microloans are secured by the real estate being purchased or improved. The value of the real estate must be at least 100 percent of the loan amount.

RATES AND TERMS

For operating microloans, eligible applicants may obtain up to $50,000. The repayment term may vary and will not exceed seven years. Annual operating loans are repaid within 12 months or when the agricultural commodities produced are sold. Interest rates are based on the regular FSA operating loan rates that are in effect at the time of the microloan approval or microloan closing, whichever is less.

For ownership microloans, eligible applicants may obtain a microloan for up to $50,000. The repayment term may vary and will not exceed 25 years. Interest rates are the regular FSA farm ownership rates in effect at the time of the loan approval or closing.

OBTAINING FORMS AND SUBMITTING AN APPLICATION

FSA microloan application forms can be obtained from the local FSA office or can be downloaded and printed from the USDA website at **www.fsa.usda.gov/microloans**. Applicants who are having problems gathering information or completing forms should contact their local FSA office for help. After completing the required paperwork, an applicant should submit the farm loan application to their local FSA office. To find your local FSA office, visit **http://offices.usda.gov**.

WHAT HAPPENS AFTER A LOAN APPLICATION IS SUBMITTED?

After a loan application is submitted, FSA reviews the application and determines if the applicant is eligible for the requested loan. The applicant will receive written notification of each step in the process, such as when the application is received, when more information is needed, when an eligibility determination is made and when a final decision is made. If the application is approved, FSA makes the loan and funds are distributed as needed. If the application is denied, the applicant is notified in writing of the specific reasons for the denial, and provided reconsideration and appeal rights.

ELIGIBILITY CRITERIA

To qualify for assistance, the applicant must not be larger than a family-sized farmer, have a satisfactory history of meeting credit obligations, be unable to obtain credit elsewhere at reasonable rates and terms and meet all other loan eligibility requirements.

FOR MORE INFORMATION

This fact sheet is for informational purposes only, other restrictions may apply. Additional information on the FSA microloan program may be obtained at **www.fsa.usda.gov/microloans** or at local FSA offices. To find your local FSA office, visit **http://offices.usda.gov**. For more information on other FSA loans, visit **www.fsa.usda.gov/farmloans**.

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Realities of Small Farms

Biographical Information:
Luke Petersen
Petersen Family Farms

Luke Petersen is a 5th generation farmer in Southwest Salt Lake County. He grew up working alongside his father and grandfather raising hay and small grains. He is the first Petersen farmer to receive a formal education, earning a Bachelors from USU and an international Master's degree in Agriculture and Business from the Royal Agricultural University in England.

His education took him around the world but his heart brought him back to the family farm in Riverton. Of all the experiences Luke has had, his greatest achievement is becoming a full-time grower. He believes in farming as not only a way to produce food, but as a culture of growth that extends from food to people and community. He has incorporated this philosophy into the next generation of agriculture at Petersen Family Farm where he follows his dream of growing people, food, and community.

Session Description:
Food is the anchor of agriculture, but the sail in the experience or the agri-CULTURE. We as farmers and ranchers have an opportunity to capitalize on the experiences the farm offers our communities. Through this we can generate more revenue and hold our place in urban communities. Working farms are powerful tools to education and create quality of life for all people, rural and urban. Through innovation, technology, and social media we can take our working farms to the next level and preserve them as an amenity in our communities for generations to come

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Basic Soil Fertility for Utah

Biographical Information:

Katie Wagner
USU Extension, Salt Lake County

Katie works for USU Extension in Salt Lake County and educates homeowners on best management practices for gardening in Utah. Katie has a Master's degree from the University of Kentucky in plant and soil science and has helped gardeners interpret soil test reports in Salt Lake County for the past 5 years.

Session Description:

Katie will discuss how to maintain soil fertility in Northern Utah for successful production of garden plants. She will cover basic properties of Utah soils and how to manage them appropriately for plant nutrient needs.