Conditioning Transplants to Improve Plant Establishment

Biographical Information:
Dr. Dan Drost
Utah State University

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, the creation of efficient farm systems, and intensive land-use management.

Session Description:
Over the last few years, growers have asked if conditioning or hardening treatments improve plant establishment under stressful conditions. Studies were initiated in the spring of 2014 to address this question and evaluate common conditioning treatments. Our goal was to determine if brushing, reduced fertilizer, water stress or low temperature grown transplants perform as well or better than transplants not subjected to any conditioning (controls). We grew watermelon, tomato and peppers and planted them early (Apr 7; in high tunnels) or (May 15; field) and again during the heat of summer (Jul 10-30) and evaluated establishment and early growth. Results were variable with brushing being as good as or better than the controls in some situations. However, cold treated plants were consistently smaller and grew slower than the controls both early and later in the season. Findings from our initial studies will be discussed and used to make better decisions about how to handle transplants prior to planting out in the field.

Improving Transplant Establishment: Conditioning Plants to Stress

by
Dan Drost, James Frisby, Karen Maughan

Utah Department of Agriculture and Food
UtahState University Cooperative Extension

Overview

- What is Conditioning
- Why or Is it necessary?
- When Useful?
- Treatment Performance
- Summary

Why Transplants

- More Uniform Seed Germination
- Less Variability
- Earlier Start
- Extends Production season
- Earlier-Enhanced Yields

Growing Not for Everyone

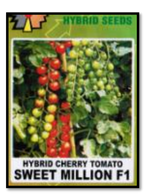
- Expensive (facilities, time, etc)
- Quality Issues
- Need lots of plants and types
- Some Plants are Hard to Grow or Transplant
  - Root Crops (carrot, beet; ???)
  - Leafy Biennials (dill,)
  - Those that Grow Quickly (lettuce, spinach)
  - Cucurbits (melon, cucumber, squash)

Production Difficulties

Easy	More Difficult	Most Difficult
Broccoli	Cauliflower	Cucumber
Brussels Sprouts	Celery	Muskmelon
Cabbage	Eggplant	Squash
Lettuce	Onion	Watermelon
Tomato	Pepper	

When to Grow Plants?

- If using Expensive Hybrids
- Plants needed for Your Production Schedule
- Unique Plants or Production Approaches



Transplant Success Depends on…….

- Seed Source
- Trays; Flats; Cell Size
- Growing Medium
- Nutrition
- Light
- Temperature
- Moisture
- Hardening

Common Production Issues

- Poor Plant Performance
- Non-uniform Growth
- Hypocotyl Elongation

To Harden (Condition) or ……

- Pre-conditions plants to cope with field stress
- Increases plant tolerance to cold, heat, water shortages
- Question? Do they work?

- Commonly used hardening approaches:
  - Reduce water or fertilizer
  - Subject to cooler temperatures
  - Brush or shaking

- Early Plantings (Apr 7 - tunnels ; May 15 - field)
- Late Plantings (Jul 8-30 - field)
- **Control**: No conditioning
- **Brush**: Four (4) strokes with rod
- **Cold**: 50F (day/nite) – one week
- **Lo Fert**: 1x application per week
- **Lo Water**: 50% less water
- Evaluate Growth

Tomato Transplants

Tomato

Apr7	Unheated; High Tunnel; No protection (28 days)				
	Control	Brush	Cold	Fert	Water
DW	5.0	4.6	3.7	4.9	4.3
LA	419	364	270	377	328

Jul8	Field planted on black plastic (17 days)				
	Control	Brush	Cold	Fert	Water
DW	12.1	11.3	7.5	11.4	11.3
LA	968	839	585	831	860

Pepper Transplants

Pepper

Apr7	Unheated; High Tunnel; No protection (32 days)				
	Control	Brush	Cold	Fert	Water
DW	1.20	1.30	0.95	1.06	1.13
LA	86	96	77	88	88

Jul18	Field planted on black plastic (33 days)				
	Control	Brush	Cold	Fert	Water
DW	11.9	11.8	11.6	10.8	9.5
LA	1246	1169	1148	1046	966

Watermelon Transplants

Water

Fertilizer

Control

Brush

Cold

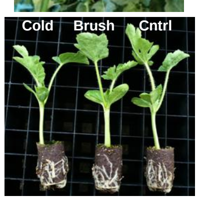
Watermelon

5-20	Field planted on black plastic (28 days)				
	Control	Brush	Cold	Fert	Water
DW	10.1	11.7	6.3	8.2	10.6
Stem	5.7	6.2	6.0	5.2	5.1

8-1	Field planted on black plastic (33 days)				
	Control	Brush	Cold	Fert	Water
DW	30.1	24.4	11.9	22.1	23.5
LA	3022	2591	1285	2253	2382

Conclusions

- No conditioning treatments preformed better than controls.
- Nutrient starving, cold, and low water adversely affect tomato and pepper.
- Cold severely reduced early melon growth.
- Brushing helps keep plant compact.



Thank You!

James Frisby
Karen Maughan
Reagan Wytsalucy

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UDAF Utah Department of Agriculture and Food
UtahState University COOPERATIVE EXTENSION

Field Evaluations of Pre-conditioned Transplants

Biographical Information:
Rick Heflebower
Utah State University Extension, Washington County

Rick is the Horticulture Extension Agent for USU located in Washington County. He's worked in Maryland and Utah Extension services for a total of more than 30 years. Rick's emphasis is on fruit and vegetable production as well as water conservation

Session Description:
This study is looking at "pre-treatment" of watermelon transplants prior to planting in the field. What effects, if any, do treatments such as temperature, irrigation, and mechanical brushing have on transplant success.

Watermelon Transplant Study

Rick Heflebower, Dan Drost

UtahState University
COOPERATIVE EXTENSION

Factors that can affect transplants?

Protocol

- All transplants were 21-24 days old
- Each was grown in the same potting media and in the same tray size
- All transplants were watered daily
- Each was fertilized with 100 ppm Nitrogen in the irrigation water twice a week
- Lighting consisted of 12 hours bright light and 12 hours of dark

Treatments

- Cold = The week prior to planting, plants were kept at 50 degrees
- Water = The week prior to planting, plants received only one half of the water
- Control = Watered daily, fertilized 2X a week and received 12 hours of light
- Fertilizer = Only received fertilizer once in the final week

Treatments

- Brush = Two passes over top of plants with a fiberglass rod each day for the week prior to planting
- Grower = The growers protocol for water, light, fertilizer, etc.

Survival Rate

Green River

Westwinds	**May 10, 2014**
Cold	23/25
Water	23/25
Control	24/25
Brush	23/25
Fertilizer	24/25
Grower	24/25

Back River	**June 6, 2014**
Cold	20/20
Water	20/20
Control	20/20
Brush	20/20
Fertilizer	18/20
Grower	20/20

Survival Rate
Leeds

Leeds #1 April 11, 2014

- Cold 25/25
- Water 24/25
- Control 24/25
- Brush 24/25
- Fertilizer 25/25
- Grower 23/25

Leeds #2 June 6, 2014

- Cold 18/25
- Water 25/25
- Control 25/25
- Brush 24/25
- Fertilizer 24/25
- Grower 19/25

Stem Length

Green River

Westwinds 5-10-14	39 days	Back River 6-6-14	38 days
• Cold	33.60	• Cold	29.09
• Water	30.50	• Water	37.33
• Control	29.20	• Control	41.50
• Brush	25.20	• Brush	33.17
• Fertilizer	24.80	• Fertilizer	40.00
• Grower	37.10	• Grower	21.71

Stem Length

Leeds

Leeds #1	4-11-14	33 days	Leeds #2	6-6-14	20 days
Cold		37.67	Cold		29.40
Water		34.33	Water		41.80
Control		41.67	Control		36.70
Brush		43.07	Brush		34.60
Fertilizer		40.67	Fertilizer		40.8
Grower		36.87	Grower		40.8

Laterals

Green River

Westwinds 5-10-14	39 days	Back River 6-6-14	38 days
Cold	7.0	Cold	4.0
Water	6.5	Water	3.0
Control	6.6	Control	4.7
Brush	5.4	Brush	3.8
Fertilizer	5.7	Fertilizer	3.5
Grower	6.3	Grower	2.4

Laterals

Leeds

Leeds #1 4-11-14 33 days

- Cold 4.1
- Water 3.7
- Control 3.6
- Brush 4.1
- Fertilizer 4.3
- Grower 3.7

Leeds #2 6-6-14 20 days

- Cold 4.4
- Water 5.7
- Control 5.2
- Brush 4.7
- Fertilizer 6.1
- Grower 5.5

Number of Flowers

Green River

Westwinds 5-10-14	39 days	Back River 6-6-14	38 days
Cold	2.89	Cold	1.38
Water	2.56	Water	2.50
Control	4.00	Control	3.33
Brush	2.20	Brush	2.80
Fertilizer	2.50	Fertilizer	2.67
Grower	3.40	Grower	1.00

Number of Flowers

Leeds

Leeds #1 4-11-14	33 days	Leeds #2 6-6-14	20 days
Cold	.33	Cold	.6
Water	.73	Water	3.7
Control	1.67	Control	4.4
Brush	2.20	Brush	3.2
Fertilizer	2.00	Fertilizer	4.6
Grower	.33	Grower	2.9

Number of Fruits in 20 ft

Leeds #2 6-6-14 to 8-7-14

• Cold	14
• Water	12
• Control	12
• Brush	13
• Fertilizer	13
• Grower	13

Westwinds 5-10-14 to 7-14-14

• Cold	8
• Water	8
• Control	11
• Brush	9
• Fertilizer	11
• Grower	9

Fruit Weight in Pounds

Leeds #2 6-6-14 to 8-7-14		Westwinds 5-10-14 to 7-14-14	
Cold	9.12	Cold	13.76
Water	8.41	Water	12.92
Control	8.50	Control	11.76
Brush	9.09	Brush	12.08
Fertilizer	8.09	Fertilizer	14.60
Grower	8.68	Grower	14.88

Grafting Melons

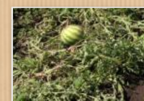
Biographical Information:
James Barnhill
Utah State University

Have worked as an Agriculture Extension Agent for Utah State University for 29 years. Areas of emphasis have been crops and pastures.

Session Description:
Watermelons grafted onto Shinto squash roots were grown in an attempt to provide resistance to Sudden Wilt. Non-grafted melons set and ripened earlier, but grafted melons grew more vigorously and produced more watermelons in a commercial field. Grafted melons in a garden exhibited resistance to Sudden Wilt.

GRAFTED MELONS?

Sherman Thompson & James Barnhill



Sudden Wilt

- Soil and seed born pathogens (thought to be several species of fungi)
- Can survive many years without a host, however rotation has been an important tool
- Plants wilt about the time the fruit is reaching maturity
- Discoloration of vascular tissue
- Varieties with some resistant to particular pathogens are available (Fusarium)
- **Will melons grafted onto a squash root be resistant?**

Why?

Grafted vegetables are created when the top part of one plant (the scion) is attached to the root system of a separate plant (the rootstock). The rootstock contributes vigor and disease resistance while the scion is chosen for fruit flavor and quality.

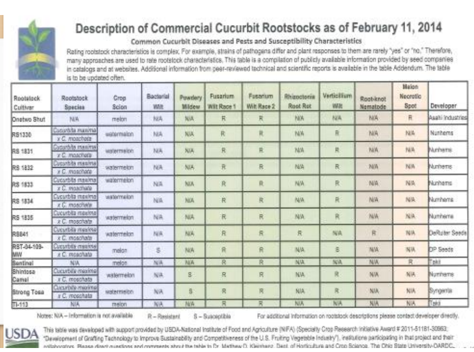
Most beneficial where soil diseases are common.

'Warm Climates'

www.kandaseed.co.jp

Rootstock SHINTOSA F1

Our Shintosa is an interspecific hybrid winter squash for grafting watermelon, melon, oriental melon, and cucumber.



Description of Commercial Cucurbit Rootstocks as of February 11, 2014

Common Cucurbit Diseases and Pests and Susceptibility Characteristics

Rating rootstock characteristics is complex. For example, strains of pathogens differ and plant responses to them are rarely "yes" or "no." Therefore, many approaches are used to rate rootstock characteristics. This table is a compilation of publicly available information provided by seed companies in catalogs and at websites. Additional information from peer-reviewed technical and scientific reports is available in the table Addendum. The table is to be updated often.

Rootstock Cultivar	Rootstock Species	Crop Scion	Bacterial Wilt	Powdery Mildew	Fusarium Wilt Race 1	Fusarium Wilt Race 2	Rhizoctonia Root Rot	Verticillium Wilt	Root-knot Nematode	Melon Necrotic Spot	Developer
Onetwo Shut	N/A	melon	N/A	N/A	R	R	N/A	N/A	N/A	R	Asahi Industries
RS1330	Cucurbita maxima x C. moschata	watermelon	N/A	N/A	R	R	N/A	R	N/A	N/A	Nunhems
RS 1831	Cucurbita maxima x C. moschata	watermelon	N/A	N/A	R	R	N/A	R	N/A	N/A	Nunhems
RS 1832	Cucurbita maxima x C. moschata	watermelon	N/A	N/A	R	R	N/A	R	N/A	N/A	Nunhems
RS 1833	Cucurbita maxima x C. moschata	watermelon	N/A	N/A	R	R	N/A	R	N/A	N/A	Nunhems
RS 1834	Cucurbita maxima x C. moschata	watermelon	N/A	N/A	R	R	N/A	R	N/A	N/A	Nunhems
RS 1835	Cucurbita maxima x C. moschata	watermelon	N/A	N/A	R	R	N/A	R	N/A	N/A	Nunhems
RS841	Cucurbita maxima x C. moschata	watermelon	N/A	N/A	R	R	R	N/A	R	N/A	DeRuiter Seeds
RST-04-109-MW	Cucurbita maxima x C. moschata	melon	S	N/A	R	R	N/A	S	N/A	N/A	DP Seeds
Sentinel	N/A	melon	N/A	N/A	R	R	N/A	N/A	N/A	R	Takii
Shintosa Camel	Cucurbita maxima x C. moschata	watermelon	N/A	S	R	R	N/A	R	N/A	N/A	Nunhems
Strong Tosa	Cucurbita maxima x C. moschata	watermelon	N/A	S	R	R	N/A	R	N/A	N/A	Syngenta
TI-113	N/A	melon	N/A	N/A	R	R	N/A	N/A	N/A	N/A	Takii

Notes: N/A – Information is not available R – Resistant S – Susceptible For additional information on rootstock descriptions please contact developer directly.

USDA This table was developed with support provided by USDA-National Institute of Food and Agriculture (NIFA) (Specialty Crop Research Initiative Award # 2011-51181-30963; "Development of Grafting Technology to Improve Sustainability and Competitiveness of the U.S. Fruiting Vegetable Industry"), institutions participating in that project and their collaborators. Please direct questions and comments about the table to Dr. Matthew D. Kleinhenz, Dept. of Horticulture and Crop Science, The Ohio State University-OARDC,

Indoors vs. Greenhouse

Tube Grafting

Tube Grafting (Source: Rivard and Louws, 2006)

Healing after grafting is critical!

- Humidity 95% + (gradually decrease)
- Air Temperature 82-84° F
- Darkness for 24-48 hrs, then 540-740 foot candle (2 fluorescent lamps)
- 7 days for cucurbits/ 5 days for tomatoes
- No wind or mechanical disturbance
- Note: Avoid excessive wetting of substrate as it increases water pressure in the graft.

Crimson Sweet on Shintosa Squash Root

Plants propagated and grafted by 'Plug Connection'

Burpee's: Grafted Heirloom Tomato Plants - 3 for $26.85

CONFIDENTIAL

Grafted Watermelon Transplants

25mm cell, 102 cell tray or 128 cell tray

1,000 -4,900 $1.40 Each

5,000 - 20,000 $1.31 Each

20,001 - 40,000 $1.26 Each

40,001-100,000 $1.16 Each

100,000 or more $1.06 Each

*Plug Connection will provide rootstock, Good Seed and Plant Practices (GSPP) Seed.

*Price may vary depending on rootstock variety and cost of that variety.

* Customer to provide scion seed including 30% buffer over and above the required quantity.

*Scion seed sent to PC needs to be unopened packages and GSPP certified.

*Customer agrees to purchase 100% of surviving plants, including surviving buffers.

Minimum Volume of Items Above
Required to Justify Quote: 5,000

http://www.vegetablegrafting.org/

Matthew Peterson's Cantaloupe Field
Wilson, Weber County, Utah

Planted May 27, 2014

July 29, 2014

July 29, 2014

Non-Grafted

Grafted

Results from Three Replications

Grafted	Standard	Grafted	Standard
Number melons	Number melons	Size melons	Size melons
16	14	22 cm	20.2 cm
26	18	20.7 cm	18.6 cm
20	12	20.6 cm	21 cm
means			
20.7 melons/37 ft	14.7 melons/37 ft	21.1 cm diameter	20.27 cm diameter

Grafted Melon Trial Conclusions

- Grafted plants have longer, healthier, more vigorous vines
- Standard non-grafted plants set and ripen earlier
- Grafted plants produce more melons *(21.7 vs 14.7 per 37 foot of row)*
- Grafted plants produce larger melons *(21.1cm vs 20.3cm)*
- Grafted plants died easier, so were thinner, but still out produced Standard melons *(13 of 87 grafted melons died while all 40 standard melons lived)*
- Sudden wilt did not occur, so could not be evaluated

Garden Crimson Sweet Trial Non-Grafted vs. Grafted

Garden Comparison

Upper Cantaloupe were grafter

The lower Cantaloupes were not grafted

<u>Large Scale Shade Structures</u>

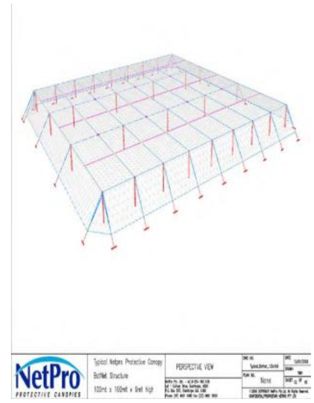
Biographical Information:
Samuel Day
Days Best Produce

Samuel grew up on a diverse vegetable farm (Day Farms) in Layton, Utah. After graduating from USU with a bachelor's degree in crop science and a master's degree in plant science he started his own vegetable farm (Days Best Produce) in 2014.

Session Description:
Discussion on how to design and install crop shade structures.

Large Scale Shade Structures

Samuel Day



Design

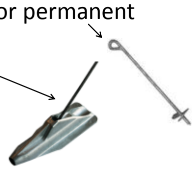
- The distance between posts will depend on the size and strength of the posts, anchors, and wire as well as the size and weight of the shade cloth
- Determine if wires will be added above the shade cloth to prevent billowing
- Determine if interior and exterior posts need to be tied together

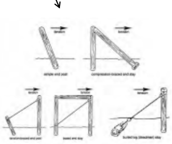
Posts

- Size (height and thickness) and material (metal/wood) will determine exterior and interior post strength
- Interior and exterior (quantity)
- Make sure there is enough clearance for any equipment you will be using (account for shade cloth sag)

Anchors

- Helical or screw – removable or permanent
- Gripple – permanent
- Cement (etc) - permanent





To net or not net 3rd edition Peter Rigden

Anchors

- Anchor length and auger size will determine pull out strength
- Quantity needed?
- Generally one per exterior post and two for exterior corner posts

Connecting Posts to Anchors

- Strength
- One per exterior post (two on corner posts)
- Make your own
- Gripple (pre-made)

Wire

- Use only high tensile wire
- Aircraft cable
- Galvanized vs. Stainless (more expensive)
- Strength
- Needs to be compatible with the tensioner you are using
- Make sure posts, anchors, and wire have similar breaking and pull out strengths

FarmTek.com

Gripple Tensioners

You will need the tool and a pin to release tension

Tensioning Tool

www.gripple.com

Quantity of Wire and Tensioners

- Calculate based on design
- Always order extra (If you are connecting the shade cloth with wire you will also need extra tensioners)
- Tensioning of wire will be limited by the strength of anchors and posts

Shade Cloth

- Woven vs. *knitted* (superior durability)
- Choose correct shade percentage
- Check all suppliers (huge variability in cost)
- Decide how you will attach (grommets and wire vs. other connectors)
- Add extra grommets on the ends if you are going to attach with wire

Installation

- Layout and mark where posts and anchors will go
- Ensure the distance between posts (width and length) is correct for each piece of shade cloth
- Check to make sure the wires connecting exterior posts to the anchors will reach before installing posts or anchors

Installing Posts

- Need somewhere to attach wires to posts
- Timing (exterior vs. interior)
- Pounding vs. Digging (auger)
- Exterior posts should be buried at least three feet deep
- Exterior posts should be installed on an angle (angle will be determined by the width of the hole if installed by digging)

Installing Anchors

- Manual vs. machine (make a bit to fit the anchor)
- Allow ground to settle before putting tension on the anchor connecting wire

Connecting Posts to Anchors

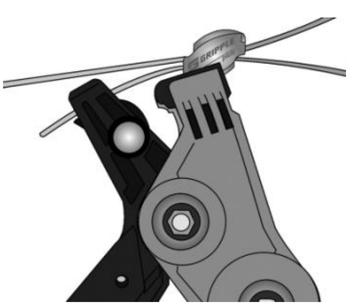
- http://www.gripple.com/us/products/catalogue/agricultural/products/gpak.html

- Can connect posts to anchors in one or two places

Installing Wires

- Precut wires or cut as you install them
- Leave extra wire on the ends and between posts so you can release tensioners
- Use a sharp wire cutter to insure ends of wire do not fray

Tension all Wires



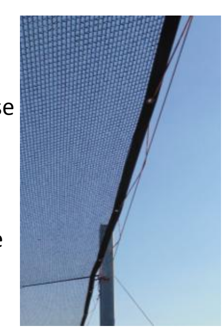
www.gripple.com

Check tension every one to two weeks

Same process to release tension just insert pin

Attaching Shade Cloth

- Timing
- Pull shade cloth apart
- Attach shade cloth lengthwise then widthwise (top and bottom then sides)
- Use some type of metal wire or connector to attach shade cloth to outside wires



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Things to consider

- Can add side panels if needed
- Remember to check tension of all wires regularly
- Alternate methods to hang cloth

Suppliers

- www.riggingwarehouse.com aircraft cable
- http://milspecanchors.com/ anchors
- http://www.wilsonirr.com/home108.php Gripple products, Juan Pinion (509-728-1339)
- http://americanclayworks.net/ shade cloth

Resources

- To net or not to net 3rd Edition, Peter Rigden (Google search)

- http://www.gidcoagshades.com/crop_shades.html (Gidco Ag Design builds custom shade structures with retractable manual and automated systems)

Questions

New Vegetable Diseases found in Utah

Biographical Information:
Claudia Nischwitz
Utah State University

Assistant Professor and extension Specialist at USU since August 2010

I work on diseases of plants with focus on vegetable and fruit tree diseases. In addition, I do diagnostics for the UPPDL lab.

Session Description:
I will cover diseases of solanecous crops (Candidatus Liberibacter, bacterial spot of pepper and tomato, Vertcillium wilt of eggplant, Tobacco mosaic virus etc.)

Diseases of solanaceous crops

Claudia Nischwitz

Assistant Professor and Extension Specialist

Email: claudia.nischwitz@usu.edu

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Candidatus Liberibacter solanacearum

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

Zebra chip - Liberibacter

Liberibacter - Pepper

Liberibacter - Tomato

nwdistrict.ifas.ufl.edu

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

Bacterial spot of pepper and tomato

- Caused by several species of *Xanthomonas*
- Bacteria are seedborne and they can survive in plant debris (primary infections)
- Spread from plant to plant: splashing water, wind and humans
- Symptoms:
  - Infected seedlings may not show symptoms but leaves can turn yellow and fall off
  - Older plants develop brown, necrotic spots on leaves and fruit with a yellow halo

Bacterial spot of pepper and tomato

- Leaves eventually die
- Tomato: Dead leaves remain on plants
- Pepper: Dead leaves fall off

Bacterial spot - pepper

Bacterial spot - pepper

Bacterial spot - tomato




Bacterial spot - tomato

Bacterial spot - management

- Use certified disease-free seed or transplants
- Remove tomato and pepper plant debris from fields
- Crop rotation for one-two years
- Application of copper products when first spots are observed (several states have problems with bacteria resistant to copper)
- Resistant varieties:
  - Pepper varieties depending on the bacterial races present
  - No resistant tomato varieties

Bacterial canker

- Hosts: Tomato and pepper (economically important only on tomato)
- Symptoms:
  - Primary infections: Wilting of plants; Leaves infected through bacterial invasion of hydathodes may develop yellow margins known as “firing”
  - Secondary infections: Spots on leaves and fruit. On fruit the spots are white with a dark center. Fruit infection occur either through flower infections or invasion through trichomes (young fruit)

Bacterial canker - tomato

Bacterial canker

- Bacteria are seedborne or transmitted through contaminated tools (pruning, trays etc), handling of infected plants and splashing water
- Bacteria survive for up to two years in plant debris
- Survive on weeds and volunteer tomatoes

Bacterial canker

- Use disease-free seed, clean trays, pots, benches etc.
- Disinfect pruning tools with a 70% ethanol solution or disinfecting wipes
- Avoid overwatering; irrigate in morning
- Crop rotation for three to four years
- Remove solanaceous weeds
- Deep plow plant debris
- Copper-based products effective in greenhouse transplant production but were ineffective in the field after transplanting.

Verticillium wilt

- Soilborne pathogen; Microsclerotia can stay viable in soil up to 10 years
- Hosts: many vegetables including tomato, pepper, eggplant and potato
- Conditions for infection: Moist soil, temperatures 70-81F; stops growing at 90F
- Transmission: Infected transplants or seed potatoes, soil cultivation and wind and water

Verticillium wilt – Symptoms

- Vascular discoloration when stems are cut
- Wilting of plants
- Symptoms may only appear on one side of plant
- Yellowing of leaves, leaves turn brown and dry
- Tomato: Yellowing of lower leaves in a v-shape

Verticillium wilt

http://www.omafra.gov.on.ca/IPM/english/tomatoes/diseases-and-disorders/verticillium-wilt.html

Verticillium wilt

http://www.apsnet.org/edcenter/intropp/lessons/fungi/ascomycetes/Pages/VerticilliumWilt.aspx

http://www.extension.umn.edu/garden/yard-garden/vegetables/verticillium-wilt-of-tomatoes-and-potatoes/

Verticillium wilt

Verticillium wilt – Management

- Resistant varieties (descriptions of varieties have a “V” in disease resistance category)
- Disease-free transplants
- Remove and destroy infected plant material
- Fumigants (pre-plant):
  - Telone C-17 (restricted use)
  - Vapam HL (restricted use)
  - K-Pam HL (restricted use)

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 ringspot on mature fruit

Tomato spotted wilt virus

Tomato spotted wilt virus

Tomato spotted wilt virus

- Management:
  - Resistant varieties (Finish Line, Fletcher, Crista, Red Defender, BHN 602 and Picus)
  - Reflective mulch
  - Insecticides (potential resistance problems)

Tobacco/Tomato mosaic virus

- Seedborne in tomato and other plants
- Transmitted by handling infected plants or tobacco
- Survives 50 years in plant debris, contaminated pots etc.

TMV on tomato

TMV on tomato

TMV on pepper

TMV/ToMV - Management

- Use certified seed
- Resistant varieties
- Disinfecting pots and tools
- Replace plant substrate in greenhouse beds
- Change gloves frequently

Pepper mottle virus

- Aphid transmitted

Tobacco etch virus

- Aphid transmitted

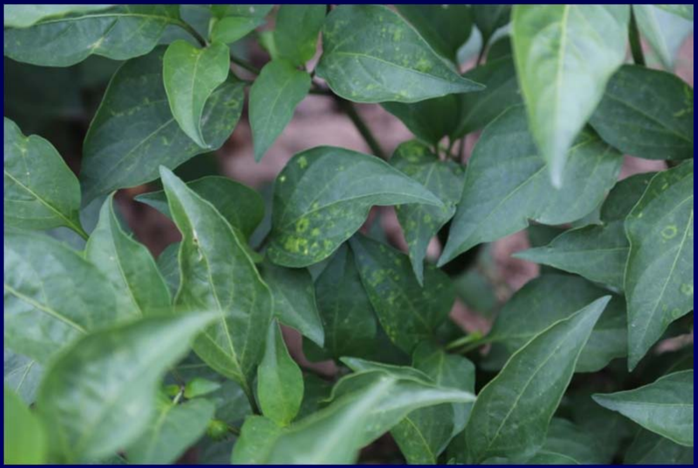
Alfalfa mosaic virus

Aphid transmitted

Management: Avoid planting close to alfalfa fields

Unknown virus






Unknown virus

Acknowledgments

- Erin Petrizzo
- Undergraduate students
- County Extension faculty
- Funding agencies:
  - Utah Dept. of Agriculture SCBG
  - USU Extension
  - UAES
- Vegetable growers

  Especially:

  Johnson Family Farms

  East Farms

  Days Best Produce

  Wilcox Farms

  MacFarland Farms

  Favaro Farms

  Castle Valley Farms

Thank you!

<u>Addressing the threat of Brown Marmorated Stink Bug in the Western U.S.</u>

Biographical Information:
Lori Spears
Utah State University

Dr. Lori Spears is the Cooperative Agricultural Pest Survey (CAPS) coordinator for Utah State University. Dr. Spears monitors for invasive pests moving into the state and conducts public education and outreach activities. Dr. Spears has a PhD from Utah State University (2012) and a BS from Weber State University (2001).

Session Description:
I will be discussing the brown marmorated stink bug, which is a newly arrived invasive insect pest to Utah. I will cover the biology, monitoring, identification, and control of this pest. I will also conduct a stakeholder needs assessment to determine USU's research and extension priorities.

Addressing the Threat of Brown Marmorated Stink Bug in the Western U.S.

Lori Spears
Cooperative Agricultural Pest Survey Coordinator
Utah State University

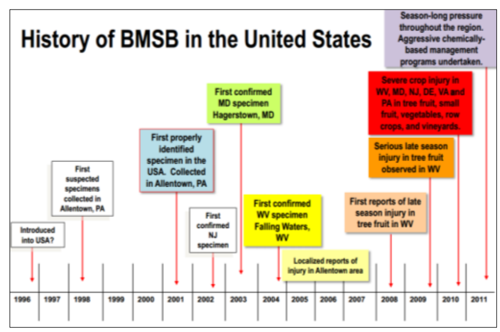
USDA-ARS-NIFA SCRI Planning Grant 2014-51181-22514

Introduction

- A highly invasive crop pest
  - Introduced to PA (1996)
  - Has since spread to 42 states
  - Detected in Utah (2012)
- Potential to damage many crops
- Nuisance in urban landscapes

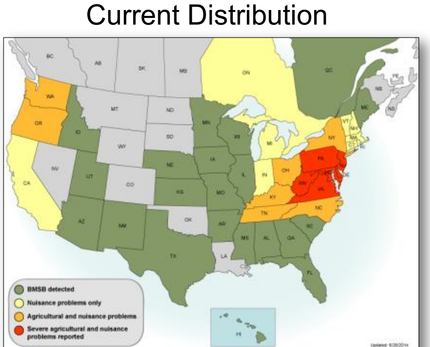
Origins

- Native to East Asia
  - China, Japan, Korea, and Taiwan
  - Periodic pest: cherry, apple, pear, soybean
- U.S. population traced to Beijing



Source: Tracy Leskey, USDA

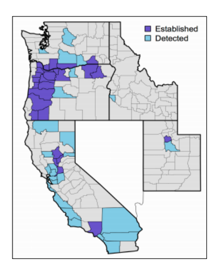
Current Distribution



From: stopBMSB.org

Current Distribution

- Increasing range and populations in the western U.S.
  - Coastal
  - Inland
  - Intermountain
- New environment types
  - Dry, irrigated crop production
  - New crops



Current county-level status of BMSB;
Source: Nik Wiman, OSU

BMSB in Northern Utah

- Most specimens (2014) were found on the Univ. of Utah campus
- Catalpa trees may act as wild hosts

Year	Total # of BMSB found	County
2012	2	Salt Lake
2013	5	Salt Lake and Utah
2014	31*	Salt Lake

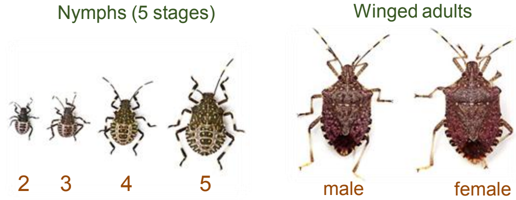
Life History & Biology

- Eggs laid under leaves in clusters of 28 eggs
- Developmental period lasts ~ 50 days from egg to adult
- 1st instars feed on the egg mass
- 2nd instars disperse from the host plant

28 eggs | "red ring" | 1st instars | 2nd instars

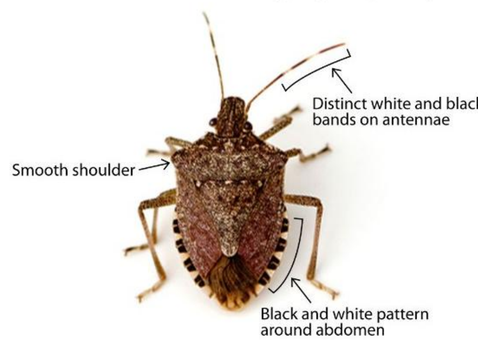
Life History & Biology

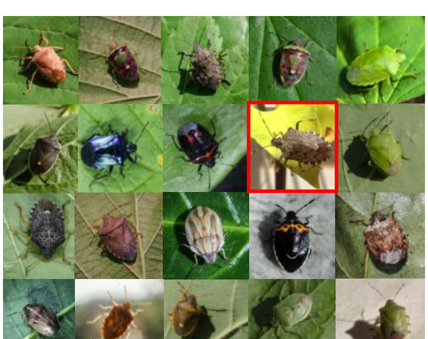
Nymphs (5 stages) | Winged adults

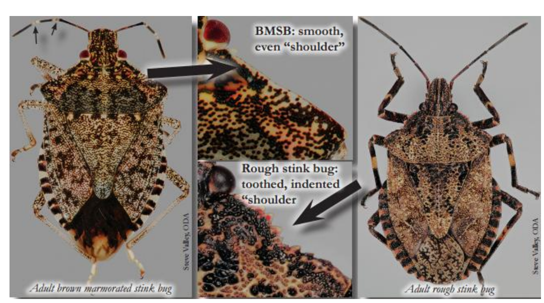


All except stage 1 are damaging

Brown Marmorated Stink Bug (*Halyomorpha halys*)



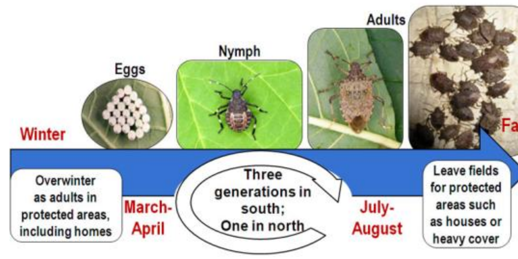


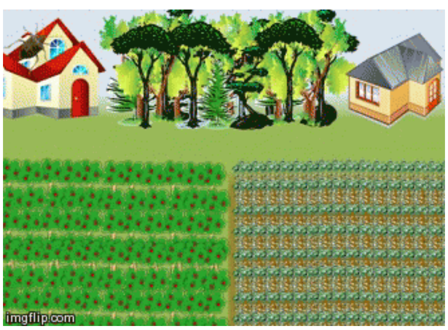


Overwintering Behavior

- Adults overwinter in groups
  - Structures: attics, in siding, sheds, containers
  - Natural: under bark in dead trees, rock outcrops, wood piles

Seasonal Activity





BMSB Feeding

- Piercing-sucking mouthparts
  - Physical damage
  - Enzymatic / toxicity damage
  - Secondary infection
- Vegetative plant structures
  - Stems, leaves, petioles, rachis
- Reproductive plant structures
  - Fruits, vegetables
  - Seeds, pods & nuts

BMSB Damage
Tree Fruits

- Corking damage to apples and peaches
- Most damage is below the surface, damaged tissues from saliva
- Damage worsens in storage
- Increased potential for decay from pathogens

BMSB Damage
Small Fruits

- Discoloration
- Necrotic/dead tissues
- Possible vector for plant disease or decay yeasts

BMSB Damage
Field Crops

- Sweet corn is a high-preference crop
- Up to 100% of ears with injury (Beltsville MA 2011)



BMSB Damage
Vegetables


Fig. 5. Severe infestations of brown marmorated stink bug can result in total loss of fruiting vegetable crops.


Fig. 6. Brown marmorated stink bug feeding scars on tomato fruit.


Fig. 7. Spongy area left by stink bug feeding on bell pepper.


Fig. 8. Brown marmorated stink bug feeding scars on bell pepper.

Cultural Control

- Place screens over windows, doors and vents
- Remove window air conditioners
- Repair caulking cracks

Chemical Control

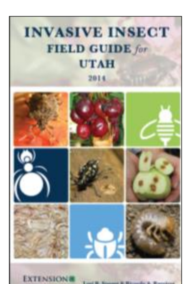
- BMSB can be difficult to manage
  - Movement between habitats
  - Cryptic, difficult to sample
  - Evidence of resistance development
  - Repopulation occurs through migration from non-treated areas

Natural Enemies

- Parasitoid from China
  - >50% egg parasitism in China
  - Low levels of parasitism in the U.S.(~ 4%)
- Fungal pathogens, other natural enemies



Announcements



EXTENSION
UtahStateUniversity

Invasive Pests in Backyard Fruit Trees and Berries: Spotted Wing Drosophila and Brown Marmorated Stink Bug

UTAH STATE UNIVERSITY EXTENSION

Overview
This hands-on workshop will cover the biology, monitoring, identification, and control of Spotted Wing Drosophila and Brown Marmorated Stink Bug. Each workshop participant will be given a bound copy of USU's Invasive Insect Field Guide for Utah, which outlines the identification and distribution of these insect pests (and several others), and descriptions of crop injury.

SWD
Is a destructive pest of tree fruit and berries. SWD was first detected in Utah in 2010. SWD has been found in Rich, Cache, Box Elder, Weber, Davis, and Utah Counties.

BMSB
Is a serious pest of fruits, vegetables, and ornamentals. BMSB is also a nuisance pest because it overwinters in sheltered environments. BMSB was first detected in Utah in 2012 and has been found in Salt Lake and Utah Counties.

This workshop is offered at various locations and dates to accommodate your schedule!
Provo, February 25, 6:00-7:30 pm
Brigham City, March 6, 6:00-7:30 pm
Logan, March 7, 10:00-11:30 am
Kaysville, March 21, 10:00-11:30 am
Logan, April 9, 6:00-7:30 pm
Salt Lake City, April 20, 6:30-7:30 pm
Thanksgiving Point, June 6, 10:00-11:30 am

To register for a FREE workshop go to:
www.utahpests.usu.edu/caps/htm/events-and-workshops

For more information about these pests visit:
www.utahpests.usu.edu/caps/htm/invaders

Questions about the workshop?
Call 801-668-4056 or email caps@usu.edu

Funding for these workshops was provided by the United States Department of Agriculture, Utah Department of Agriculture and Food, and Utah State University Extension.

Acknowledgements

USDA-ARS-NIFA SCRI Planning Grant
2014-51181-22514

United States Department of Agriculture
National Institute of Food and Agriculture

UDAF Specialty Crop Block Grant
USDA Farm Bill Grants

Diane Alston
Anna Fabiszak
Jaci Larson
DaShell Burnham
Kris Watson
Clint Burfitt

For more information about BMSB:
stopBMSB.org

USU IPM Group

Biographical Information:
Bonnie Bunn
Utah State University

Bonnie Bunn recently joined the Utah Pests team to conduct outreach in vegetable integrated pest management. Bonnie is completing her M.S. in Biology at USU under Diane Alston. She ran the 2014vegetable IPM advisories, monitored and trapped for vegetable pests, and is expanding the vegetable diagnostics image database.

Session Description:
This session will be covering the different options USU offers through its IPM program.

How Much Water is Needed? Using Sensors to Improve Plant Performance

Biographical Information:
Dr. Dan Drost
Utah State University

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, the creation of efficient farm systems, and intensive land-use management.

Session Description:
To improve irrigation water management, measuring and monitoring soil water status is an essential component of best management practices (BMPs) to conserve water and improve water quality. Efficient irrigation requires a systematic water management program. Such a program answers the questions of when to irrigate, how much water to apply during irrigation and how best to apply the water (rate of application, method, etc.). A key component of good on-farm irrigation water management is the routine monitoring and measurement of soil water. Soil water must be maintained between desirable upper and lower limits of availability to the plant if optimal productivity is to be expected. The information discussed will be outline critical times when water is needed, provide some explanation on what happens when water is in short supply, and how to measure or determine soil water content.

How Much Water? Using Sensors to Improve Plant Performance

Dan Drost
dan.drost@usu.edu

UtahState University
COOPERATIVE EXTENSION

Overview

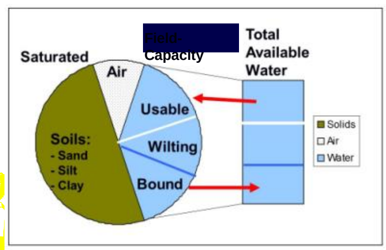
- Soil Properties
- Crop Water Needs
- Critical Water Periods
- Improving Water Use
- Sensors & Monitoring

- Soil Type Issues
  - Sand: Large pores, rapid drainage
  - Silt: Smaller pore size
  - Clay: Highest water holding

Table 1. Ranges of available water by soil texture (PNW Irrigators Pocket Guide).

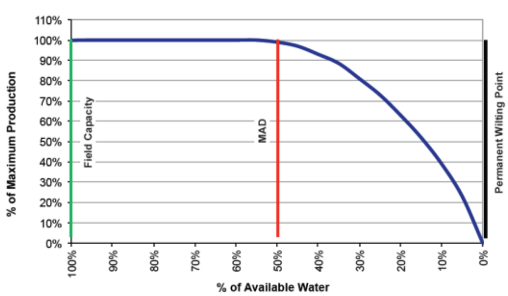
Soil Texture	Available Water Capacity (AWC) in/ft
Coarse Sand	0.2–0.8
Fine Sand	0.7–1.0
Loamy Sand	0.8–1.3
Sandy Loam	1.1–1.6
Fine Sandy Loam	1.2–2.0
Silt Loam	1.8–2.5
Silty Clay Loam	1.6–1.9
Silty Clay	1.5–2.0
Clay	1.3–1.8
Peat Mucks	1.9–2.9

- **Saturated**: All pores water filled; no air.
- **Field Capacity**: water left after 24 hours drainage.
- **Usable**: Water supply before shortage affects growth.
- **Permanent Wilting**: Water unavailable to plant, no recovery.

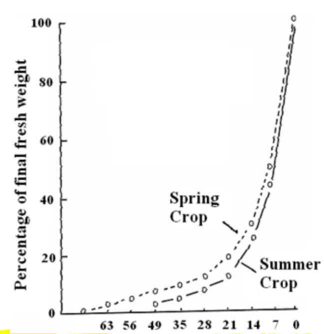


Plant Growth and Water Stress

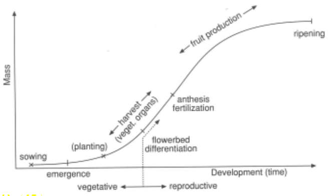
Management Allowable Depletion: % usable water



Leafy Vegetable Growth Patterns

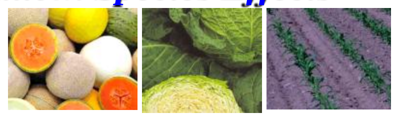


Fruiting Vegetable Growth Patterns



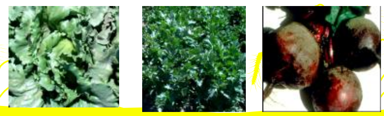
Germination: Species Effects

- **Drier Soil**
  Below Usable Range



- **Moist Soil**
  In Usable Range

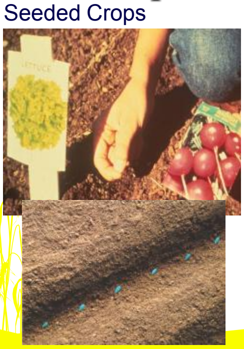
- **Wet Soil**
  Near FC



Crop Establishment

Seeded Crops

Transplants



Crop Growth and Water (cont)

- **Establishment**
- **Vegetative Growth Period**
  - Rooting depth
  - Maximizing leaf area
  - Competition
  - Crop development length

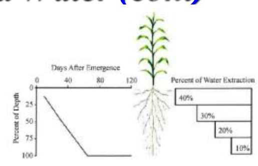
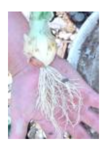


Figure 2. Root zone soil water extraction and plant root development patterns.

Vegetative Growth Issues

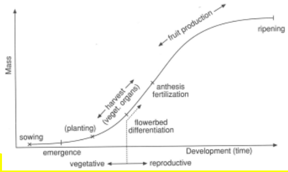
Rooting Depth | Canopy Closure | Season Length



Shallow (12-18")	Moderate (24-36")	Deep (>36")
Cabbage/Broc	Bean	Asparagus
Lettuce/Celery	Carrot	Pumpkin
Spinach	Corn	Wi. Squash
Onion/Beet	Cantaloupe	Sw. Potato
Potato	Pepper	Tomato
Radish	Su. Squash	Watermelon

Crop Growth and Water (cont)

- Establishment
- Vegetative
- **Flowering/Fruiting**
  - Fruit set issue
  - Rapid fruit expansion
  - Disorder development



Early Flowering/Fruiting

Flower Tissue

Immature Fruit

Off-shapes

Crop Growth and Water (cont)

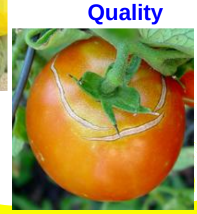
- Establishment
- Vegetative Period
- Early Flowering/Fruiting
- **Fruit Maturation**
  - Fruit size
  - Flavor and color development
  - Disorders

Fruit Maturation

Seed Crops

Fruit Ripening and Flavor

Quality



Critical Periods of Water Use

Crop	Critical Period
Broccoli, Brussels Sprouts, Cabbage, Kale	Head Development
Beet, Carrot, Parsnip, Radish, Turnips	Growth, Root Enlargement
Lettuce, Spinach, Greens	Establishment, Leaf Growth
Sweet Corn	Tasseling and Ear Fill
Eggplant, Peppers, Tomato	Flowering, Fruit Set, and Fruit Sizing
Cucumber, Melon, Pumpkin, Squash,	Vining, Flowering, Fruit Set, and Fruit Sizing
Beans, Peas	Flowering and Pod Development
Onions, Garlic	Bulb Development
Potatoes	Tuber Initiation and Enlargement
Asparagus	Fern Development

Irrigation Methods

- Furrow
- Sprinklers
- Drip

Crop Rooting and Irrigation Needs

Rooting Depth (ft.)	Water Needed to Grow Crop (in)			
	12	12-17	18-24	30-40
Shallow (<1.5 ft.)	Lettuce (early) Spinach	Brassica Crops	Lettuce Potato (early) Onion Sw. Corn	Celery Potato (late)
Medium (1.5-3 ft.)	Pea	Cucumber Beans	Beet Carrot Eggplant Pepper Sum. Squash	
Deep (3+ ft.)		Lima Bean Watermelon	Asparagus Muskmelon Squash Pumpkin Tomato	

Soil Water Monitoring w/ Sensors

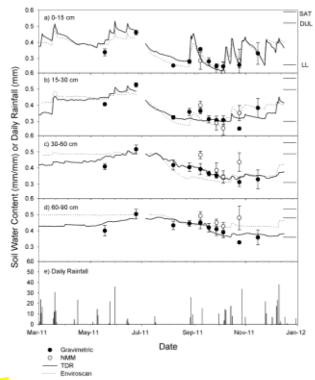
- Feel or Appearance
- Gravimetric
- Porous Blocks
- Probe Types
- Tensiometers




Method		Advantages	Disadvantages
Feel		Easy, $	Skill required, low accuracy, not suitable to all moisture ranges
Gravimetric		Direct measure, $, accurate, relatively simple	Accurate sampling equipment, scales, driers, good calculation skills
Tensiometers		Easy to read, $80-100, large sphere measured, simple to install and maintain,	Limited range, slow response, one reading, good soil contact, frequent maintenance,
Porous Blocks		Simple, $30-50, easy to maintain, good sphere	Low resolution, slow reaction, temperature sensitive, drying out
Probes		Accurate, large radius of measure, $500+, not influenced by salts, measure many depths	Safety, calibration, Installation issues, slow readings, expensive, may be influenced my soils

Change in Soil Water over Time and Depth

- Sensors track changes. Note that some like the TDR or Enviroscan continuously track water content.
- Gravimetric & NMM are spot measurements but show similar values
- Note SWC is more constant as depth in soil profile increases
- Note dry down occurring late in growing season.



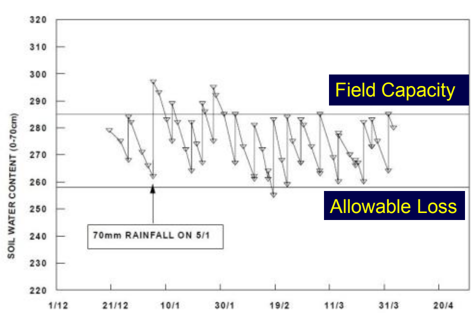


Figure 1. Soil water content in the surface [redacted]

Conclusions

- Know & Understand your Soil
- Understand the Crops Grown
- Time Applications to Crop Needs
- Monitor, Monitor, Monitor
- Use Data to Help with Irrigation Mgt.

QUESTIONS?

Utah Agricultural Experiment Station

UtahState University COOPERATIVE EXTENSION

Low-flow or drip irrigation systems

Biographical Information:
Ron Patterson
South Meadows Produce and Utah State University

In addition to being the USU Extension County Agent in Carbon County, Ron has operated his small farm to supply CSA customers and a vendor booth at the High Desert Growers' Farmers' Market in Price, UT. Living on the dry side of the second driest state in the nation, and having access to only culinary water, he has focused on irrigation efficiency. He also designed a do-it-yourself high tunnel that will withstand the severe spring weather conditions of East-central Utah.

Session Description:
Advantages and disadvantages of drip irrigation systems

Layout and design issues

Management and maintenance

Drip Irrigation

Ron Patterson
Utah State University
Carbon County

Extension
UtahStateUniversity

Irrigation Systems

- Surface
- Sprinkler
- **Drip/Micro**

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Objectives

- System Selection
- Design & Installation
- Operation & Maintenance

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2 Approaches

- 1 line
  - Water frequently
  - Plants do not require less water
  - Hard to catch up
- Use soil bank
  - 2 or more lines

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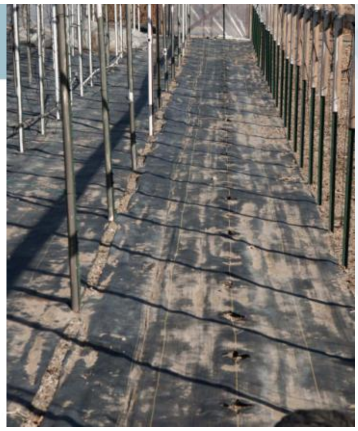

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System Selection

- Drip/Micro
  - Drip
    - Tube
    - Tape
    - Emitters
  - Micro spray
  - Bubbler
    - Higher flow rate
  - Subsurface drip.

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Drip Irrigation Advantages

- Efficiency
- Accuracy
- Expensive water
- Flexibility
- Slope application/runoff
- No water on foliage
- Fertigation.

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Drip Irrigation Disadvantages

- Initial cost
- Clean water/filtering
- Design requirements
- Slope/pressure differential
- No water on foliage.

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Design & Installation

- Factors to consider
  - Soil characteristics
  - Root depth
  - Flow rate
  - Watering schedule
  - Row length
  - Pressure & slope.

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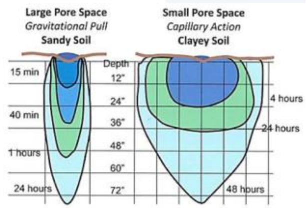
Design & Installation

- Soil characteristics
  - Texture
  - % organic matter
  - Infiltration rate
  - WHC.



Average Available Water Holding Capacity of Soils

Source: Grant Cardon, Utah State University Extension, Soil Specialist

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

Design & Installation

- Root depth
  - Majority in top 12 inches
  - Group crop irrigation by root depth
  - Water for root depth.

Design & Installation

- Flow rate
  - 5 gallon time
    - Gph = (5x3600)/time in seconds
    - Example—82 seconds
  - General rule
    - ¼” tube—35 gph
    - ½” tube—220 gph
    - ¾” tube—480 gph
    - 1” tube—780 gph

Design & Installation

- Watering schedule
  - Frequency depends on # lines
  - # hours
  - 0.6234 gallons = 1”/ft^2

Design & Installation

- Row length
  - Example
  - .25 gpm/100’, 12” emitter spacing
  - Flow 190 gph
  - How long can the row be?

- Example
  - .25 x 60 = 15 gph/100’
  - 190/15 = 12.67 100’ lengths
  - 1267’ maximum row
- Or
  - 190/60 = 3.17 gpm flow
  - 3.17/.25 = 12.67 100’ lengths
  - 1267’ maximum row

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Design & Installation

- Pressure & slope
  - .434
  - Go uphill pressure decreases
  - Go downhill pressure increases
  - Runoff

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Operation & Maintenance

- How long and how often do you run it?
  - Duration depends on soil characteristics and root depth
  - Frequency depends on evapotranspiration
  - Start with full profile
  - Check soil moisture level often

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Operation & Maintenance

- Example
  - Corn
  - Silty Clay Loam
  - Flow = 109 seconds for 5 gallons
  - .380 GPM/100’ drip tape, 12” emitter spacing
  - 2 lines
- Answer
  - How long and how often to run system

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Operation & Maintenance

How long?

- Corn root depth
  - 3 ft.
- Soil WHC

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Average Available Water Holding Capacity of Soils
Source: Grant Cardon, Utah State University Extension, Soil Specialist

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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

Operation & Maintenance

How long?
- Corn root depth
  - 3 ft.
- Soil WHC
  - 2” per foot
- Place 1.5 – 2” each irrigation

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Operation & Maintenance

- How many gallons to apply?
  - 2 inches x .62 gal/inch = 1.24 gallons
  - 1.5 inches x .62 gal/inch = .93 gallons
- How long to run to get 1.24 gallons?
  - .38 gpm/100’ x 60 min/hr = 22.8 gph/100’
  - 22.8/100 = .228 gal/emitter
  - 1.24 gallons/.228 gph/ft = 5.4 hours
  - .93 gallons/.228 gph/ft = 4.1 hours

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Operation & Maintenance

- Filtering
  - Screen
  - Disc
  - Sand
- Watch crop carefully—moisture sensor
- Check for leaks and blocked emitters
- Fertilization

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Questions?

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Small Acreage Low Flow (Micro or Drip) Irrigation System Design and Installation

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Robert W. Hill, Extension Specialist – Irrigation

Irrigation has been an essential part of Utah's agriculture since pioneer days. Over half of Utah's 1.3 million irrigated acres are watered using surface methods such as flood, furrow, border, or basin irrigation. About 40% of the irrigated acreage is under some form of sprinkler irrigation, including hand move, wheel move, center pivot, and other types. Low flow or micro-irrigation systems, including drip emitters, emitter tubes, drip tapes, bubblers and micro-sprinklers (sprays) are currently used on only a small fraction of the total irrigated area, but will become more common as water becomes more scarce and expensive. Currently, low flow and micro-irrigation is primarily used in orchards, vegetables and landscapes. When designed and operated properly, low flow or micro-irrigation systems apply water more efficiently and uniformly than sprinklers or surface irrigation systems, conserving water and generating higher yield per unit of water applied.

Most low-flow systems are designed to operate at pressures of 10 to 25 pounds per square inch (psi). Municipal water systems typically deliver water at 50 to 70 psi. Water pressure can be tested with a pressure gage designed for water systems. Some gages are designed to test static pressure and can be fastened directly onto the hose bib or pipe. Other gauges are designed to test the pressure of flowing water, such as in a sprinkler nozzle, by inserting the tester directly into the stream of water. Simple pressure gages can be purchased at a local plumbing or irrigation supply store.

For most low-flow systems, a pressure reducer will need to be installed to provide the manufacturer-recommended pressures for low-flow components and fittings. Be sure to install the pressure reducer *before* testing for flow rate.

Low Flow Irrigation System Characteristics

Individual Drip Emitter & Emitter Tubes

Individual drip emitters apply water at a given rate to a specific location. Emitters are typically rated at 1 – 4 gallons per hour. Emitters are usually attached at the end of a ¼″ tube that is connected to the main supply line. Some emitters are pressure compensating and can be connected to higher-pressure lines or to lines that have variable pressure due to changes in elevation. Other emitters must have the supply pressure reduced in order to function properly.

Another type of emitter is the emitter tube, which has minute laser-drilled holes spaced at six or twelve-inch intervals. Each hole emits ½ gallon per hour. Emitter tubing is typically ¼″ in diameter. It is used to supply water to plants growing in rows, or to cover large areas that would otherwise require numerous individual emitters. Good filtration is needed to minimize plugging of holes.

Drip Tape

Drip tape is a thin-walled single or double tube which has emitter holes spaced at regular intervals. It is designed for short-term use (such as annual row crops or vegetable gardens) but can last several years if carefully rolled up and stored through the winter. It may also last for multiple seasons if buried. Drip tape is deployed on the soil surface, with the emitters facing ***upward.*** It can be spaced at whatever interval is needed to provide adequate coverage. Like emitter tubing, drip tape will become plugged if unclean water is used.

Bubblers

Care must be taken when selecting bubblers for a low-flow irrigation system. Some bubblers measure output in gallons per minute. For a low-flow system a bubbler should not exceed 60 gallons per hour or one gallon per minute.

Bubblers are typically used to fill a small basin area very quickly and should not be used where run-off may occur.

Micro-sprinklers and Sprayers

In some situations it is desirable to wet more soil surface than is wetted by a typical drip emitter. Root growth occurs only in the portion of the soil wetted by precipitation or irrigation. If a large plant (such as a tree) is irrigated using a drip emitter, only a small area is wetted and the tree may become "root bound" and stunted, much like a large house plant growing in a small pot. This can be prevented by installing multiple drip emitters, or by using emitters that wet more soil.

Micro-sprinklers (which have moving parts) and micro-sprayers (which have no moving parts) are low-flow emitters that wet a relatively large area of soil. They are useful in orchards, flower beds, ground cover plantings and other situations where more irrigation coverage is needed. Micro-sprinklers and sprayers provide better lateral coverage of water on sandy soils than drip emitters, and minimize ponding and soil saturation problems that may occur under drip emitters on clay soils. They are available in several patterns (full or part circle), coverage and flow rates.

Because micro-sprinklers and sprayers emit a mist of water over a relatively large area, evaporation losses are higher than under traditional drip emitters. A larger wetted area also means more potential for weed growth. Flow rates from micro-sprinklers and sprayers may be four to ten times higher than flows from traditional emitters, so system design and zoning must account for required flow rates.

Micro-sprinklers and sprayers are typically installed several inches above the soil surface on a ¼″ feeder tube attached to a supply line. It is important that micro-sprinklers and sprayers be mounted with the spray discharge parallel to the soil surface to avoid distorted spray patterns and uneven coverage. They are less prone to plugging than drip emitters, but water filtration is still needed to minimize plugging. With many different sizes and styles of sprinklers and sprayers available, irrigation coverage and volume can easily be adjusted by simply changing emitters.

Sub-surface (buried drip)

Sub-surface drip tape or tape covered with mulch can be even more efficient than surface systems, since there is less evaporation from the soil surface. Buried components can be connected to underground or above-ground supply lines, and deliver water directly to the root zone.

Sub-surface drip tape should be buried deep enough to avoid problems with tillage operations, yet shallow enough to supply moisture to the majority of the plants' feeder roots, which are typically in the top 12 inches of the soil. In instances where the system is providing water for germinating seeds, the drip line should be within 4 to 5 inches of the soil surface. These factors should be carefully considered before a buried drip line is installed. One point of caution regarding subsurface irrigation systems—rodents, such as gophers, voles, ground squirrels and mice, can cause serious operation and maintenance problems as they seem to like chewing through the buried tubes.

Estimating System Flow Rate

Flow rate refers to the quantity of water that the system can safely deliver. The flow rate of a drip system is typically measured in gallons per hour (gph). The first step in determining flow rate is measuring the output of the supply source, since it is important to match the system gph requirement to the water source supply. An easy way to measure the supply flow rate is to time how long it takes to fill a container such as a 5-gallon bucket. Using a larger container (or two 5- gallon buckets) will allow a more accurate measurement, since flow rate can be measured over a longer period of time. The following procedure uses a five-gallon bucket to determine flow rate, but can be adapted to larger containers:

- Mark the 5-gallon line on the bucket
- Get stopwatch ready to go
- Turn on supply water away from the bucket (be sure the pressure reducer has been installed previously).
- Simultaneously start the stopwatch and run the water into the bucket
- Stop the stopwatch as soon as the five-gallon mark is reached
- Turn off the water and calculate the gallons per hour using this formula:

gallons per hour (gph) = (5 gallons x 3600)/time in seconds

Example: If the time required to fill a 5 gallon bucket is 82 seconds then the flow rate is 220 gallons per hour (220 = 5 x 3600 / 82). If a quantity other than 5gallons is used, substitute the number of gallons measured where "5" is in the formula.

A general rule of thumb for flow rates of common-sized polyethylene pipe is:

¼″ – 35 gph; ½″ – 220 gph; ¾″– 480 gph; 1″– 780 gph

The next step is to design the irrigation zones so they will not exceed the supply flow rate. A zone is an area that would all be irrigated through the control of a single valve. Zones should be designed based on the needs of the plants and the soil type. High water use plants should not be grouped with drought tolerant plants, and sandy soils should not be irrigated using the same zones as clayey soils.

The flow requirement of a zone is calculated by adding up the flow from all the emitters in the zone. For example 1/4″ emitter tubing usually has a flow rate of ½ gallon per hour per emitter hole. The holes are typically spaced at 6″ or 12″. This means that with a ½″ supply pipe there could potentially be 440 emitter holes in each irrigation zone (220 gph/.5 gallons per emitter = 440 emitters). A word of caution: there is no way in the

world you will be able to force 220 gph through that much ¼″ tubing. The rule of thumb for the maximum length of ¼″ emitter tubing with 6″ spacing between emitter holes is 19 feet of tubing. Beyond that, efficiency and consistency are lost. The rule of thumb for the length of emitter tubing with 12″ spacing between emitter holes is 33 feet. Thus, if ¼″ emitter tubing is used the lines connected to the supply line should not exceed the amounts indicated above.

Filtration

Filtration requirements for a low-flow system depend on water quality and the intended flow rate of the system. Water from a culinary system may require little or no filtration, while canal or pond water may contain so many contaminants that water filtration becomes costly or impractical. Mineral particles, organic matter and algae are the primary concerns when filtering water for a low-flow system. The filtration system must be capable of handling the flow rate of the irrigation system.

The three standard filter types used in low-flow irrigation are sand media filters, screen filters and disk filters. Sand filters are metal or plastic canisters filled with sand or layers of sand and gravel. Water is filtered as it passes through the pores between sand grains. Most sand filters are designed to be self cleaning through a back-flushing mechanism. Screen filters consist of a plastic or metal mesh that traps contaminants, and are available in various mesh sizes. The higher the mesh number, the smaller the openings in the mesh. Disk filters are made by stacking metal or plastic disks inside a canister. Water is filtered as it negotiates small openings between the disks. Both screen and disk filters are cleaned by physically removing the filters and brushing or flushing the screens or disks.

Most culinary water is treated with chlorine, which eliminates algae problems. When using culinary water in a low-flow irrigation system, the main concern is mineral particles that may plug emitters. Depending on the emitter opening size, a 100 – 200 mesh screen should provide adequate filtration. This should be confirmed by referring to the manufacturer's specifications. While well water may have more sediment than municipal water it can generally be filtered in the same way as described above.

Irrigation water from a canal or pond may cause serious plugging problems without adequate filtration. Large and small organic particles, algae, and silt or other suspended minerals are common in surface water sources. In this situation a sand media filter combined with a screen or disk filter is much more effective than either filter alone.

When using muddy water from a canal or ditch, a settling structure may be needed in addition to the filtration system. A settling structure is typically a diversion designed to slow the current, allowing sand and silt to drop out of the water before it passes through the filters. Like other filtration components, settling structures must be cleaned periodically, either by physically removing sediment or through a flushing system.

In some instances it may be necessary to chlorinate raw water to prevent algae growth in a low flow system. This procedure will be dealt with in a separate fact sheet.

Other Considerations

The number and placement of emitters is critical, since the irrigation system must deliver water to the soil where plant roots are located. For closely spaced plants such as vegetables, bedding plants and herbaceous perennials the emitters should be spaced closely enough to provide uniform soil coverage.

Irrigation systems for young woody plants (trees and shrubs) should be designed with excess capacity to accommodate more emitters and higher flows as the plants grow. Mature woody plants not only use more water than younger plants, but have much larger root systems. Roots cannot grow in dry soil. If the irrigation system does not wet a large enough volume of soil, trees and shrubs become root bound, much like a large house plant in a small pot. Emitters can be added as the plants grow if extra capacity is built into the initial design. Low-flow irrigation systems can allow for precise application of fertilizer (fertigation) and other chemicals (chemigation) directly through the irrigation system. These topics are dealt with in a separate fact sheet.

Summary

Low flow irrigation systems provide an efficient and effective way to water plants. A wide variety of emitters and delivery systems are available. Plant type, system capacity and filtration requirements are all important considerations when designing a low flow system.

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Where Can You Get Help?

Utah State University - Extension Service
Utah Counties – Extension Office see:
http://extension.usu.edu/htm/counties for directory.

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Small Acreage Irrigation System Operation and Maintenance

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CHARACTERISTICS OF IRRIGATION METHODS

Surface Irrigation

Surface irrigation includes flood (sometimes denoted "wild flood," as in uncontrolled), furrow, border, and basin. Surface irrigation operation and maintenance may be more of an art than a science. It can also be more labor intensive than other irrigation methods. Proper design of surface irrigation systems takes into account the soil type (texture and intake rate), slope, levelness of the field, stream size, and length of run. It is generally more difficult to obtain high uniformity of water distribution in long fields on coarse textured soils (gravel and sands) than on fine textured soils (loams to clay).

Sprinkler Irrigation

Sprinklers are any of numerous devices for spraying water over the soil surface. They include impact, rotators, sprays, and wobblers and may be made out of brass, plastic, or zinc. Field systems include hand move, wheel move, center pivot, solid set, drag line (such as K-Line™), and water cannon. Sprinklers can be a good investment when properly designed, installed, operated, maintained, and managed.

Water from a sprinkler discharged into the air should infiltrate the soil where it falls, but it should not saturate the soil surface to the point of ponding and/or run off. For high uniformity of wetting, the spray patterns from adjacent sprinklers must be properly *overlapped*. This generally means that the water sprayed from one head reaches the adjacent spray heads. Evaporation, wind drift, and deep percolation are chief causes of water loss.

Sprinkler irrigation is suitable for almost all crops and is a good choice for fields that have varied soils and topography because the depth of water application is independent of surface variations.

If runoff is occurring, the rate of application should be reduced to match the rate of soil water intake. Sprinklers are convenient for small acreage situations, but do require a continuous supply of water during operation. Small amounts of water (0.5 to 2 acre-inches per acre) can be applied more uniformly with sprinklers than with surface methods. Thus, sprinklers are suitable for coarser textured soils and shallow rooted crops.

Low Flow (Micro or Drip) Irrigation

Low flow or micro-irrigation methods include drip (individual emitters apply water to the soil surface), micro-spray or micro-sprinkler (water is sprayed in a small area close to trees or shrubs), bubbler (stream of water is applied to small basins by individual trees), and subsurface drip (emitters apply water below the soil surface). Relatively small amounts of water can be precisely applied with low flow or micro-irrigation methods. Thus, low flow or micro-irrigation is adaptable to any soil type where daily or more frequent irrigation may be required. However, a continuous supply of water is required during operation. Due to the small opening size of the emitters, supply water must be adequately screened or filtered to eliminate clogging. Low flow or micro-irrigation is suitable for individual trees and shrubs, fruit crops, vegetables in beds or rows, and other high-value crops, but not generally for field crops such as alfalfa, grain, and pasture, due to the high installation cost.

OPERATION

Good operation of any irrigation system includes matching the irrigation duration with the rate of application and the intake rate of the soil to maximize the fraction of water stored in the root zone. Field irrigation (application) efficiency is the ratio of water stored in the root zone divided by the water delivered to the field. For example, if 5 inches of water are delivered to an acre during irrigation and 3 inches are ultimately stored in the root zone, then the application efficiency (Ea) is 60% ($60 = 100 \times 3/5$). In this example, since volume equals area times depth and the area is one acre, the equivalent volume of water delivered is 5 acre-inches. If a field is under-irrigated, all the infiltrated water could be stored in the root zone, giving an apparent high irrigation efficiency even though the water distribution uniformity across the field may be poor. Conversely, an over-irrigated field will have low irrigation efficiency, even if the irrigation was very uniform, because of the deep percolation. Thus, knowledge of the soil moisture content prior to irrigation is essential to maintaining high application efficiency while providing sufficient water for optimum crop growth.

Surface (Flood, Furrow, Border)

Operation of surface irrigation requires being there to “tend” the water, i.e. to move the water to successive application points as it reaches the end of the run. Adequate water application from the top to the bottom of the field can be realized if the water in furrows reaches the end of the field within one-quarter of the planned irrigation duration. For example, if the irrigation is planned to take 12 hours, then the water advance to the end of the field should be accomplished in 3 hours. Once the water reaches the end of the field the application rate at the top of the field should be cut back to avoid excess loss of runoff water. Where possible, the supply stream flow to the furrows should be adjusted to match the intake rate of the field. This could be accomplished by spreading the water over more or fewer furrows or borders. Some tail water runoff is inevitable if the bottom of the field is to be adequately irrigated; however, it should be minimized. If possible "capture" runoff water and reuse it in lower fields.

The use of border irrigation changes the operation from that of furrows in that a "sheet" of water moves across the field. The supply stream should be moved to the next border prior to the advance reaching the end.

Sprinkler

To realize the full benefit of the sprinkler system, it must be operated according to design. The nozzle size, available pressure, and set duration should produce an application rate that matches the intake rate of the soil and evenly distributes the amount of water needed to refill the depleted soil water in the crop root zone.

To achieve a uniform application, the sprinkler spacing or move distance may need to be adjusted to compensate for variations due to wind or exceptionally hot days. This may involve special operating techniques such as using an offset hose or alternating between day and night on successive irrigation cycles to improve distribution uniformity. Where pressure differences, within a sprinkler system, result in low water application uniformity, special hardware such as flow control nozzles or pressure regulators may be required.

Low Flow (Trickle or Drip)

The supply water must be screened or filtered to reduce or prevent drip system emitter clogging. Depending on the amount of debris (silt, sand, and/or trash) in the source water, the filters or screens may need servicing daily or more frequently. This is a particular concern when water is supplied from an open ditch or canal. The frequency of cleaning the filters may be greater in the spring when more debris is in the water.

Operating pressure. Low-flow systems are designed to operate with low pressures, usually 15-25 psi. Fittings and connections are not designed to handle the higher pressures of household or culinary systems. Be sure to operate within the design specification of your system. Inexpensive pressure regulators can be used to keep your water pressure within the desired range.

Emitter placement and flow metering. Low-flow systems place water very accurately. Depending on the soil type, the water may spread over an area of more than 24 inches in diameter (12 inches from the emitters). In order to get the water to spread out, it is important to not cycle the system. The water needs to be discharged continuously to assist the capillary action of the soil to spread the moisture horizontally. Since low-flow system designs do not typically have surface water runoff problems, cycling the system is not usually needed. Medium coarse to coarse soils have a weak capillary action so the water will not spread out as much. Emitters in coarse soils will need to be closer together. A general rule is to space emitters 12 inches apart in sandy (light) soils, 18 inches apart in loamy (medium-textured) soils, and 24 inches apart in clayey (heavy) soils.

Low-flow systems may be automated. The length of time for running the system depends on the soil type, emitter flow rate and depth of the root zone. Since low-flow systems are measured in gallons per hour (gph), it is helpful to know that 0.62 gallons of water will provide one inch of water on one square foot of soil surface. Thus, if the area being irrigated is 100 square feet and the desired amount of water to apply is 1 inch, then the system should apply 62 gallons of water to the target area. (Formula = inches of water to apply X square feet to cover X 0.62)

For large plants, such as trees and shrubs, that have a large root system, a micro-sprayer or bubbler may be more appropriate. Flow rates will typically be fairly high for bubblers or micro-sprayers. Regardless, it is important to supply enough water to wet the root zone, both horizontally and vertically, with the top 12 inches being most critical. With large trees and shrubs it is especially important to place emitters or micro-sprinklers over the entire root zone and not just at the trunk or base.

MAINTENANCE

Proper maintenance involves anticipating the need for repairs and replacement of worn mechanical parts and damaged or broken pipes. Spare parts of commonly needed items should be kept on hand for emergencies. Periodic inspection of supply ditches or pipes, mechanical equipment (such as pumps, nozzles, emitters and filters) and distribution systems should be made throughout the irrigation season. It is a good idea to perform preventative maintenance in the fall, winter, and/or early spring in order to be ready for the next irrigation season.

An audit or evaluation of the irrigation system is recommended if you suspect that the system is not as efficient as it should be. An audit determines the depth of water being applied, and distribution uniformity. If a pump is used, it is tested to determine fuel or energy use efficiency. Contact your local county extension office for more information about irrigation system audits. See also: http://www.slowtheflow.org/watercheck/default.aspx

Surface (Flood, Furrow, Border)

Ditches should be cleaned out at least annually and more often if needed. A shovel can be used to clean smaller ditches. A mechanical ditcher and tractor is very helpful on larger ditches. Often ditch cleaning is an early spring “rite” to be completed prior to the first delivery of water. Many irrigation and canal companies require that shareholders maintain their own head gates and keep them in good operating condition. In areas where rodent damage is a problem, “tromping gopher holes,” or otherwise fixing leaks in ditches may be a daily chore. Periodic re-leveling of surface irrigated fields may be needed to compensate for soil settlement or consolidation over time.

Sprinkler

Regular maintenance of sprinkler equipment will reduce repair costs, help the system last longer, and keep irrigation efficiency at design levels. Each manufacturer provides guidelines and manuals for equipment operation and maintenance. Such information is the preferred source and should be referenced when performing irrigation equipment repair and maintenance.

Sprinkler systems should be inspected and any necessary repairs completed prior to the start of the irrigation season. All irrigation systems should receive special attention at the end of each irrigation season. During the fall, while water is still available for operation, it may be a good idea to run the sprinkler system and look for problems. This will allow you to plan for any needed maintenance well in advance of the next irrigation season. Check all nozzles for plugging, mismatched sizes, breakage, corrosion or other damage caused by wear. Couplers and connections should be checked for leaks and repairs/replacements should be completed as soon as possible. If a sprinkler system has been properly prepared for winter storage, spring maintenance is much easier. Often local irrigation supply companies provide a fall or winter tune-up service at a reasonable cost. If the field is used for pasture, careful attention should be given to protecting the irrigation system from livestock damage.

Low Flow (Trickle or Drip)

Flush the system at the beginning of the growing season and check to be sure the emitters are not clogged. Do this by opening the ends of the tube and running clean water through the system, starting with the lines closest to the supply source. Once the tubes have all been checked and sealed again, check for flow from each emitter. Regular flushing of the system throughout the season may be necessary depending on the cleanliness of the water supply and filtering system. This will help remove larger mineral and organic matter particles that can clog emitters.

To keep the small openings in low-flow systems from becoming clogged, the water source must be properly filtered. The cleanliness of the irrigation water will determine how often the filters should be checked and cleaned. For systems that use culinary water this may mean only a couple of times during the growing season. A 150-200 mesh screen will generally be adequate. For secondary water systems, supplied from a ditch or pond, it may mean daily. If continual clogging is a problem, it may be necessary to select finer screens or use a sand filter or chemically treat the water.

Check the filters regularly and frequently until the best cleaning schedule for the system can be determined. The frequency of cleaning the filters may be greater in the spring when more debris is in the water. Back flushing, or removing the filters and washing them out backwards is the most common way to clean most filters. Replace the filters when they get holes or openings too large to filter out damaging or clogging particles.

Organic matter slipping past the filter or algae growing in pipes or fittings may cause serious system problems, especially when the source is a secondary water system. Opening the end of the system and flushing will help remove organic matter. If algae growth is a problem, chlorine can be used to kill the algae. Applying a concentration of 10 to 20 ppm of chlorine for 30 to 60 minutes should solve most algae problems. After the algae has been killed it will need to be flushed as described above.

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Additional information on wheel move sprinkler management is available on the Utah State University Web site at: http://extension.usu.edu

Select “Publications” and then select “Irrigation Engineering”

List # Title and year published:

03 Energy Conservation with Irrigation Water Management – AG/BIE/WM02 May 1999

09 Maintenance of Wheelmove Irrigation Systems – ENGR/BIE/WM05 August 2000

38 Wheelmove Sprinkler Irrigation Operation & Management – ENGR/BIE/WM08 Aug 2000

WHERE CAN YOU GET HELP?

Utah State University - Extension Service

Utah Counties – Extension Office see: http://extension.usu.edu/htm/counties for directory.

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This publication is issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Noelle E. Cockett, Vice President for Extension and Agriculture, Utah State University.

July 2009 AG/SmallAcreage/2009-01pr

Small Acreage Irrigation System Selection

James V. Barnhill, Agricultural Agent – Weber/Morgan County
Robert W. Hill, Extension Specialist – Irrigation
Ronald Patterson, Agricultural Agent – Carbon County

Irrigation has been an essential part of Utah's agricultural production since pioneer days. Utah's 1.3 million irrigated acres are primarily watered with surface irrigation methods. About 40% of the irrigated area is under sprinklers. Low flow or micro-irrigation such as drip emitters, drip tape, and micro-sprinklers irrigate a small portion of the total area. Low flow irrigation is mostly used in orchard, vegetable, and ornamental growing areas.

Irrigation Systems

A complete irrigation system includes the water source, conveyance facilities, field application method and provision for drainage of excess water. Streams, surface reservoirs, municipal water supplies, and wells are common irrigation water sources. Important questions for you to ask about your source of water and site conditions are:

What is your water right?

Water rights in Utah, as in other western U.S. states, are founded on the doctrine of "prior appropriation" and are administered by the State Engineer. All waters are public property in Utah (UT Water Rights, 2005). A ***water right*** is a right to the use of water based upon 1) quantity, 2) source, 3) priority date, 4) nature of use, 5) point of diversion and 6) physically putting water to beneficial use (http://www.waterrights.utah.gov).

What is your water source, supply amount and pressure?

Canals and ditches are the most common irrigation water sources in Utah. The use of pressurized irrigation pipe lines is increasing, often in suburban areas as a secondary water supply. Trash exclusion (water filtration or screening) is a concern with surface sources supplying sprinkler or drip irrigation systems since plugging of nozzles and emitters is a common maintenance issue.

As Utah becomes increasingly urbanized, more small acreage water is being supplied by municipalities. These suppliers deliver a set amount of water for a monthly fee. Municipal water pressure is fairly constant and is not usually a concern, except with drip systems where pressure may need to be reduced. Using culinary water for irrigation can be expensive if it exceeds the monthly allocation covered by the base fee. More efficient application methods, such as drip, may be a good investment when water is expensive or limited.

If your water is delivered through a canal or ditch, how many shares does it take to irrigate your property and when is the water available?

There are about 1,000 irrigation or canal companies in Utah. The amount of water in a share varies considerably from one irrigation company to another. Thus, the number of shares needed to adequately irrigate an acre of land will vary with the irrigation company. Water is usually measured in Cubic Feet per Second (CFS). A flow rate of 1 CFS for 1 hour will cover an acre with 1 inch of water. Most crops use about 30 inches of water per season, however 40 to 50 inches of water is commonly required because of inefficiencies in the irrigation system. Thus, to know whether you have adequate water you will need to determine the flow rate of the water you will be receiving and the amount of time it will be available to you. The water is generally available on "turns" rotated in sequence down the ditch.

The interval between successive turns commonly varies from one week to 14 days.

What is the quality of your irrigation water, particularly the salinity?

Salt content is measured as Electrical Conductivity (EC) in units of decisiemens per meter (dS/m) or millimhos per centimeter (mmhos/cm). Both units of measurement are equivalent. The higher the salt concentration of the water the easier an electrical current passes through it. Generally, water used for field crop irrigation should have an EC of less than 2.0 dS/m (Hill and Koenig 1999, Kotuby-Amacher, Koenig, and Kitchen 2006). The local irrigation company will usually have water quality data on their water source. The Utah State University Analytical Lab (http://www.usual.usu.edu) can provide an irrigation water quality analyses. Contact your local Extension Office for information.

How should you irrigate your property?

The answer to this question requires considering your economic situation, the need to conserve water, and your personal preferences along with the physical realities of the site; slope and levelness, water intake rate of your soil, length of the field, crops grown, water source, water table, and soil salinity. The most common irrigation method for small acreages in Utah is surface (flood) followed by sprinkler. As the population grows, there is an increasing demand for the limited water resources available. This has raised the general awareness of the need for water conservation. Thus the use of low flow irrigation methods is slowly growing.

Soil salinity and non-usable wet spots can often be improved with proper drainage. The need for surface and/or subsurface drainage is indicated by high water tables or wet spots in the field. Also, changing from flood irrigation to sprinklers will usually help with salinity and high water table problems.

Factors to Consider in Selecting an Irrigation Method

Relative advantages and requirement of some common irrigation application methods are given in Table 1. For example, surface irrigation methods (furrow, border, and level basin) are more suitable to land that is relatively flat with a uniform slope. Surface irrigation methods require very little energy (head) compared to sprinklers or drip and are lower in initial cost. The main reason the water salinity level needs to be “low” for sprinklers is the potential for leaf damage from foliar application of “salty” water.

The irrigation method used for a specific small acreage situation is largely determined by the size and shape of the site, water supply, labor availability, and cost. Further discussion of each of the three main application methods is in the following sections.

Table 1. Comparison of Irrigation System Characteristics (Adapted from Neibling, 1997)

FACTORS	SURFACE SYSTEMS			SPRINKLER SYSTEMS				DRIP
	Border	Level Basin	Furrow	Hand Line	Wheel Line	Center Pivot	Big Gun	Drip
Slope Limitations								
Direction of irrigation	0.5 – 4%	Level	3%	20%	15%	15%	15%	None
Cross slope	0.2%	Level	10%	20%	15%	15%	15%	None
Intake Rate Limitations (inches/hour)								
Minimum	Moderate	Moderate	Moderate	None	None	Moderate	Moderate	None
Cost								
Initial	Low	Low to moderate	Low	Moderate	Moderate	High	Low	High
Operation/labor	High	Low	High	High	Moderate	Low	High	Low
Water Quality Limitations								
Salt level (ability to handle)	High	High	Moderate	Low	Low	Low	Low	High
Water Required								
Rate of flow	Moderate	Moderate	Moderate	Low	Low	High	High	Low
Availability	Periodic	Periodic	Periodic	Continuous	Continuous	Continuous	Continuous	Continuous
Conservation								
Irrigation Efficiency	Low	High	Low	Moderate	Moderate	High	Low	Very High
Energy Required								
Head (feet of water)	1 – 5	2 – 5	1 – 5	140	140	65	185	45
Pressure (psi)	NA	NA	NA	40 0 55	40 – 55	25 – 30	55 – 65	10 – 20

Characteristics of Irrigation Methods

Surface Irrigation

Proper management of surface irrigation may be more of an art than a science. It is also often more labor intensive than other irrigation methods. Flood irrigation application methods include; wild flood (letting the water run with no confinement mechanism), border (confining the water between two dikes), furrow (uniformly spaced small ditches), and level basin (dike surrounded flat basin which is rapidly covered with a uniform depth of water at each irrigation). One of the most common water supply methods for flood irrigation is to place a plastic or canvas dam in the head ditch to back the water up, and then a cut a notch in the ditch to let the water out for a specific area of the field. Each time the dam is moved and reset is called an irrigation 'set'. Many variations of this method are used, such as screw open valves (alfalfa valves), slide open gates (head gates), siphon tubes and gated pipe.

The application efficiency (% of water delivered that ends up in the root zone of the crop) of surface irrigation systems varies from as low as 15 to 20% with wild flooding to as high as 85-90% with level basins. Deep percolation and run off are common water losses with surface irrigation systems. Generally the greater the control over water movement and the more precisely level (or graded) the field is the higher the application efficiency. With surface irrigation it is difficult to obtain uniform water distribution on fields that are long or have coarse textured soils (gravel or sands) due to the time it takes for the water to travel to the bottom of long fields and the high intake rate of coarse soils. Management of surface irrigation requires being there to "tend" the water, i.e., to move the water to successive application points as it reaches the end of the run. Water that is not properly tended may move off of the field and enter basements and neighboring properties. Also, the amount of area watered with each set may need to be adjusted to match the amount of water flowing in the supply ditch during that particular irrigation.

Sprinkler Irrigation

Sprinklers can be a good investment when properly designed, installed, maintained, and managed. Sprinkler application methods include; hand line, wheel line, solid set, center pivot, big gun, and end tow (lines of sprinklers which are towed to the next desired location) systems. Sprinklers apply water more efficiently and uniformly than typical surface irrigation systems, thus they produce more crop yield for each acre-foot of water supplied.

Water discharged from a sprinkler into the air should infiltrate the soil where it falls, there should be no runoff. For high uniformity of wetting, the spray patterns from adjacent sprinklers must properly overlap. Generally, in a full coverage situation, the spray from

one sprinkler head should reach the adjacent sprinkler heads. Evaporation, wind drift, and deep percolation are the chief causes of water loss from sprinkler systems.

Sprinkler irrigation is suitable for almost all crops and is a good choice for fields that have varied soils and topography because the uniformity of water application is independent of surface variations. Where soils have low water intake rates, lower discharge nozzles can be used or the length of time the sprinklers operate at each setting can be adjusted to reduce runoff. Sprinklers are convenient for small acreage situations, but do require a continuous supply of water during operation. Small amounts of water (0.5 to 2 acre inches per acre) can be applied more uniformly with sprinklers than with surface methods. Thus, sprinklers are suitable for coarser textured soils and shallow rooted crops.

Low Flow (Drip) Irrigation

Low flow or micro-irrigation methods include drip (individual emitters apply water to the soil surface), micro-sprinkler (water is sprayed over a small area close to trees or shrubs), bubbler (stream of water is applied to small basins near individual trees), and subsurface drip (emitters apply water below the soil surface). Relatively small amounts of water can be precisely applied with low flow or micro-irrigation methods. Thus, low flow irrigation is adaptable to almost any soil; however it is particularly valuable on very coarse low water holding capacity soils where daily or more frequent irrigation is needed. A continuous supply of water is required during operation of the low flow system. Due to the small opening size of the emitters, supply water needs to be adequately screened or filtered to eliminate clogging.

The initial cost of low flow systems is relatively high, thus usage is usually limited to higher value crops. Of course, if the amount of water is limited or its cost is extraordinarily high, the use of low flow methods may

be a good investment. Low flow (drip) irrigation may be the only viable option for crops grown on steep slopes and gravelly soils. Low flow irrigation is also suitable for small and odd shaped parcels, for windbreaks, trees, vines, vegetables, and shrubs.

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Additional information on irrigation is available on the Utah State University web site at: http://extension.usu.edu

Select “Publications” and then select “Irrigation Engineering.”

WHERE CAN YOU GET HELP?

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Utah Counties – Extension Office see: http://extension.usu.edu/counties for directory.

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Irrigation Issues

Biographical Information:
Niel Allen
Extension Irrigation Specialist
Utah State University

As the Extension Irrigation Specialist Dr. Allen works with irrigators and water users in Utah. His goal is to provide assistance to better utilize waters of the State of Utah. Agricultural irrigation water diversions consists of about 82 percent of Utah's fresh water diversions (USGS, 2009). Additionally, irrigation of landscapes, gardens, golf courses, and parks consume about 60 percent of the urban, domestic, and municipal water supplies. He has 35 years of professional irrigation expertise. He has work at the University level for 10 years and 25 years with private irrigation and consulting firms. His expertise include estimation of irrigation water requirements, irrigation suitability analysis, economics of irrigation, water rights, preparation of water conservation and management plans, agriculture and landscape irrigation system assessment, water resources planning, technical litigation support, water rights negotiation support, and water management policy. His current research includes safflower irrigation, pasture irrigation, and water use of gardens.

Session Description:
Irrigation scheduling, crop water requirements, water application rates, and irrigation systems for small and urban farms.

Irrigation Scheduling for Urban and Small Farms

Urban and Small Farm Workshop
February 18, 2015

Presentation by
L. Niel Allen
Extension Irrigation Engineer
n.allen@usu.edu
http://extension.usu.edu/irrigation/

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COOPERATIVE EXTENSION

Irrigation Scheduling

- ***When*** to irrigate and
- ***How much*** water to apply

OBJECTIVE:

Apply only the water needed met crop water use and to refill the root zone

Information Needs

- Plant or crop water use
- Crop root zone and readily available water
- Irrigation system capabilities

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Plant or Crop Water Use

- Evaporation and transpiration
  - Estimated from available energy and climate conditions (solar radiation, temperature, wind, humidity)
- Reference crop (alfalfa or grass)
- Adjustment for specific crops based on crop growth or vegetative stage (crop coefficient)

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Weather Station at Murray, Utah

Rain, wind speed and direction, temperature, solar radiation, humidity, soil temperature

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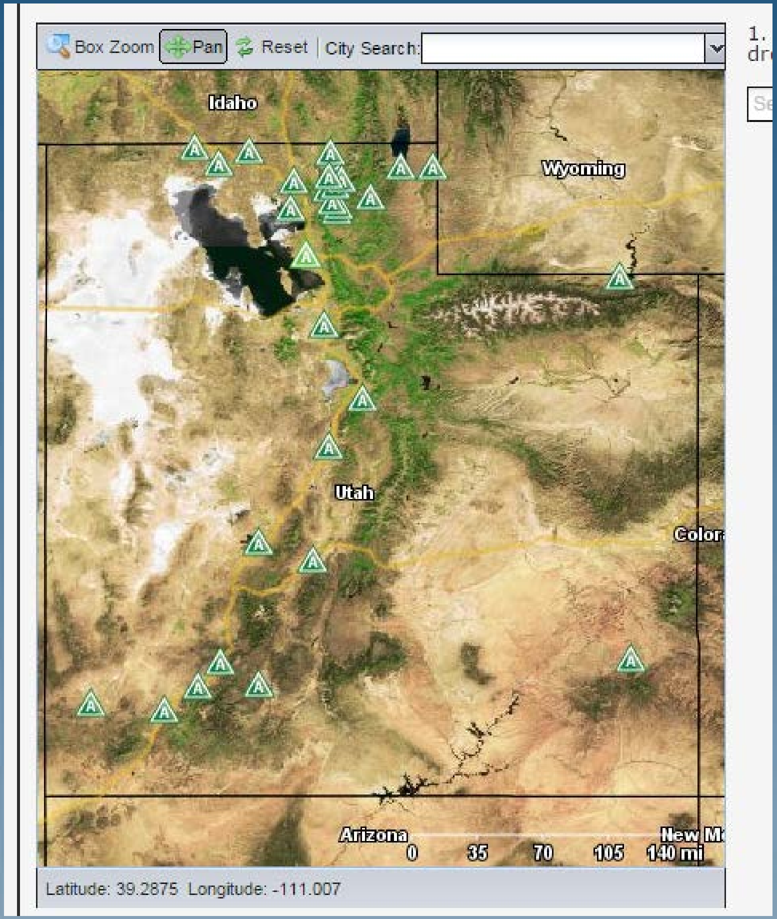
Utah Ag Weather Network

https://climate.usurf.usu.edu/agweather.php

https://climate.usurf.usu.edu/

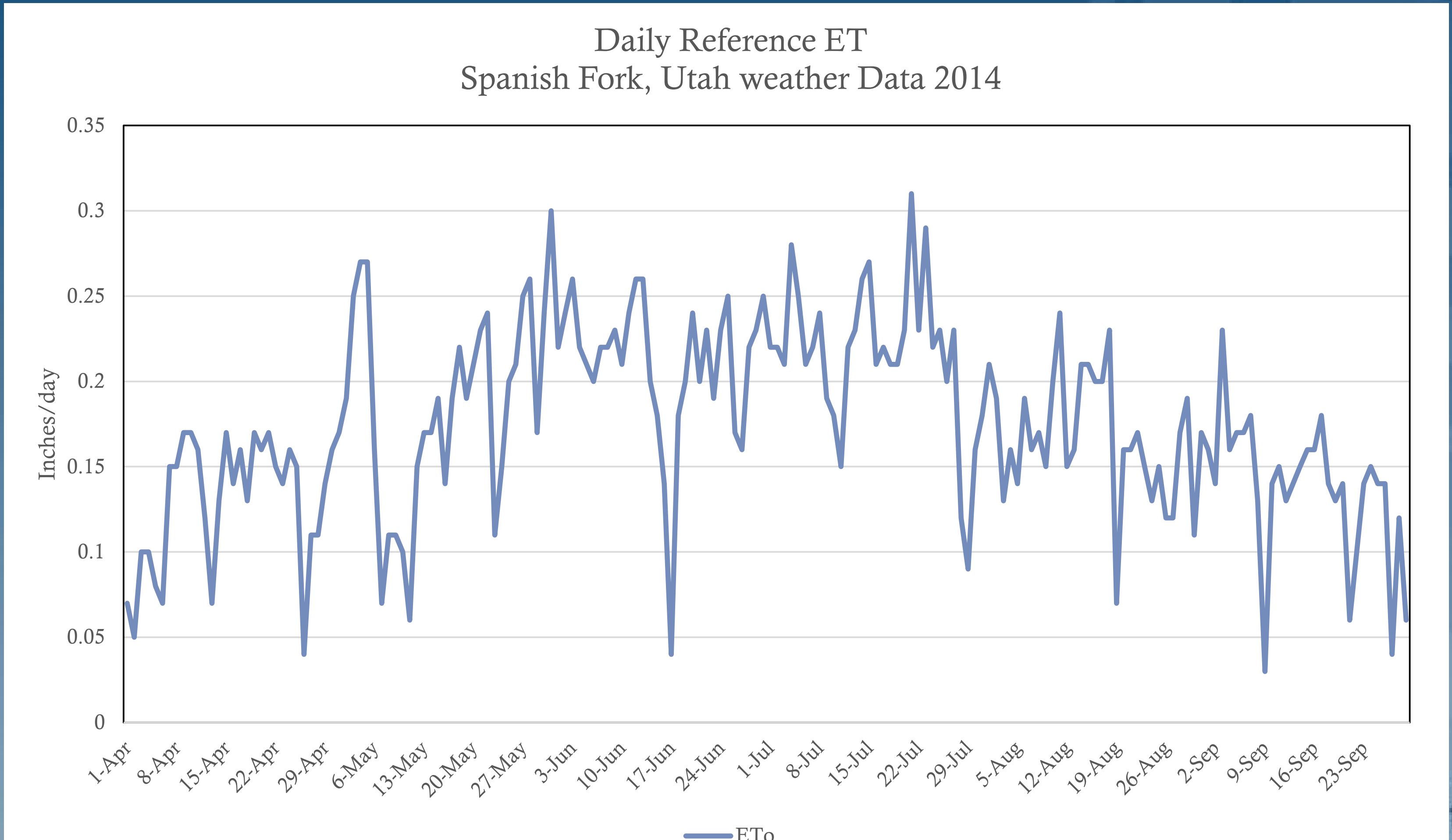


Bear Lake
Beryl Junction
Birch Springs Draw
Blue Creek
Buckhorn
Canyonlands Research Center
Cedar City
Corinne
Drainage Farm
Eagle Lake
EastFork
Evans Farm
Flowell
Greenville Farm
Hardware Ranch

LBW ExpFarm
LBW Paradise
LBW SouthFork
Laketown
Lewiston
Logan Golf
Murray
Nephi
Panguitch
Parowan
Randolph
Snowville (West)
Snowville South
Spanish Fork
Tremonton
Venice

COOPERATIVE EXTENSION

Reference ET

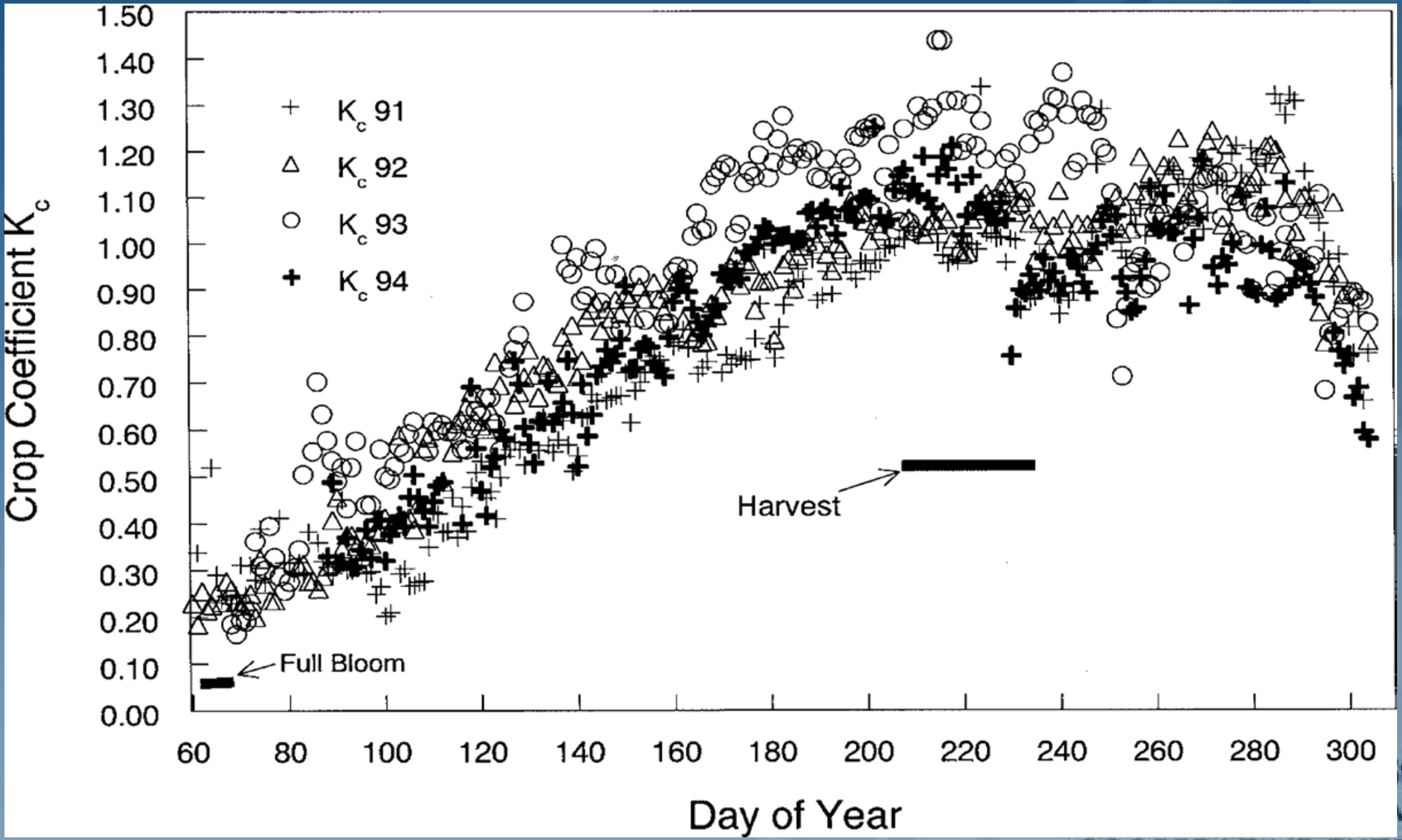


Water use by drip-irrigated late-season peaches

J. E. Ayars, R. S. Johnson, C. J. Phene, T. J. Trout, D. A. Clark, R. M. Mead

Irrigation Science 22.3-4 (2003): 187-194.

Kc for Eto grass reference



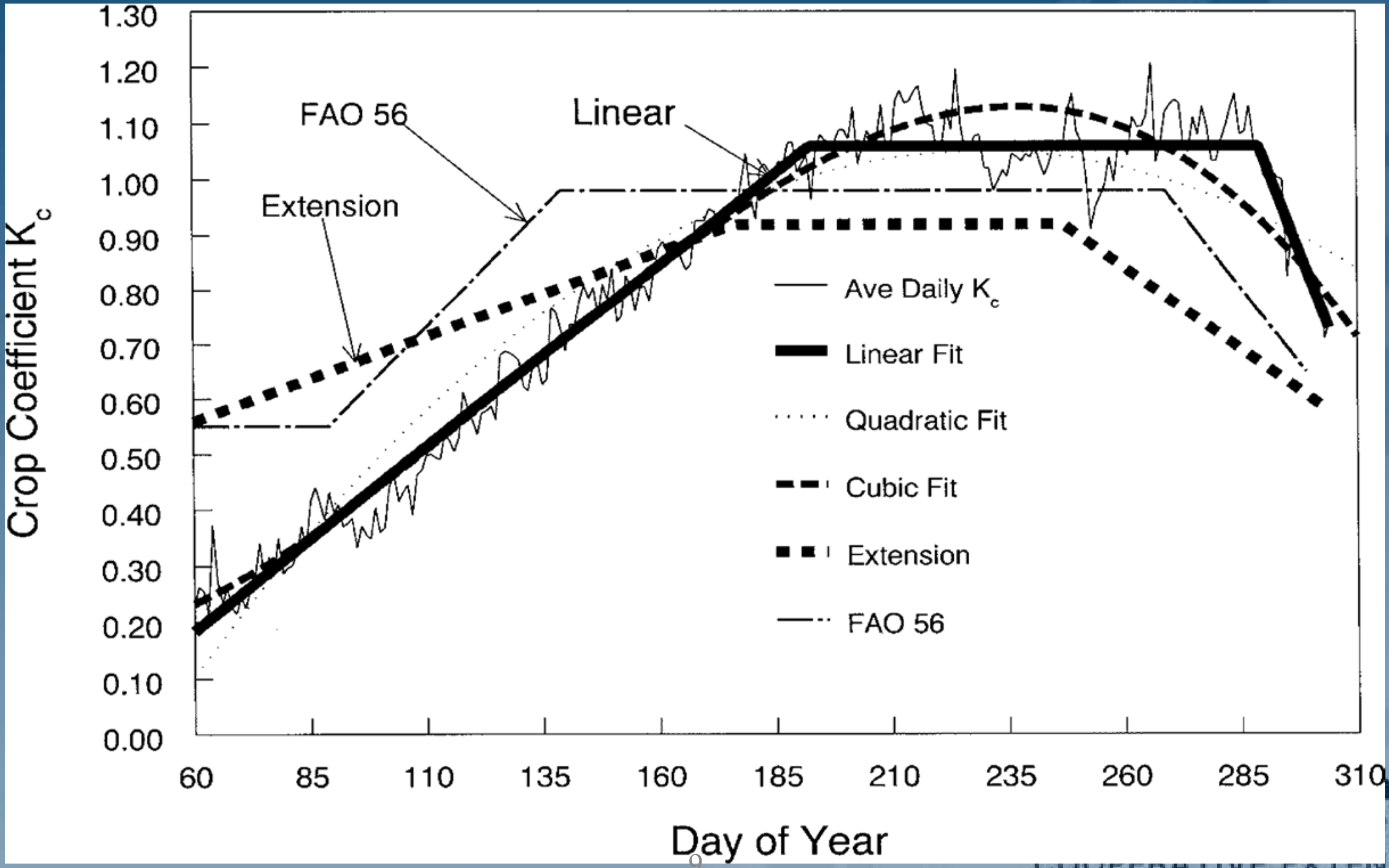
State University
COOPERATIVE EXTENSION

Water use by drip-irrigated late-season peaches

J. E. Ayars, R. S. Johnson, C. J. Phene, T. J. Trout, D. A. Clark, R. M. Mead

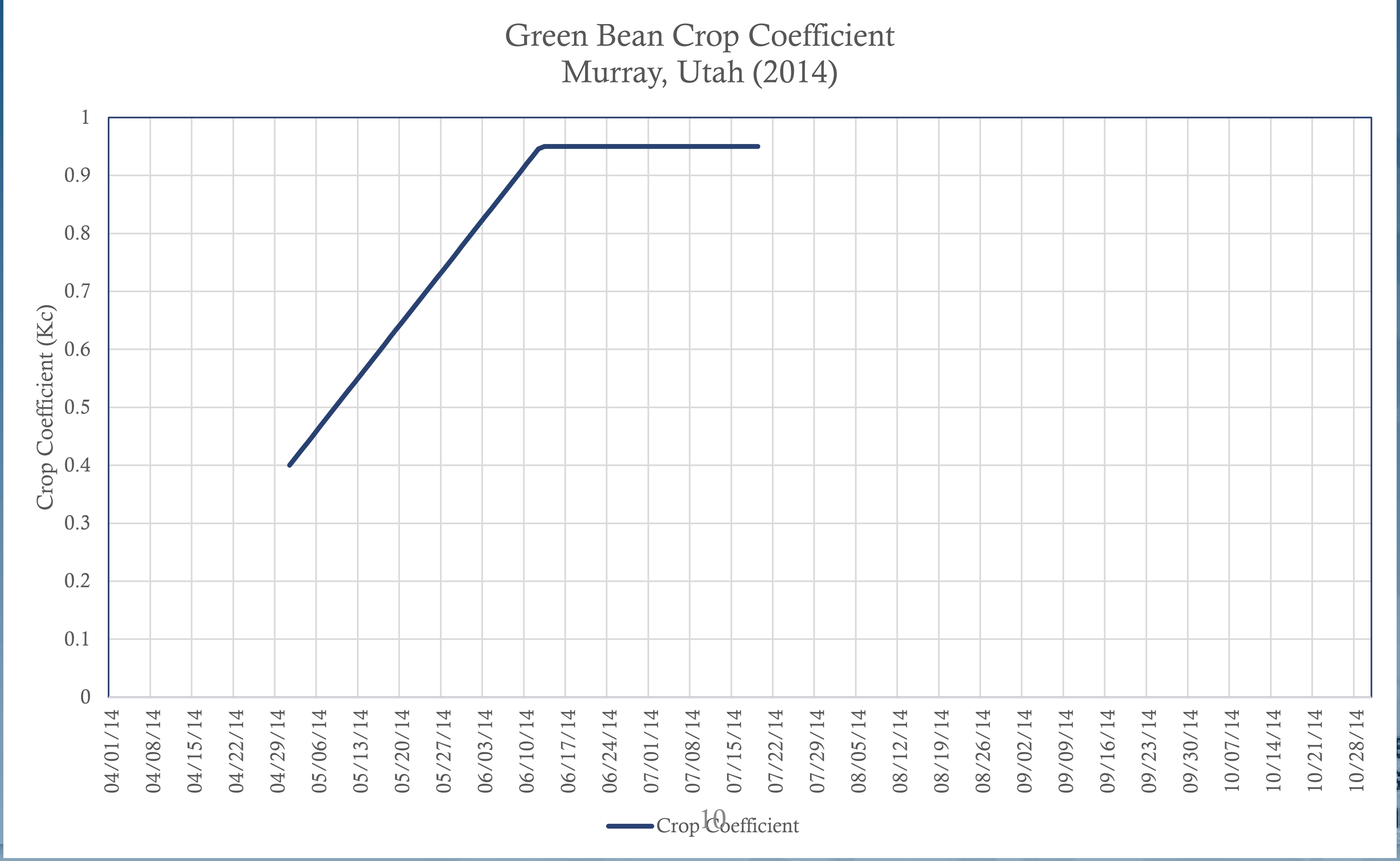
Irrigation Science 22.3-4 (2003): 187-194.

Kc for Eto (grass reference)

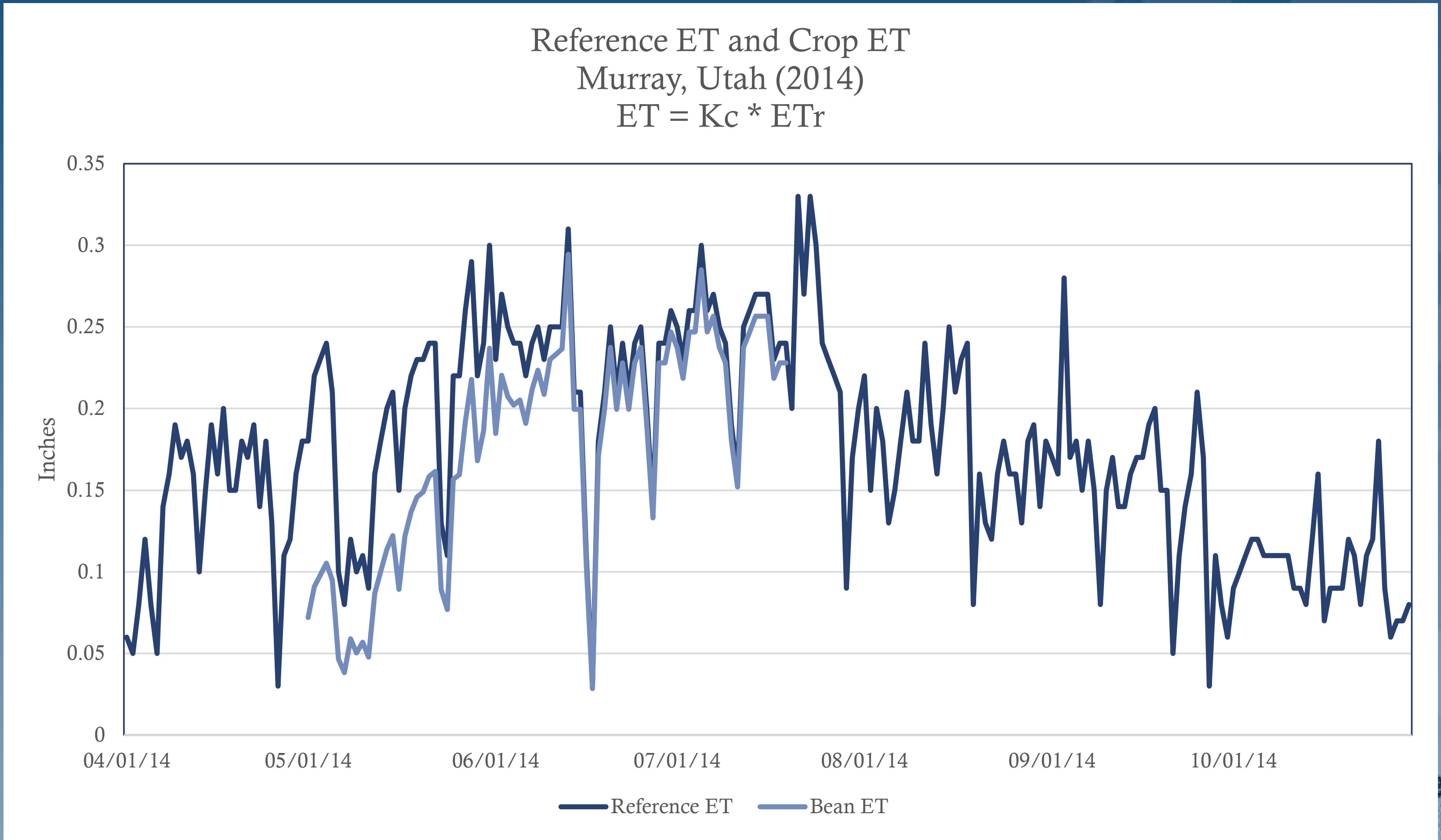


Example of Crop Coefficient Estimated ET crop = Kc * ETr

http://www.usbr.gov/pn/agrimet/cropcurves/crop_curves.html

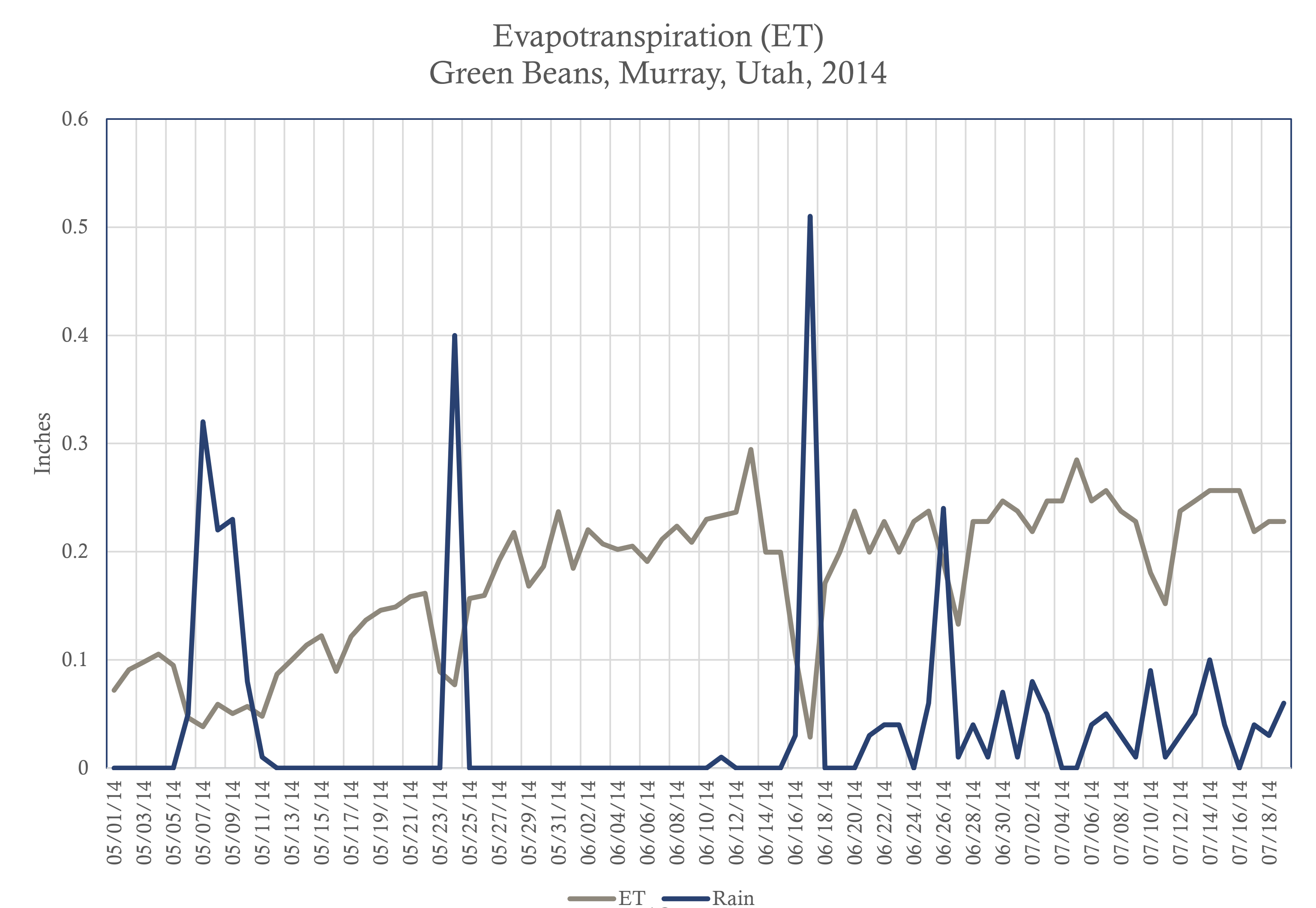


Reference ET and Bean ET

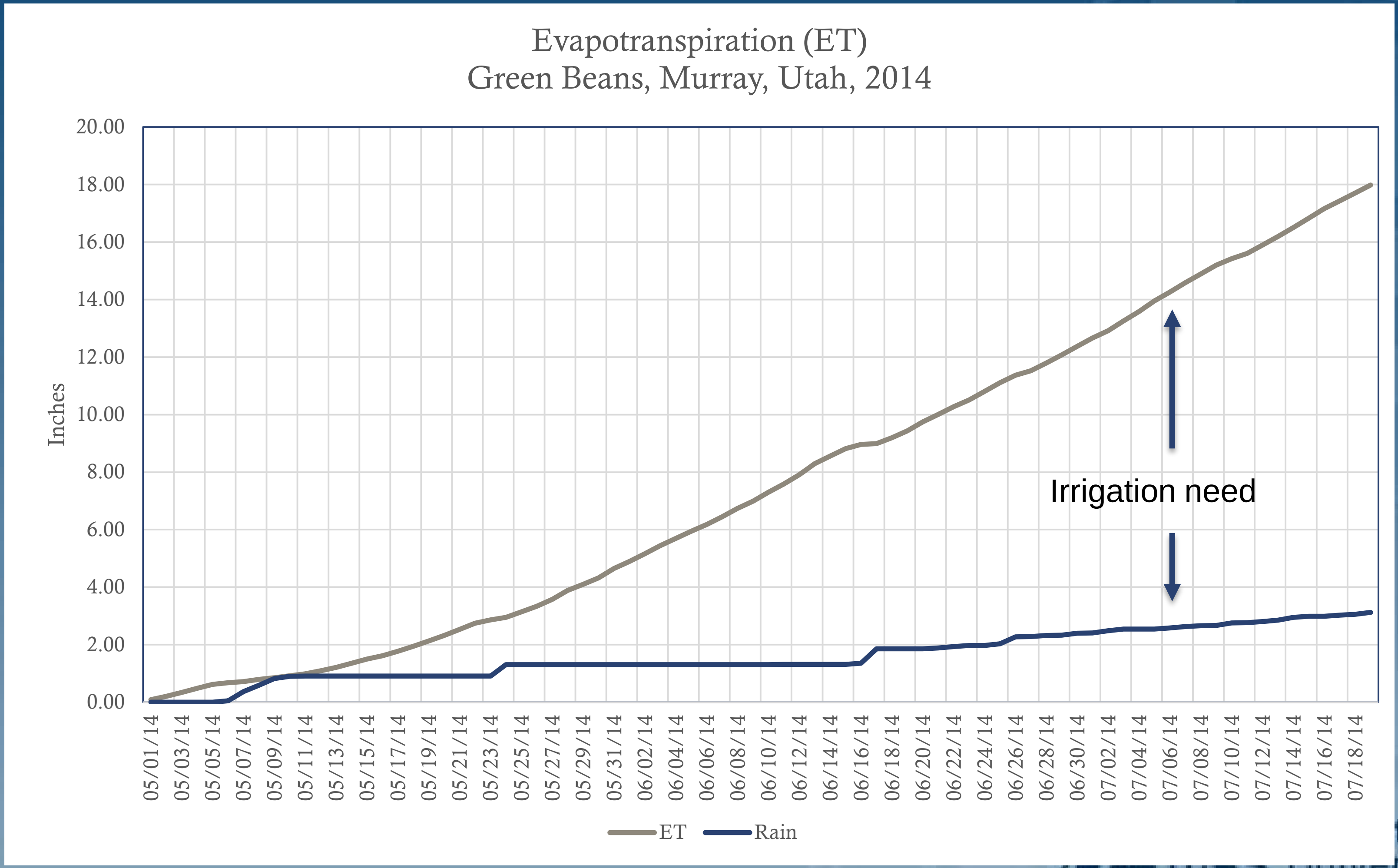


COOPERATIVE EXTENSION

Example of Estimated ET (also shows precipitation)

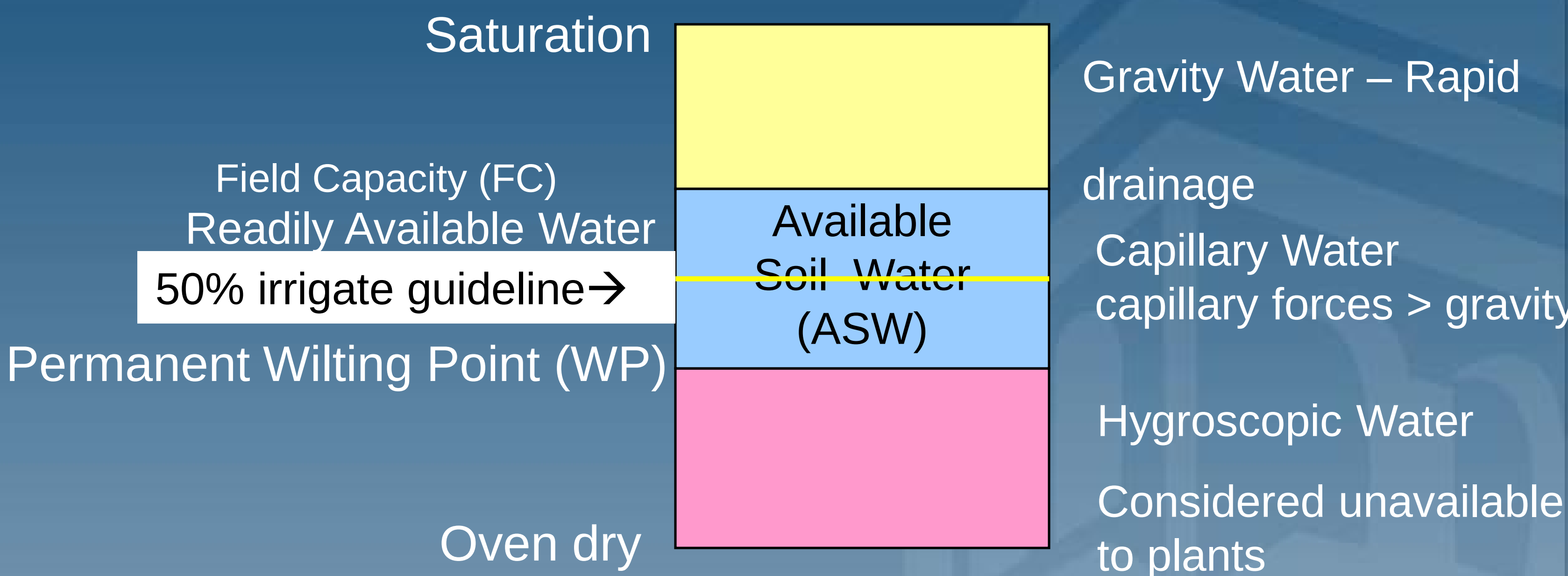


Cumulative ET and Rain



COOPERATIVE EXTENSION

Soil Water

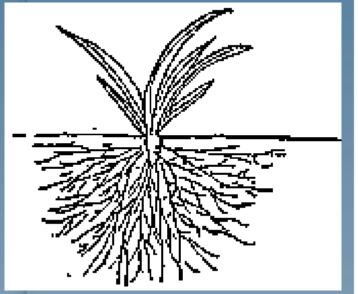


WP is a function of soil texture, crop, ET rate, soil salinity.

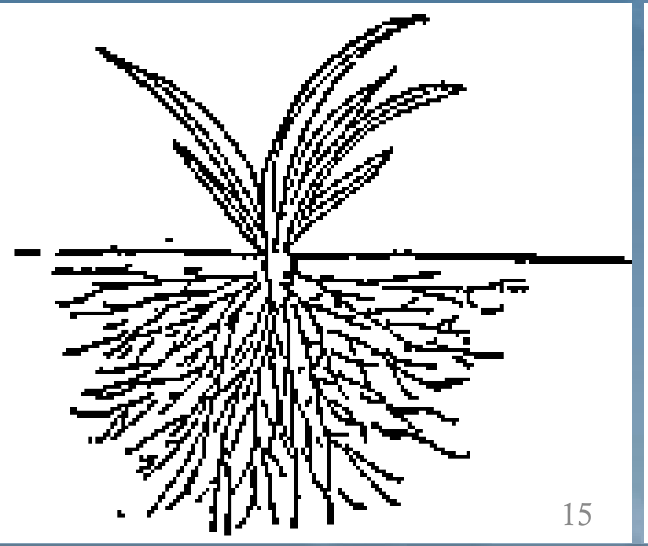
Available Soil Water

- Using example of Beans
  - Rooting Depth of 1.5 to 2 feet
  - Readily Available Water (about 1 inch per foot)
  - Readily Available Water is 1.5 to 2 inches (more is available but may cause stress)

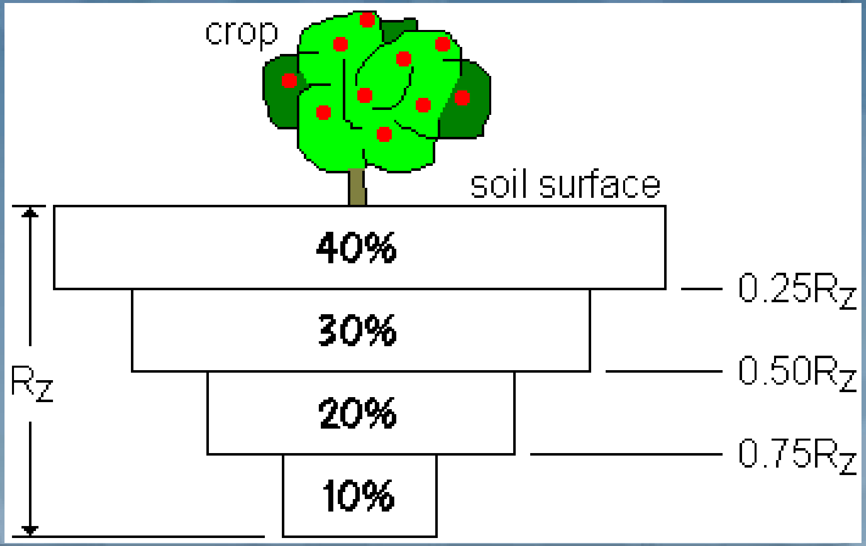
Young Plant



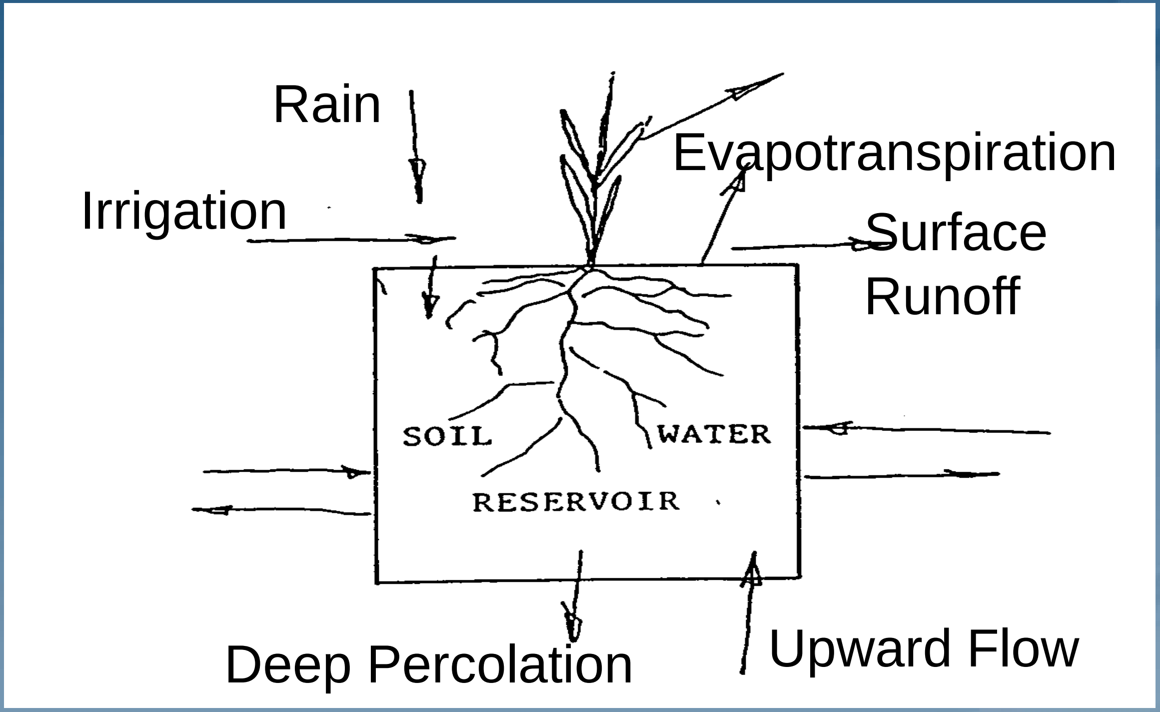
More Mature Plant



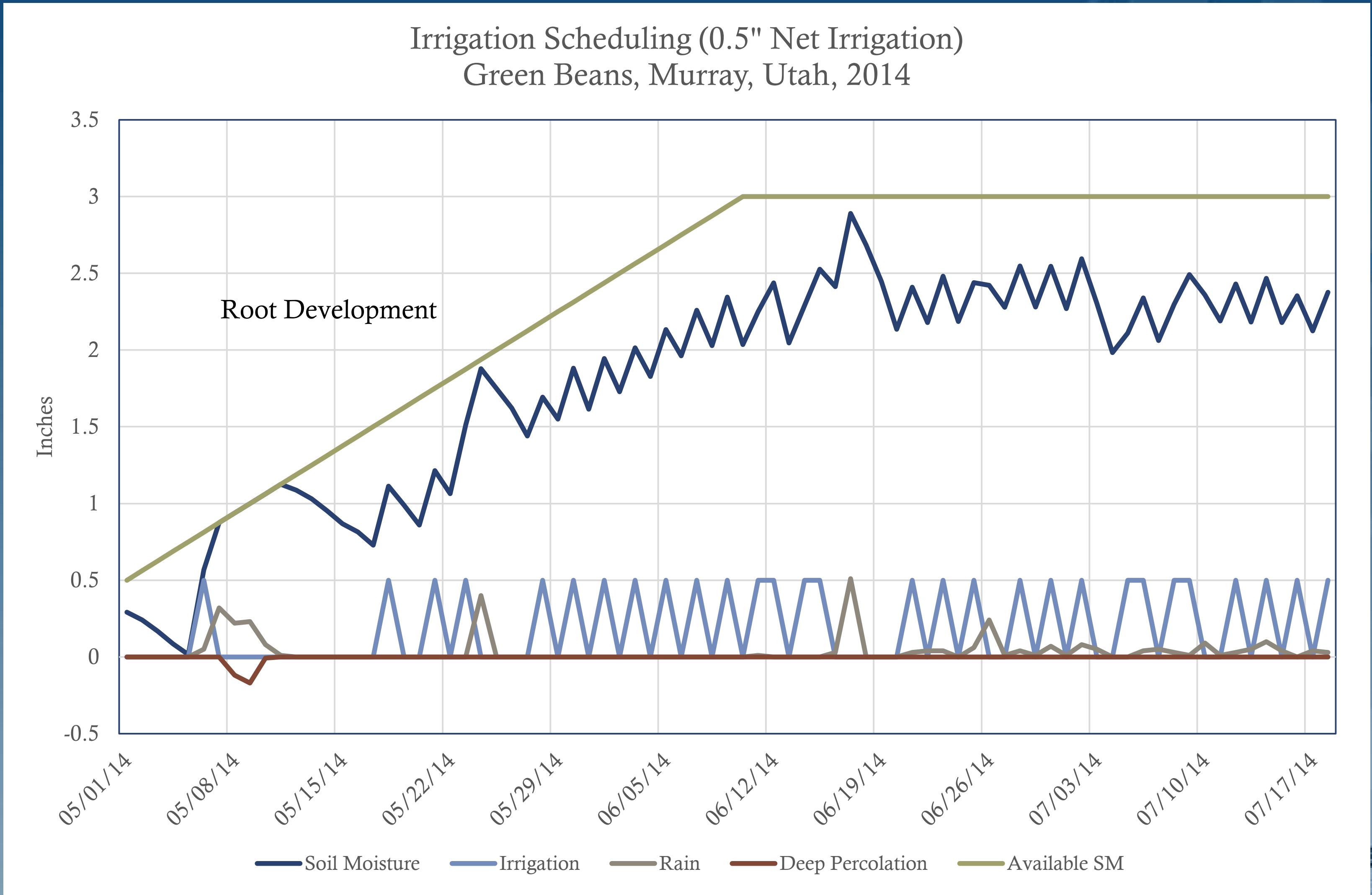
Typical Water Extraction Pattern



Soil Water Budget

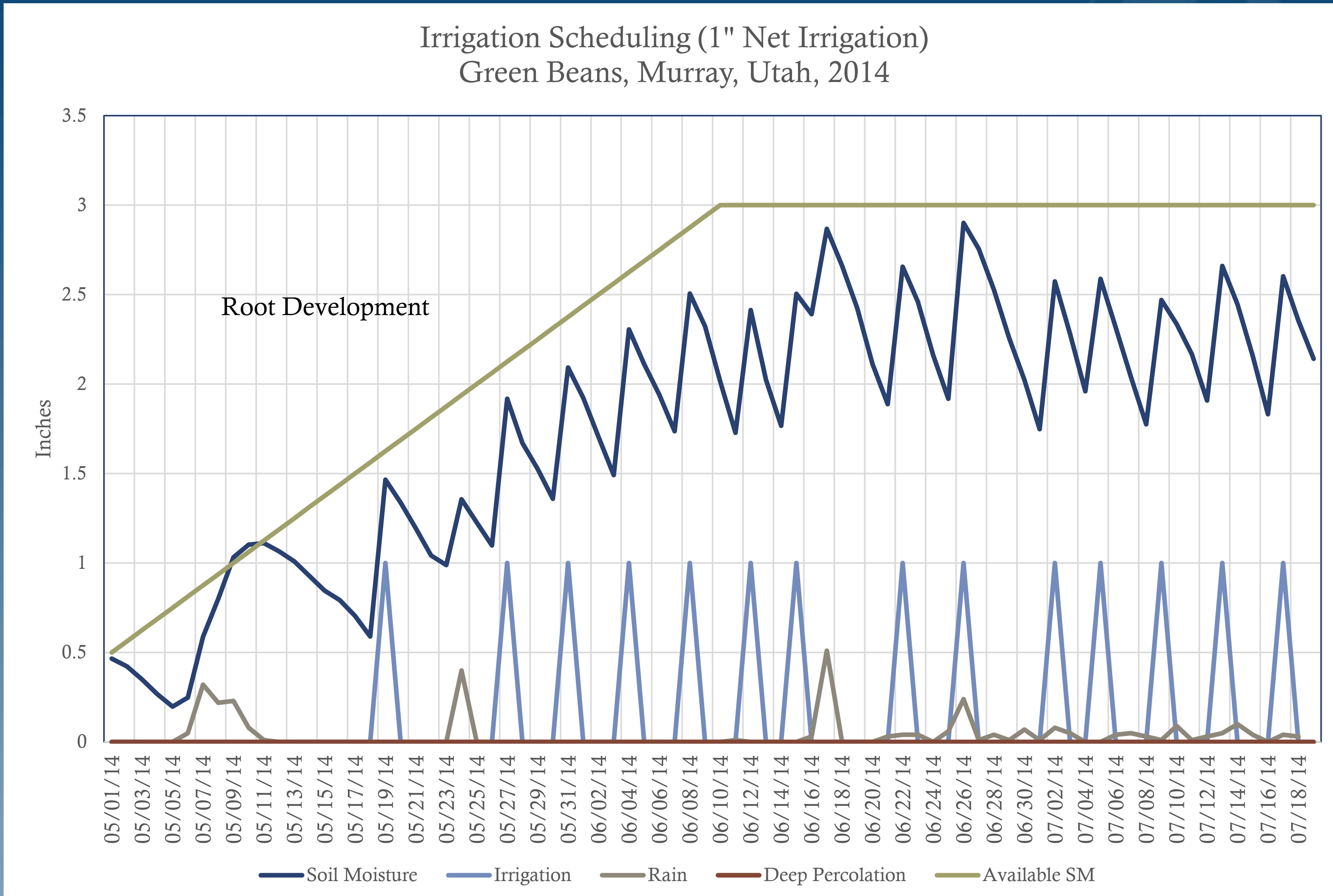


Irrigation Scheduling (0.5" Net Irrigation)



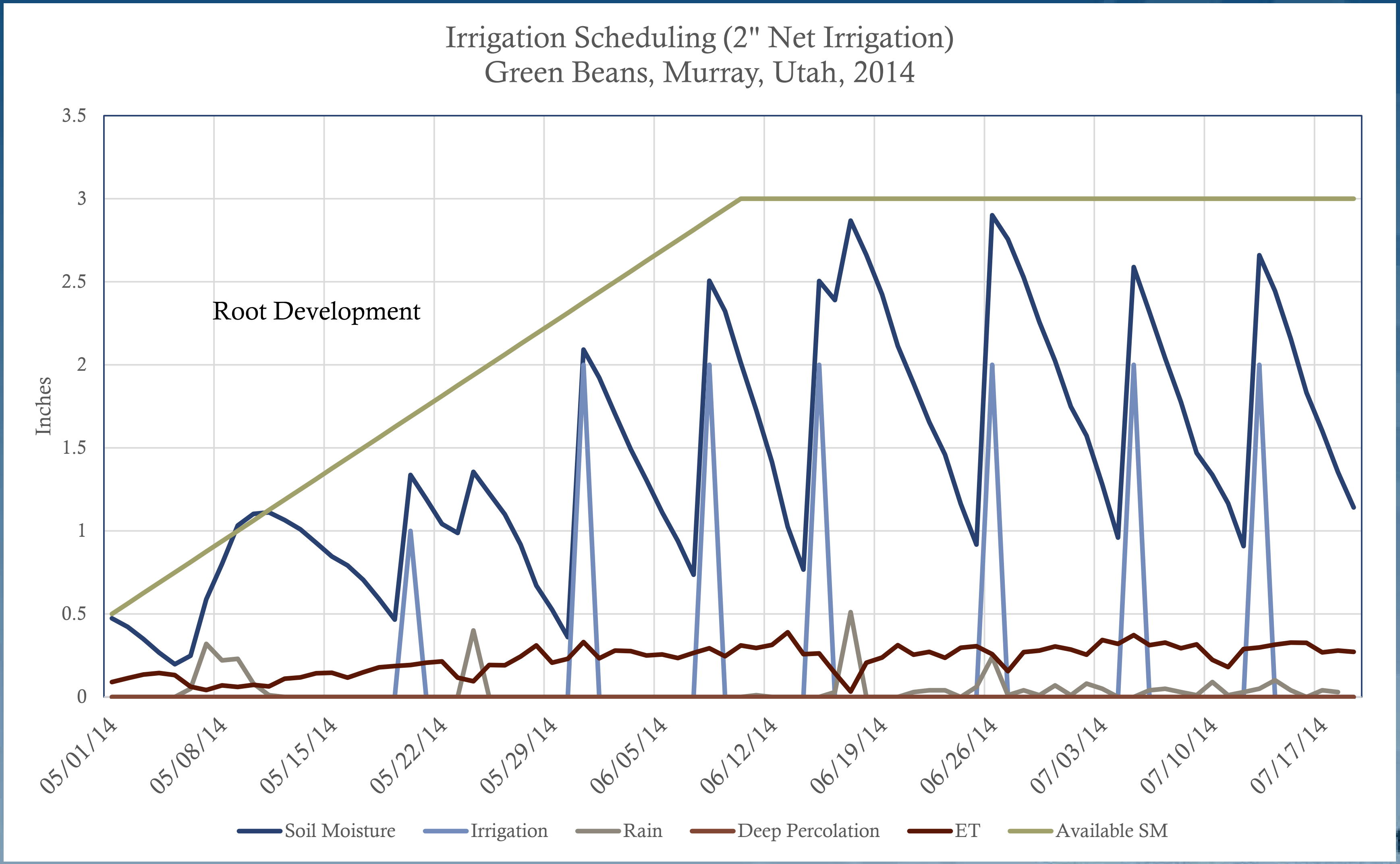
COOPERATIVE EXTENSION

Irrigation Scheduling (1" Net Irrigation)



COOPERATIVE EXTENSION

Irrigation Scheduling (2" Net Irrigation)



How Much and When to Irrigation

- Water holding capacity of soil
- How much water is in the soil
  - Feel the soil
  - Weigh and dry the soil (need bulk density of soil)
  - Tensiometer
  - Resistance blocks (WaterMark Sensors)
    To estimate matrix potential
  - Other devices (probe)
- Appearance of the plants
- Quantity of water applied

Irrigation Interval – Pasture

Root Depth = 2.5 ft, Allowable Depletion = 50%, Peak ET = 0.25 in/day

Soil Type	AWHC in/ft	Root Zone Available Soil water, inches	MAD (50%) refill (inches)	Maximum Irrigation Interval, days
Sand	0.6	1.5	0.75	3
Fine sandy loam	1.0	2.5	1.25	5
Loam	2.0	5.0	2.5	10

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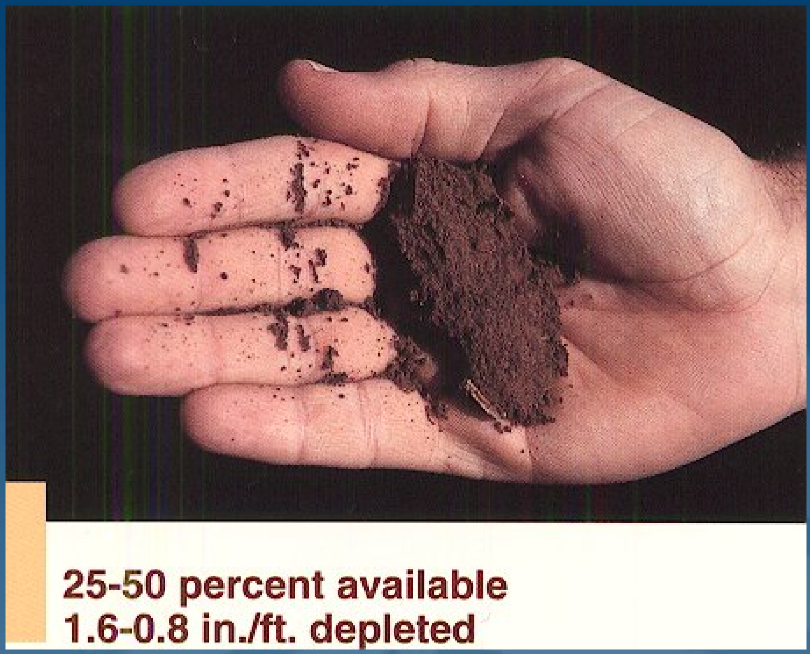
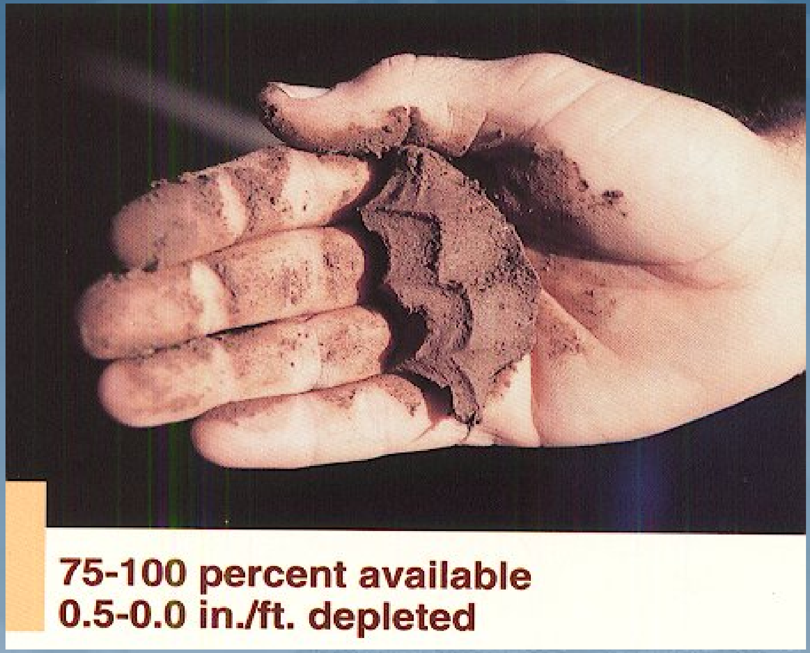
Soil Water by Feel

Sandy clay loam, loam, and Silt loam soils





Soil Water by Feel

Sandy loam and
Fine sandy loam soils

25-50 percent available
1.3-0.7 in./ft. depleted

50-75 percent available
0.9-0.3 in./ft. depleted

75-100 percent available
0.4-0.0 in./ft. depleted

Irrigation Application Rates

- Surface Irrigation (flow usually in cubic feet per second)
  In./hr. = cubic feet per second (cfs) / acres
  Example: 4 cfs / 5 acres = 0.8 in/hr

- Sprinkler Irrigation (flow is usually in gallons per minute)
  In./hr.=96.24 *gallons per minute(gpm)/area (ft^2)
  Example: 96.24*7 gpm / (40 ft*60 ft) = 0.28 in/hr
  Example: pivot 96.24*900 gpm / (125 ac.*43,560 ft^2/ac) = 0.0159 in/hr or (0.0159 in/hr * 24 hrs/day) = 0.38 in/day

- Drip Irrigation (flow per emitter is usually in gallons per hour)
  In./hr.=1.6 *gallons per hour(gph)/emitter spacing (ft^2)
  Example: 1.6*.5 gph / (1 ft * 2.5 ft) = 0.32 in/hr

- Conversions
  1 cfs = 448.8 gpm
  1 gpm = 60 gph
  1 acre = 43,560 feet^2

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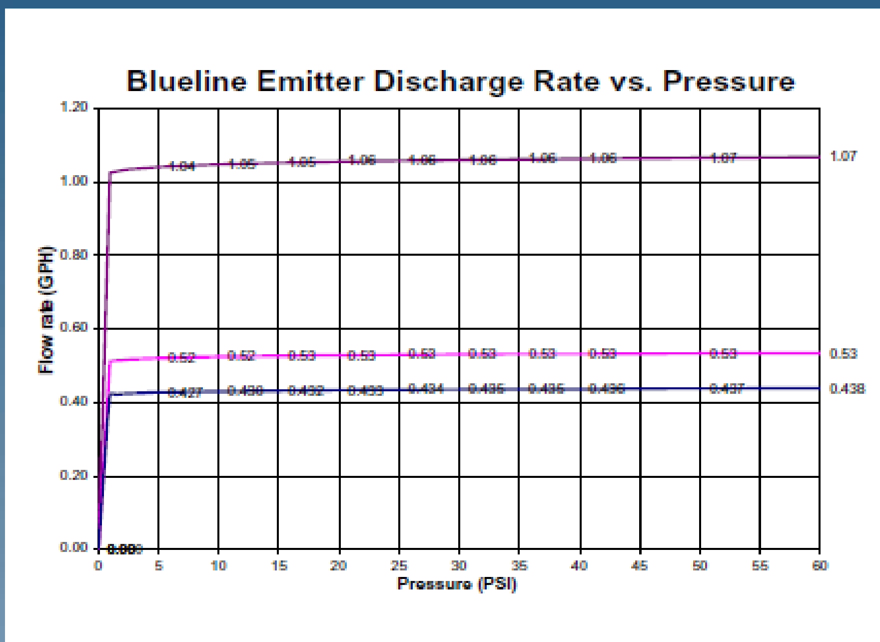
COOPERATIVE EXTENSION

Pressure Compensating Emitters

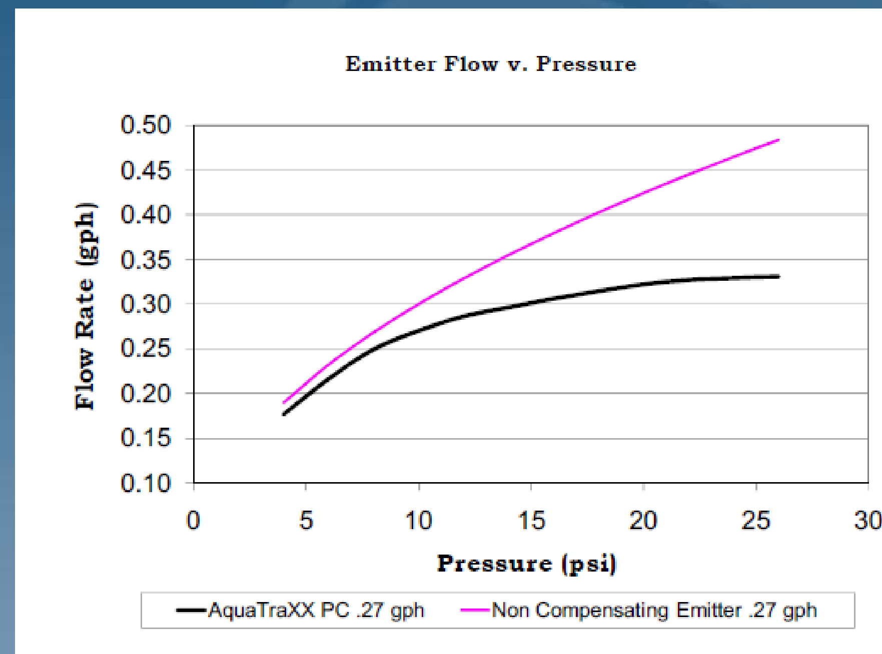
In./hr.=1.6 *gallons per hour(gph)/emitter spacing (ft^2)

spacing is row spacing time emitter spacing

Drip tubing



Drip tape



Examples from Toro Irrigation literature

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How many feet of tubing can I operate with my water supply? Can be designed to accommodate water supply. Pressure compensating emitters best for long lines. A typical outdoor faucet can provide about 5 gallons per minute.

Drip Tubing/Tape for various water supplies (feet)		Drip Tubing/Line/Tape (gallon per minute per 100 feet)							
		0.17	0.33	0.50	0.67	0.83	1.00	1.17	1.33
		Drip Tubing/Line/Tape (gallon per hour per 100 feet)							
		10	20	30	40	50	60	70	80
Water Supply Flow (gallons per minute)	5	3000	1500	1000	750	600	500	429	375
	10	6000	3000	2000	1500	1200	1000	857	750
	15	9000	4500	3000	2250	1800	1500	1286	1125
	20	12000	6000	4000	3000	2400	2000	1714	1500
	25	15000	7500	5000	3750	3000	2500	2143	1875
	30	18000	9000	6000	4500	3600	3000	2571	2250
	35	21000	10500	7000	5250	4200	3500	3000	2625
	40	24000	12000	8000	6000	4800	4000	3429	3000

How much time should I run an irrigation set?

In./hr.=1.6 *gallons per hour(gph)/emitter spacing (ft^2)

Efficiencies are 85 to 95 percent

Application Rate (inches/hour)		Drip Tubing/Line/Tape (gallon per minute per 100 feet)							
		0.17	0.33	0.50	0.67	0.83	1.00	1.17	1.33
		Drip Tubing/Line/Tape (gallon per hour per 100 feet)							
		10	20	30	40	50	60	70	80
Line Spacing (inches)	6	**0.32 in/hr**	**0.64**	**0.96**	**1.28**	**1.60**	**1.92**	**2.25**	**2.57 in/hr**
	12	**0.16**	**0.32**	**0.48**	**0.64**	**0.80**	**0.96**	**1.12**	**1.28**
	18	**0.11**	**0.21**	**0.32**	**0.43**	**0.53**	**0.64**	**0.75**	**0.86**
	24	**0.08**	**0.16**	**0.24**	**0.32**	**0.40**	**0.48**	**0.56**	**0.64**
	30	**0.06**	**0.13**	**0.19**	**0.26**	**0.32**	**0.38**	**0.45**	**0.51**
	36	**0.05**	**0.11**	**0.16**	**0.21**	**0.27**	**0.32**	**0.37**	**0.43**
	42	**0.05**	**0.09**	**0.14**	**0.18**	**0.23**	**0.27**	**0.32**	**0.37**
	48	**0.04**	**0.08**	**0.12**	**0.16**	**0.20**	**0.24**	**0.28**	**0.32**
	60	**0.03**	**0.06**	**0.10**	**0.13**	**0.16**	**0.19**	**0.22**	**0.26**
	66	**0.03 in/hr**	**0.06**	**0.09**	**0.12**	**0.15**	**0.17**	**0.20**	**0.23 in/hr**

Drip Flow Rates

Flow Rates

Product	Part Number	Individual Emitter Flow Rate GPH@ 10 psi	Spacing inches	Q-100 GPM per 100 ft. @ 10 psi
0.20 GPH @ 10 PSI				
	EAPXxx0667	0.20 gph	6"	0.67
	EAPXxx0850	0.20 gph	8"	0.50
	EAPXxx1234	0.20 gph	12"	0.34
	EAPXxx1625	0.20 gph	16"	0.25
	EAPXxx1822	0.20 gph	18"	0.22
	EAPXxx2417	0.20 gph	24"	0.17
0.27 GPH @ 10 PSI				
	EAPXxx0690	0.27 gph	6"	0.90
	EAPXxx0867	0.27 gph	8"	0.67
	EAPXxx1245	0.27 gph	12"	0.45
	EAPXxx1634	0.27 gph	16"	0.34
	EAPXxx1830	0.27 gph	18"	0.30
	EAPXxx2422	0.27 gph	24"	0.22

Example from Toro Irrigation literature

3 to 5 gpm for 5/8” diameter
drip tape $0.04 to $0.12 per foot (8 to 15 mil)
drip tubing $0.20 to $0.30 per foot (45 mil)

Sprinkler Discharge Rates (approximate)

NOZZLE DISCHARGE – GALLONS PER MINUTE								
Nozzle Diameter in Inches								
p.s.i.	3/32	1/8	9/64	5/32	11/64	3/16	13/64	7/32
20	1.17	2.09	2.65	3.26	3.92	4.69	5.51	6.37
25	1.31	2.34	2.96	3.64	4.38	5.25	6.16	7.13
30	1.44	2.56	3.26	4.01	4.83	5.75	6.80	7.86
35	1.55	2.77	3.50	4.31	5.18	6.21	7.30	8.43
40	1.66	2.96	3.74	4.61	5.54	6.64	7.80	9.02
45	1.76	3.13	3.99	4.91	5.91	7.03	8.30	9.60
50	1.85	3.30	4.18	5.15	6.19	7.41	8.71	10.10
55	1.94	3.46	4.37	5.39	6.48	7.77	9.12	10.50
60	2.03	3.62	4.50	5.65	6.80	8.12	9.56	11.05
65	2.11	3.77	4.76	5.87	7.06	8.45	9.92	11.45
70	2.19	3.91	4.96	6.10	7.34	8.78	10.32	11.95
75	2.27	4.05	5.12	6.30	7.58	9.08	10.66	12.32
80	2.35	4.18	5.29	6.52	7.84	9.39	11.02	12.74
85	2.42	4.31	5.45	6.71	8.07	9.67	11.35	13.11
90	2.49	4.43	5.61	6.91	8.31	9.95	11.69	13.51
95	2.56	4.56	5.76	7.09	8.53	10.2	11.99	13.86
100	2.63	4.67	5.91	7.29	8.76	10.5	12.32	14.23

Sprinkler Application Rates

In./hr.=96.24 *gallons per minute(gpm)/area (ft^2)

Efficiencies (70-80 percent)

AVERAGE APPLICATION RATE – INCHES PER HOUR Gallons Per Minute From Each Sprinkler											
Spacing Feet	2	3	4	5	6	7	8	9	10	12	
20x20	.48	.72	.96	1.20	1.44	1.70	1.93	2.16	2.40		
20x30	.32	.48	.64	.80	.96	1.12	1.28	1.43	1.60	1.93	
30x40	.24	.36	.48	.60	.72	.84	.96	1.08	1.20	1.45	
30x30	.21	.32	.43	.54	.64	.75	.88	.96	1.07	1.28	
30x40	.16	.24	.32	.40	.48	.56	.64	.72	.80	.95	
30x50	.13	.19	.25	.32	.38	.45	.51	.58	.64	.76	
40x40	.12	.18	.24	.30	.36	.42	.48	.54	.60	.72	
40x50	.10	.14	.19	.24	.29	.34	.38	.43	.48	.58	
40x60		.12	.16	.20	.24	.28	.32	.36	.40	.48	

Example Problem
Putting it all together

An onion producer has a drip irrigation system:

The flow rate of drip tape is 0.2 gallons per hour per foot of tape.

The drip tape spacing is 40 inches.

The irrigation efficiency is 85 percent.

The soil has a readily available water holding capacity of 1 inch per foot of rooting depth.

The desired net irrigation depth is 1 inch per irrigation.

The rooting depth is 1.5 feet.

The projected average ET rate for the next week is 0.2 inches per day.

Determine:

What is the gross application amount per irrigation (inches)? **(1 inch / 0.85 = 1.18 inches)**

What is the recommended irrigation frequency (days)? **(1 inch net irrigation / 0.2 in./day = 5 days)**

How many hours is the irrigation set time**? (1.6 * 0.2 gph / (1 ft x (40 in / 12 in/ft) = 0.096 in/hr)** then **(1.18 in / 0.096 in/hr = 12.3 hours)**

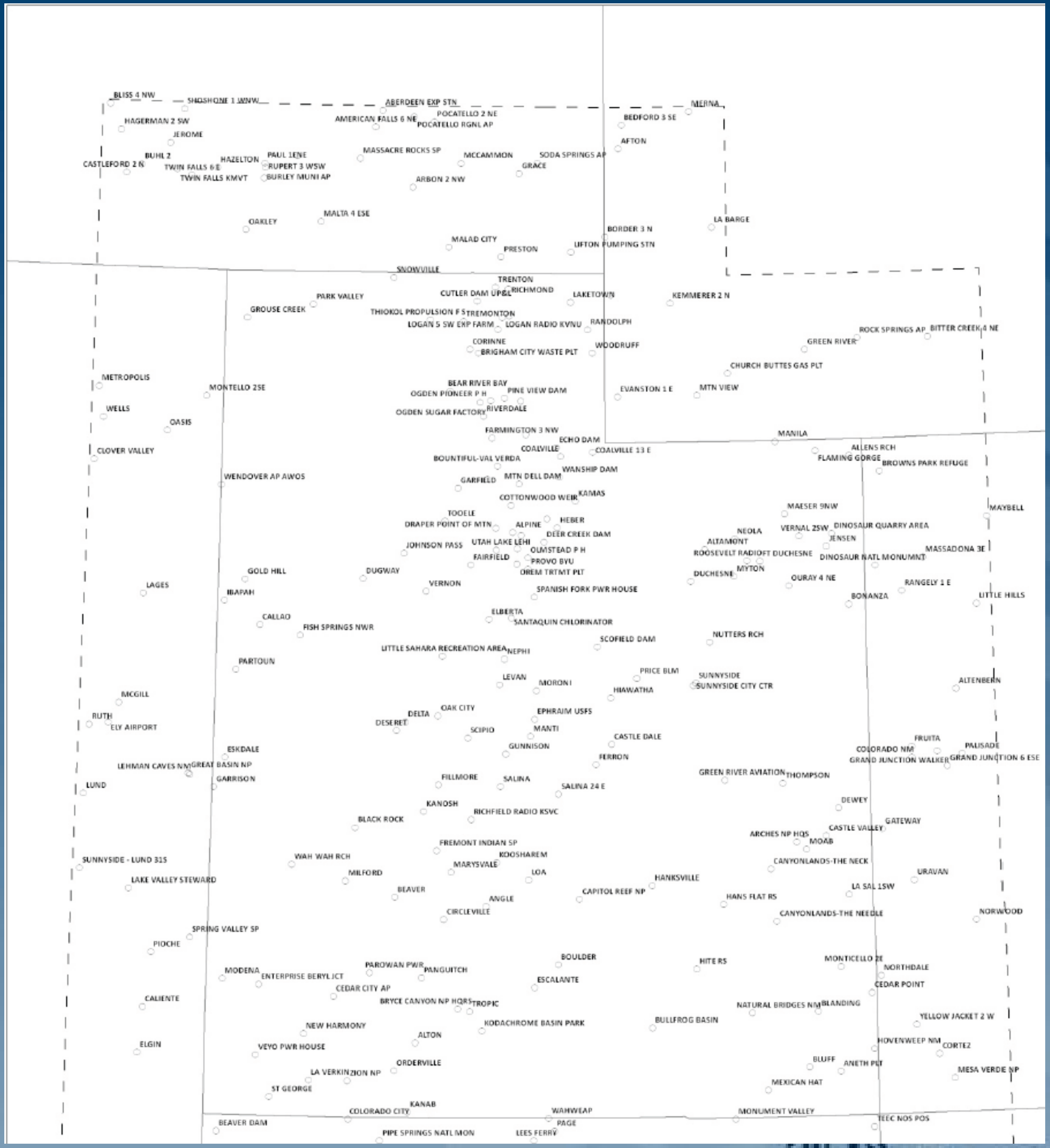
If the irrigation frequency was changed to 3 days how many hours would the irrigation set be? **(3 days/irr * 0.2 in/day = 0.6 net in./irr.), (0.6 in/irr. / 0.85 = 0.71 inches/irr.),** then **(0.71 in/irr / 0.096 in/hr = 7.4 hours)**

Note: Our net irrigation depths are below the 1.5 inches of readily available soil moisture.

National Weather Service Site

ET in Report

Crop and Wetland Consumptive Use and Open Water Surface Evaporation for Utah
APPENDIX I: Updated Consumptive Use Estimates at NWS Stations
and
APPENDIX J
Electronic Weather Stations



https://extension.usu.edu/irrigation/

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COOPERATIVE EXTENSION

Estimated Consumptive Use for EWS: USU Murray Golf Course

Aridity Index: 0%, Temp. Adj. (F): 0, Period: 2000-2010, Lat: 40.63, Long: -111.92, Elev: 4290 ft, 8/25/2011

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
Temp (F)	31.16	35.17	42.78	50.23	58.95	67.81	77.26	74.31	64.35	52.17	39.67	31.46	52.11
St Dev	4.56	2.76	2.57	2.29	2.69	1.92	1.61	2.07	2.08	2.45	3.18	3.45	0.90
Precip (in)	0.68	0.84	1.30	1.63	1.61	1.18	0.71	0.81	1.02	1.29	0.88	0.77	12.72
St Dev	0.49	0.65	0.62	0.81	0.94	0.79	0.72	0.49	0.63	1.00	0.71	0.50	2.57
Aridity Adj. (F)													
Est. Dewpoint (F)	23.39	24.94	27.25	31.05	37.10	41.81	47.79	47.49	41.08	35.76	28.36	24.04	34.17
Rs (langleys/day)	165	249	381	483	589	648	639	547	459	308	201	147	401
Wind (mpd)	77	85	103	115	94	90	82	90	79	77	73	82	87
Calc. Wind Limit (mpd)	96	96	105	114	96	96	96	96	96	96	96	96	98
							Inches						
Alfalfa (Beef)				2.76	5.75	7.37	7.03	6.33	5.10	2.07	0.23		36.63
St Dev				0.54	0.32	1.00	0.44	0.32	0.44	0.72	0.43		2.26
Net Irr				1.46	4.46	6.42	6.46	5.68	4.29	1.04			29.81
Alfalfa (Dairy)				2.76	5.27	6.16	7.08	6.27	4.46	2.33	0.10		34.44
St Dev				0.54	0.41	0.64	0.41	0.26	0.35	0.44	0.19		1.99
Net Irr				1.46	3.98	5.21	6.51	5.62	3.65	1.30			27.74
Apples / Cherries				1.55	5.79	8.59	9.75	8.34	4.88	2.00			40.90
St Dev				0.29	0.66	0.89	0.59	0.39	0.46	0.30			2.43
Net Irr				0.25	4.51	7.65	9.18	7.70	4.07	0.97			34.31
Barley				1.54	5.98	7.94	1.52						16.98
St Dev				0.35	0.89	0.69	0.82						0.92
Net Irr				0.24	4.69	6.99	0.95						12.88
Corn					1.06	4.37	8.99	4.82	0.20				19.43
St Dev					0.21	1.10	0.62	1.07	0.23				0.95
Net Irr						3.42	8.42	4.18					16.01

COOPERATIVE EXTENSION

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
Melon					1.08	4.49	6.09	5.32	3.52	0.02			20.51
St Dev					0.26	0.61	0.37	0.25	0.41	0.04			1.16
Net Irr						3.54	5.52	4.67	2.70				16.43
Onion				0.13	3.35	6.51	9.37	7.86	2.25				29.46
St Dev				0.16	0.37	0.82	0.57	0.37	0.40				1.67
Net Irr					2.06	5.56	8.80	7.21	1.43				25.07
Other Hay				2.77	7.03	7.51	4.06	2.59	1.07				25.03
St Dev				0.51	0.68	0.77	0.27	0.14	0.17				1.66
Net Irr				1.47	5.75	6.56	3.49	1.94	0.26				19.47
Other Orchard				1.44	5.55	7.94	9.00	7.67	4.41	1.98			37.98
St Dev				0.27	0.63	0.82	0.54	0.35	0.41	0.29			2.27
Net Irr				0.14	4.26	6.99	8.43	7.02	3.60	0.95			31.38
Pasture			0.08	2.44	4.68	5.62	6.37	5.56	3.91	2.08	0.38		31.12
St Dev			0.08	0.27	0.43	0.58	0.38	0.27	0.35	0.31	0.36		1.92
Net Irr				1.14	3.39	4.68	5.80	4.91	3.09	1.05			24.07
Potato					1.52	5.29	7.00	3.26					17.09
St Dev					0.37	0.85	0.38	0.89					0.83
Net Irr					0.24	4.35	6.43	2.61					13.63

UtahState University
COOPERATIVE EXTENSION

Estimated Consumptive Use for EWS: USU Murray Golf Course

Aridity Index: 0%, Temp. Adj. (F): 0, Period: 2000-2010, Lat: 40.63, Long: -111.92, Elev: 4290 ft, 8/25/2011

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
							Inches						
Spring Grain				1.48	5.78	8.23	2.49						17.98
St Dev				0.34	0.91	0.72	1.02						0.88
Net Irr				0.18	4.50	7.28	1.92						13.88
Winter Wheat			0.82	2.25	6.47	6.51	0.60						16.66
St Dev			0.11	0.46	0.97	0.95	0.46						0.74
Net Irr				0.95	5.19	5.57	0.03						11.73
Garden				0.10	1.85	3.83	7.08	5.98	1.28				20.13
St Dev				0.12	0.21	0.49	0.54	0.30	0.25				1.15
Net Irr					0.57	2.89	6.51	5.33	0.47				15.77
Small Fruit					1.40	5.19	9.08	7.78	3.87				27.34
St Dev					0.31	0.76	0.62	0.36	0.54				1.51
Net Irr					0.12	4.25	8.51	7.14	3.06				23.07
Turfgrass			0.13	2.42	3.99	4.96	5.62	4.91	3.47	2.03	0.43		27.97
St Dev			0.14	0.20	0.38	0.52	0.34	0.23	0.30	0.26	0.38		1.67
Net Irr				1.12	2.70	4.02	5.05	4.26	2.65	1.00			20.81
Turfgrass Dixie			0.15	2.62	3.93	5.38	6.09	5.32	3.76	2.20	0.49		29.93
St Dev			0.16	0.21	0.39	0.56	0.37	0.25	0.32	0.28	0.44		1.80
Net Irr				1.31	2.64	4.43	5.52	4.67	2.94	1.17			22.69
Open Water Deep	0.92	1.01	1.63	2.29	2.88	3.95	5.27	5.36	3.34	2.29	1.35	0.91	31.20
St Dev	0.24	0.22	0.22	0.29	0.56	0.81	0.74	0.63	0.55	0.42	0.33	0.21	3.10
Net Evap	0.24	0.17	0.33	0.66	1.28	2.77	4.55	4.55	2.32	1.00	0.47	0.14	18.48
Open Water Shallow	0.87	1.37	2.81	3.93	5.20	5.90	6.60	5.83	4.33	2.59	1.28	0.77	41.48
St Dev	0.14	0.14	0.23	0.30	0.37	0.50	0.27	0.19	0.28	0.23	0.18	0.12	1.35
Net Evap	0.19	0.53	1.50	2.30	3.59	4.72	5.89	5.02	3.32	1.31	0.40		28.77
Wetlands Large					0.49	5.35	9.69	8.59	6.07	3.31	0.32		33.81
St Dev					0.26	0.91	0.65	0.41	0.52	0.35	0.59		2.14
Net ET						4.41	9.12	7.94	5.25	2.28			28.99
Wetlands Narrow					0.58	7.36	13.83	12.27	8.67	4.73	0.45		47.88
St Dev					0.32	1.31	0.94	0.59	0.74	0.50	0.84		3.03
Net ET						6.42	13.26	11.62	7.85	3.70			42.84
ETr	1.14	1.71	3.62	5.27	6.93	8.27	9.37	8.18	5.78	3.38	1.67	1.02	56.34
St Dev	0.21	0.23	0.31	0.42	0.62	0.86	0.56	0.39	0.49	0.43	0.32	0.20	2.83

All values are 11 year averages. Effective precipitation is 80% of total for crops and 100% of total for open water evaporation.

Estimated Consumptive Use for NWS Station: RICHFIELD RADIO KSVC

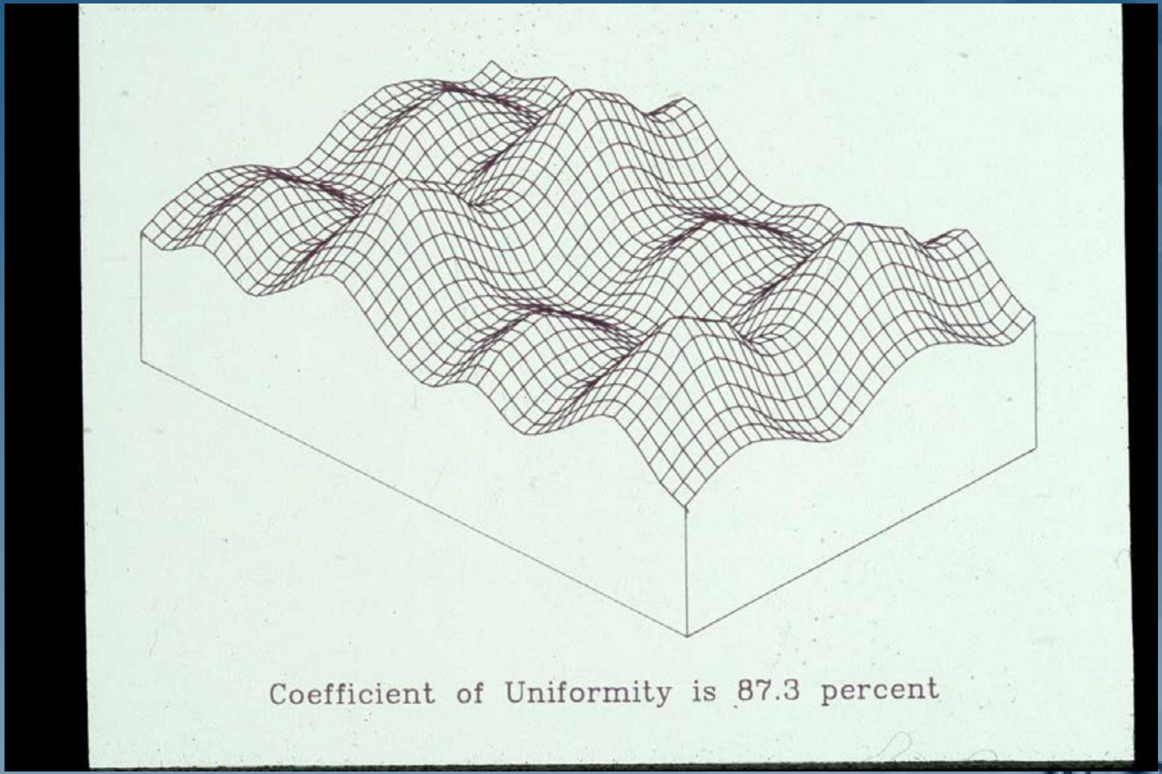
Aridity Index: 32%, Temp. Adj. (F): -3, Period: 1971-2008, Lat: 38.76, Long: -112.08, Elev: 5300 ft, 8/25/2011

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
	Inches												
Garden					0.58	2.64	4.77	6.64	2.02				16.64
St Dev					0.08	0.18	0.23	0.51	1.17				1.57
Net Irr						2.17	4.21	6.03	1.32				13.73
Turfgrass				1.63	3.76	5.37	5.44	5.06	3.30	0.53			25.08
St Dev				0.20	0.29	0.38	0.25	0.19	0.56	0.62			1.40
Net Irr				1.12	2.99	4.90	4.88	4.46	2.60				20.95
Open Water Deep	0.65	0.86	1.97	2.56	3.03	4.11	4.37	4.52	2.87	2.34	1.34	0.72	29.35
St Dev	0.15	0.17	0.29	0.32	0.32	0.38	0.28	0.19	0.19	0.24	0.21	0.15	1.21
Net Evap	0.19	0.47	1.38	2.05	2.27	3.64	3.82	3.92	2.17	1.54	0.83	0.32	22.60
Open Water Shallow	0.76	1.47	2.87	4.04	4.85	5.73	5.84	5.69	4.24	2.67	1.29	0.77	40.22
St Dev	0.14	0.21	0.28	0.31	0.28	0.30	0.20	0.15	0.18	0.20	0.17	0.14	1.05
Net Evap	0.30	1.08	2.28	3.54	4.09	5.26	5.29	5.08	3.54	1.86	0.78	0.37	33.46
Wetlands Large					0.24	5.06	9.20	8.83	4.22	0.14			27.70
St Dev					0.13	0.64	0.47	0.39	1.72	0.33			2.39
Net ET						4.59	8.65	8.23	3.52				24.99
Wetlands Narrow					0.27	6.85	13.13	12.61	6.03	0.20			39.10
St Dev					0.14	0.92	0.68	0.55	2.46	0.48			3.41
Net ET						6.38	12.58	12.01	5.33				36.30
ETr	1.00	1.80	4.19	5.95	7.26	8.95	9.06	8.43	6.10	4.12	2.01	1.03	59.92
St Dev	0.26	0.36	0.57	0.61	0.55	0.64	0.41	0.32	0.35	0.44	0.38	0.28	2.19

All values are 38 year averages. Effective precipitation is 80% of total for crops and 100% of total for open water evaporation.

UtahState University
COOPERATIVE EXTENSION

Strategy – Improve Irrigation System Coefficient of Uniformity (Sprinklers)



Irrigation Uniformity

Yield Uniformity

The yield impact is the obvious. Some yield impacts are as real but not as obvious.

Business Plans & No-Cost Planning Resources

Biographical Information:
Jason Yerka
Utah State University Small Business Development Center

I graduated with my MBA from Utah State University in 2009 and began working as a private small-business consultant and soon thereafter began working for the Utah Small Business Development Center Network which provides one-on-one management consulting services. In 2010 I opened an SBDC center in Tooele and another one in Brigham City in 2011. I currently wear two hats as the Director of the Box Elder Business Resource Center and the Director of the Northern Region USU SBDCs.

When I'm not at work I greedily spend every moment I can with My Lovely Wife, Kiley, and our three children, Jake, Nathan and Kenzie, who are quite possibly the cutest children who have ever lived.

Session Description:
We will be discussing the common elements found in business plans and the no-cost resources available to help you prepare your plan so it's ready for the bank.

Market Position Strategy:

Where in the market you intend to win

PROFITABILITY RATIOS

Return on Assets (ROA)

$$\frac{\text{Income}}{\text{Assets}}$$

Return on Invested Capital (ROIC)

$$\frac{\text{Net Income}}{\text{Total Liabilities and Stockholder's Equity} - \text{Current Liabilities}}$$

Return on Equity (ROE)

$$\frac{\text{Net Income}}{\text{Stockholder's Equity}}$$

Earnings per Share (EPS)

$$\frac{\text{Net Income} - \text{Perferred Stock Dividends}}{\text{Number of Shares of Common Stock} + \text{Equivalents}}$$

Net Profit

$$\frac{\text{Net Income}}{\text{Net Sales}}$$

ACTIVITY RATIOS

Asset Turnover

$$\frac{\text{Net Sales}}{\text{Total Assets}}$$

Inventory Turnover

$$\frac{\text{Cost of Goods Sold}}{\text{Average Inventory}}$$

Inventory Turnover in Days

$$\frac{365}{\text{Inventory Turnover}}$$

Working Capital Turnover

$$\frac{(\text{Net Sales})}{(\text{Average Current Assets} - \text{Average Current Liabilities}}$$

SOLVENCY AND LEVERAGE RATIOS

Current Ratio

$$\frac{\text{Current Assets}}{\text{Current Liabilities}}$$

Acid Test Ratio

$$\frac{\text{Quick Assets}}{\text{Current Liabilities}}$$

*Quick assets are those that are highly liquid (i.e. cash, marketable securities, certain accounts receivable…)

Debt Ratio

$$\frac{\text{Total Debt}}{\text{Total Assets}}$$

Debt to Equity Ratio

$$\frac{\text{Total Liabilities}}{\text{Owner's Equity}}$$

Times Interest Earned

$$\frac{\text{Pretax Operating Income} + \text{Interest Expense}}{\text{Interest}}$$

MARKET-RELATED AND DIVIDEND RATIOS

Price Earnings Ratio (PE)

$$\frac{\text{Market Price per Share of Stock}}{\text{Earnings per Share}}$$

Dividend Yield Ratio

$$\frac{\text{Dividends per Share}}{\text{Market Price per Share}}$$

Dividend Payout

$$\frac{\text{Dividends}}{\text{Net Income available to common stockholders}}$$

Strategic Formulation:

How you intend to win in the market.

Identify Competitor Position:

1.______________________________________

2.______________________________________

3.______________________________________

4.______________________________________

Identify Weaknesses in Competition:

1.______________________________________

2.______________________________________

3.______________________________________

4.______________________________________

Identify Strengths in Your Business:

1.______________________________________

2.______________________________________

3.______________________________________

4.______________________________________

Identify Strategy to Exploit Your Strengths Against Competitor Weaknesses:

1.______________________________________

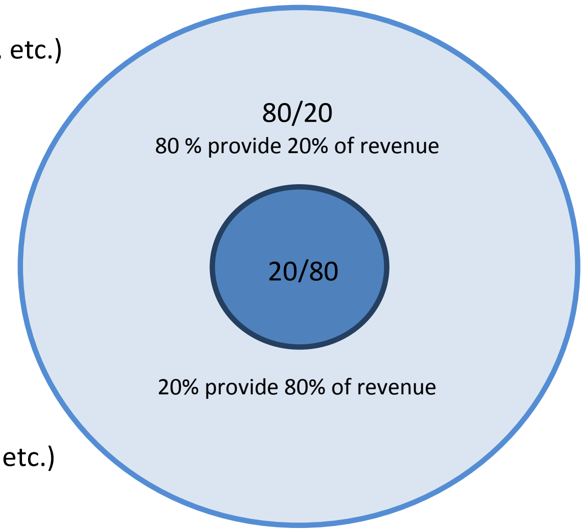
2.______________________________________

3.______________________________________

4.______________________________________

Target Marketing:

Identifying and studying the customers of your products and services.



Identify Demographics of the 20%: (Age, Sex, Social Class, etc.)

1.____

2.____

3.____

4.____

Identify their Psychographics: (Needs, Wants, Ambitions, etc.)

1.____

2.____

3.____

4.____

Identify their Habits: (Where They Live, Eat, Shop, Recreate, etc.)

1.____

2.____

3.____

4.____

Identify Potential Advertising based on their habits: (Locations, Mediums, Tag Lines, etc.)

1.____

2.____

3.____

4.____

Creating a Basic Business Plan

Because every business is different, there are many different styles of business planning out there. This outline is merely a simple version that will create the fundamentals of a business plan. Depending on the complexity of your business you may need to include additional information to your specific plan.

1. **Executive Summary** –
   - **a) A good Executive Summary will cover your entire plan without the details**

2. **Business Plan** – 6-9 pages
   - **a) The Company**
   - **b) The Product/Service**
   - **c) Identify an Opportunity**
   - **d) Seizing this Opportunity**
   - **e) Management Team**
   - **f) Financials**

3. **Appendix**

GAP Introduction: What is new and various types

Biographical Information:
Shawn Olsen
Utah State University

Shawn Olsen works as a Utah State University Extension Agent in Davis County.

Session Description:

Reviewing what is new in the GAP program and discussing different areas of GAP including different food safety methods. Good Agricultural Practices commonly known as GAP are a set of recommendations that can help improve the quality and safety of the produce grown. Increasingly, wholesalers and others are requiring that the farms they buy from become GAP certified. This session will review what is new in the GAP program and discuss the different areas of GAP including food safety methods.

Food Safety Begins on the Farm

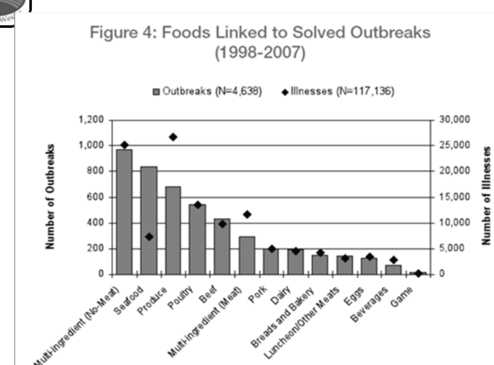
This material is based upon work supported by NIFA under Award Number 2012-49400-19767.

Why is Food Safety Important?

- 1 in 6 (48 m) people in U.S. suffer from foodborne illness/year (www.cdc.gov; Scallan et al. 2011)
  - 128,000 hospitalized
  - 3,000 die
- It is estimated that 76 million cases of foodborne illness occur in the United States each year (Mead et al. 1999)
  - 325,000 hospitalizations
  - 5,000 deaths

Why is Food Safety Important?

- Not all cases are reported to CDC
- Approximately 34% of them are "solved"
  - Source and product verified
- Economic costs
  - $152 billion/year
  - $39 billion/year is related to produce (www.makeourfoodsafe.org/cost_map)



http://cspinet.org/new/pdf/alloverthemap.pdf

Microbial contamination of fresh produce is one of the most challenging public health issues

- Why?
  - Eaten raw
  - Produce characteristics
    - Uneven surfaces and consumption of entire plant
  - Contamination is often a result of cross-contamination
  - Consumed across different venues
  - Direct contact handling

Why is Food Safety Important?

- Consumers concerned/uncertain about food - fueled by three food industry trends
  - Rising disposable household incomes
    - Food away from home (52%)
    - Health issues
  - Increasing food safety concerns
    - GMOs, BSE, salmonella, antibiotic-resistance, pesticide/herbicide residues, hormone transfer
    - Increased demand for "local" foods
  - Growing separation between agricultural producers & consumers
    - <2% of population living on farms, 17% living in rural areas

Why is Food Safety Important?

- Reducing consumer uncertainty may lead to higher pricing
- Consumers willing to pay premiums for products perceived to be safer, healthier, or environmentally friendlier
  - Natural/organic/reduced chemical inputs
  - Food safety inspections
  - Local foods or certain areas of origin
  - Humane animal treatment
  - Social responsibility
- Food safety plans required by many vendors and grocery retailers

Are there reasonable steps that a grower can take to reduce the risk that pathogens will contaminate the food produced on the farm?

Absolutely!

Food Safety Plan

- A good idea for every farm—regardless of size or commodity produced
- Different certification/audit programs to meet different goals
- Will discuss general safety plans, environmental stewardship, + GAP

Resources:

Steps to Reduce/Limit Contamination?

- Identify Risks
  - Educate and train yourself
- Develop Standard Operating Procedures
  - Educate and train others
- Develop Food Safety Plan

Keep PACE

- Prevention
  - A commitment to prevent microbial contamination
  - Fixing a problem takes more time than preventing it
    - Some problems can't be fixed
  - Developing Standard Operating Procedures (SOPs)

http://edis.ifas.ufl.edu/pdffiles/FY/FY96600.pdf

Keep PACE

- Accountability
  - You are accountable for all inputs, products and processes on your farm (including employees)
  - Must be prepared for the responsibility that comes with it

http://edis.ifas.ufl.edu/pdffiles/FY/FY96600.pdf

Keep PACE

- Control
  - All aspects of product from field to consumer
  - Including both the human and the environmental factors that affect your farm
- Education
  - Everyone involved in production and distribution must be properly trained
  - All (employees, family, volunteers) need to be well trained in proper food handling procedures

http://edis.ifas.ufl.edu/pdffiles/FY/FY96600.pdf

Recordkeeping

- Types of Records
  - Farm map
    - Identifying potential contaminants
  - Water tests results
  - Cleaning and sanitizing logs
  - Training logs
  - Harvest logs
    - Date, field, workers, product(s)
  - Sales logs
    - Buyer, product(s), quantity, date

ACES

- Utah Agriculture Certificate of Environmental Stewardship
- Includes education, planning, and inspection components
- Focus on environmental protection

Resources:

ACES

- Three steps:
  - Education modules
  - On-farm risk assessment
  - On-farm inspection by UDAF
- Good for five years

Resources:

ACES

- Major sectors:
  - Farmstead
  - Cropping systems
  - Animal feeding operations
  - Grazing and pasture

Resources:

ACES Benefits

- Sustain ag viability
- Protect natural resources
- Build positive public opinion
- Other?

Resources:

Food Safety Risk Controls/Management

1. Good Agricultural Practices (GAPs)
   - FDA & USDA published farm level voluntary 'guidelines' in 1998
   - Created an audit program based on guidelines
     - Producer must pay auditor's time and mileage (federal rate $92.00/hour)
     - Separate audit required for each crop
2. Leafy Greens Marketing Agreement (LGMA)
   - Response to 2006 spinach outbreak
   - Mandatory for many California farmers
     - Not easily adopted by small and midsized farms or farms growing multiple crops

GAPs

- Good Agricultural Practices
- Reduce the chance of causing on-farm microbial contamination of food
- Fruits and Vegetables

USDA GAP

- May be required to sell to school lunch program or military
- Based on FDA's *Guide To Minimize Microbial Food Safety Hazards For Fresh Fruits And Vegetables*
- Requires agreement allowing un-announced visits

GAP Audit

- May be required to sell to certain vendors
- Goal is to reduce risk
- Does not eliminate all risk—passing an audit is snap shot in time
- Need to continue to refine/follow risk mitigation practices

Components of GAPs

- Clean Soil
- Clean Water
- Clean Hands
- Clean Surfaces

Clean Soil

- Field Location
- Manure Application
- Animal Access

Clean Soil
Field Location

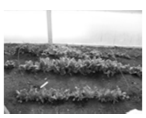
- Review land history for prior use and applications of sludge or animal manure.
- Choose fields upstream from animal housings.
- Make map of farmstead and fields

Clean Soil
Field Location

- Know upstream uses of surface water and test water quality as needed.
- Prevent runoff or drift from animal operations from entering produce fields.

Clean Soil
Manure Application

- Harvest ready-to-eat produce at least 120 days after application of raw manure.
  - Requirement varies with audit program
- Do not sidedress ready-to-eat crops with fresh or slurry manure.



Clean Soil
Manure Application

- Follow composting standards
  - Time and temperature can reduce pathogens
  - Considered safe if fecal coliforms <1000 MPN/gram
- Compost Tea
  - Use potable water and know compost source
- Keep records of application rates, source, and dates.

Clean Soil
Animal Access

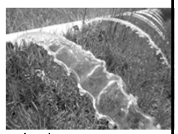
- Minimize wild and domestic animal traffic in produce fields.
  - Don’t graze livestock near produce fields
  - Document methods used
    - Fencing, decoys, noise deterrents
  - Scout for signs of livestock in fields
    - Manure, sleeping spots, damaged crops
  - What about employee’s dogs???

Clean Water

- Irrigation Water
  - Risk varies with source (low to high)
    - Municipal
    - Well
    - Surface
  - Test for fecal coliforms
    - Quantified test
    - If not zero, lower potential risk
  - Keep copies of all water tests

Clean Water

- Irrigation Water
  - Risk varies with type of irrigation (high to low) and crop
    - Overhead
    - Flood
    - Drip
  - Test for fecal coliforms
    - Quantified test
    - If not zero, lower potential risk by changing method
  - Keep copies of all water tests



Drip (trickle) irrigation waters crops efficiently
Credit: Nova Scotia Agriculture and Fisheries

Clean Water

- Are there different levels of risk associated with the source and method of irrigation water for these crops?

Clean Water

- Monitor Wash Water Quality
  - Use potable water
    - Zero Fecal coliforms allowed
  - Treat contaminated water
    - Use only FDA-approved disinfectants.
      - Read and follow all label instructions.
      - 1 tsp chlorine bleach per 10 gallons of water
    - Monitor chlorine levels
      - 5 ppm
    - Keep pH between 6.5 and 7.0
      - Above 7.5; chlorine ineffective

Clean Hands

- Worker Health and Hygiene
  - Education
    - Training and appropriate signage
    - Setting a good example.
      - Show commitment to good practices
  - Wash Hands
    - Soap, water and single use towels
    - Never use hand sanitizer to replace hand washing
    - Gloves do not take the place of washing hands
      - Single-use latex gloves recommended

When to wash your hands…

- BEFORE
  - Returning to the field or entering the packing line
  - Touching clean produce
  - Putting on new gloves
  - Preparing or consuming food
  - Working your shift
  - Cleaning equipment and preparation surface
- AFTER
  - Visiting the rest room
  - Touching bare human body parts (ears, nose, hair, etc)
  - Working with soil, rotten produce or garbage
  - Smoking or doing other activities that dirty your hands

Clean Hands

- Worker Health and Hygiene
  - Monitor health symptoms
    - Sick employees should not harvest or process vegetables
  - Appropriate rest room facilities
    - Within 5 minute walk of field (1/4 mile)
    - Appropriate hand washing station with signage

Clean Surfaces

- Equipment
  - Field
    - Avoid cross contamination of manure
    - Look for oil/fuel leaks
  - Packing House
    - Use food grade lubricants
  - Have plan for spill/leak

Clean Surfaces

- Tools
  - Wash and sanitize
  - Harvesting tools (knives, blades, etc)
  - Are they easy to clean?
    - Scissors
  - Where are they stored?

Processing surfaces
  - Need to be easy to clean (non porous)
    - Wood versus plastic versus stainless steel
  - Wash and sanitize
  - Tables/Bins/Coolers

GAP Audit

- Requires documentation on soil, water, worker training, pesticides, etc.
- Farm visit, generally during harvest
- In UT, done by private co.
- Good for one year
- Cost of record keeping and audit

Resources:

Some Auditors

- Quality Certification Services, www.qcsinfo.org
- World Quality Services, www.wqcert.com
- Primus GFS, www.primuslabs.com
- NSF Agriculture, www.nsf.org

Resources:

Food Safety Modernization Act of 2011

- Creates new produce safety regulations and allows FDA to order recalls
- Farmers and food processors have to tell FDA how they are working to keep food safe
- New regulations are due in 2013-2015
- Focus is on prevention, not recalls
- FDA may decide to conduct farm audits

FSMA

- Gives FDA more authority to recall unsafe food
- More authority to access records about potentially hazardous food
- Focus is on microbial hazards and not on chemical or physical contamination

FSMA Focus

- Routes of microbial contamination
  - Agricultural water—periodic testing
  - Animal origin soil amendments—composting standards, waiting time
  - Health and hygiene—hand washing, etc.
  - Domesticated and wild animals—grazing waiting periods, monitor animal intrusion
  - Equipment, tools, and buildings—cleaning, sanitation

Food Safety Modernization Act

- Regulations still being developed
- Go to www.fda.gov/fsma for more info
- May increase costs for small scale and organic producers
- May conflict with federal organic standards, esp. manure regs
- May increase food costs

FSMA

- By 2012… , FDA required to:
- Develop standards relating to production and harvesting of produce that pose a serious risk
- Develop updated good agricultural practices document
- Focus on traceability in production and processing of high risk foods
- (www.kelleydrye.com)

FSMA

- Proposed changes based on public comments:
  - Water applied during growing subject to recreational water criteria
  - Expanded review of manure waiting time
  - May accept organic standard for manure
  - Covered farms based on produce sales, not all food sales

FSMA Exemptions

- Produce rarely consumed raw: such as potatoes, pumpkins, sweet corn, etc.
- Produce to be processed: canned beans

FSMA Effective dates

- Effective 60 days after final rule publ.
- Produce sales <$25K, not covered
- Very small business, $25K—$250K, 4 years, 6 years on water req.
- Small, $250K- $500K—3 years, 5 years on water
- Over $500K, —2 years, 4 years for water

Traceback

- What is Traceback?
  - Tracing a product back to the farm
    - Label and date on a bag of produce
    - Label and date a box delivered to a restaurant
  - Tracing produce back to specific field
    - Including workers who picked and/or processed produce
- Develop a simple traceback system

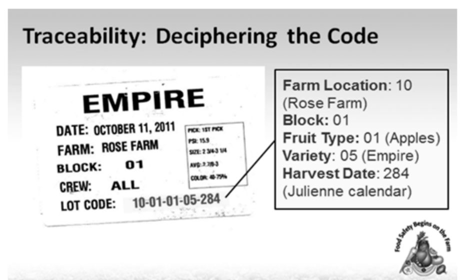
Why Traceability Systems?

- Improve supply-side management
  - Inventory accounting, “just in time” input arrival
  - Lower costs
- Differentiate products based on quality attributes
  - For unobservable quality, recordkeeping is the only proof of product quality
  - Expand sales of quality products

Why Traceability Systems?

- Facilitate food safety issues
  - Isolate extent and source of safety issue
  - Recall of affected products
  - Minimize potential for bad publicity

Traceback
Develop a simple system!



Review

- What are the steps to reduce/limit contamination?
  - Educate yourself
  - Analyze your risks
  - Educate and train others
  - Develop SOPs
    - Standard Operating Procedures
  - Develop an on-farm food safety plan

What are your Options?

- Start with something simple!
  - Make a farm map
  - Identify your risks
  - Test your water

What are your Options?

- Develop a Food Safety Plan
  - Increase recordkeeping
  - Develop system for traceability
- Consider a Third Party Audit
  - May be required by schools, restaurants or grocery stores

Resources

- Food Safety Modernization Act info at http://www.fda.gov/Food/FoodSafety/FSMA/ucm250568.htm
- Harmonized Food Safety Standards – United Fresh Produce Association at http://www.unitedfresh.org/assets/food_safety/Harmonized_Standard_pre-farm_gate_110722.pdf
- FDA Labeling & Nutrition at http://www.fda.gov/Food/LabelingNutrition/default.htm
- National Organic Program & Farmers' Markets at http://www.ams.usda.gov
- Utah's Own at https://utahsown.utah.gov/
- Western Extension Marketing Committee at http://www.valueaddedag.org

Good Agricultural Practices Webinars

- Part 1: Food Safety Basics, Regulatory Landscape, 3rd Party Audits, Worker Hygiene Available from: https://connect.extension.iastate.edu/p97225744/; Webinar 1 Slides
- Part 2: Minimizing Risks During Production: Irrigation Water and Manure Management Available from: https://connect.extension.iastate.edu/p26083829/; Webinar 2 Slides
- Part 3: Minimizing Risks During Harvest & Post-Harvest: Washing & Packing, Cooling & Storage, Transportation & Traceback Available from: https://connect.extension.iastate.edu/p51292549/; Webinar 3 Slides

Building Farmers in the West

Thank You!

Environmental Stewardship Certificate

Biographical Information:
Jay Olsen
Utah Department of Agriculture and Food

Jay was raised in Ephraim on a cattle and sheep ranch. Not far from home, he graduated from Manti High School in 1973. Then went on to attend Snow College for an associate degree of science in 1975 and got his Bachelor's Degree from Brigham Young University in Animal science two years later. Following college, Jay became a self-employed farmer and rancher and has been for the past 36 years in Sanpete County.

Jay is a loving husband to his wife, Tawny Jean Nelson, who he married in 1983. Together, they have been proud parents to ten children, followed by seven grandchildren, which he claims as his greatest accomplishment.

Jay has served on the AFO/CAFO committee from 1999-2013 and the State Quality Board from 2002-2010, of which he was chair for the last two years. Currently, he serves as the chair for the Sanpitch Watershed Stewardship Group and also works for the Utah Department of Agriculture and Food in 2013 as an Environmental Specialist.

Session Description
This session will cover the Agriculture Certificate of Environmental Stewardship (ACES).

AGRICULTURE CERTIFICATE OF ENVIRONMENTAL STEWARDSHIP

ACES

Sustains & Rewards Agriculture | Educates | Protects the Environment

Urban and Small Farms Conference
February 18 & 19 2015
Jay Olsen

Purpose

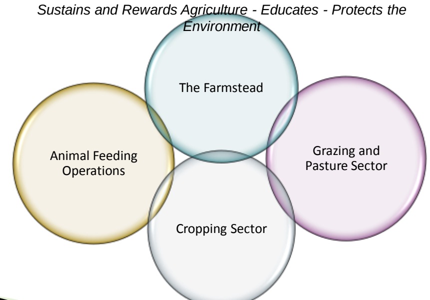
- Preserve
- Protect
- Provides
- Improves sustainabil
- Meets regulation
- Proactive approach

Benefits

- Certification for 5 year + 5 year renewal
- No additional regulation
- Required 75%-90% funded
- Migrating factor for penalties
- Permit by rule (AFO)

Agriculture Certificate of Environmental Stewardship

Sustains and Rewards Agriculture - Educates - Protects the Environment



Farmstead

- Emergency Plan
- Emergency spill kit
- Pesticide storage
- Fertilizer storage & handling
- Petroleum storage & handling
- Septic system
- Noxious or invasive weeds

Animal Feeding Operation

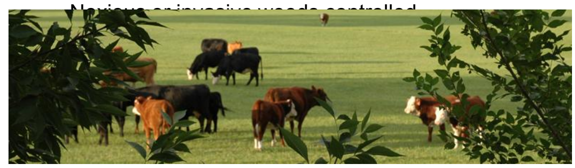
- Permitted CAFO, UPDES
- AFO/CAFO unpermitted/permit by rule
- Nutrient Management Plan
- Runoff from facilities contained
- Manure tested & records maintained
- Noxious or invasive weeds controlled

Cropping System

- Soil Health
- Fertilizer records maintained
- Soil testing and records maintained
- Equipment calibrated (fertilizer & spray)
- Pesticide application
- Irrigation management
- Noxious or invasive weeds controlled

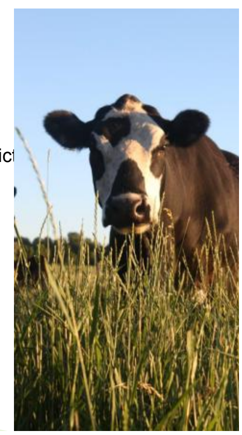
Grazing & Pasture Systems

- GIP's principles of Time, Timing and Intensity
- Grazing Management Plan followed
- Allotment Management Plan followed



How to Certify

- Obtain Workbook
- Contact Local Conservation District
- Planner Reviews requirements
- Request Certification
- Third Party Audit
- Certification from UCC



Utah Department of Agriculture and Food

UDAF

ACES

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ACES Website
http://ag.utah.gov/aces/index.html

Produce Safety Rule

Associated Food Stores

foodsafety

Food Safety Modernization Act (FSMA)

Major FSMA Regulations

FSMA Regulation	Link to Published Agency Rule(s)	Link to FMI's Comments	Court-Ordered Final Rule Deadline	Expected Compliance Date
Preventive Controls: Human Food*	Revised PR: 9/29/2014 Proposed Rule: 1/16/2013	12/15/2014 11/22/2013	8/30/2015	8/30/2016
Preventive Controls: Animal Food*	Revised PR: 9/29/2014 Proposed Rule: 10/29/2013	12/15/2014 3/31/2014	8/30/2015	8/30/2016
Produce Safety*	Revised PR: 9/29/2014 Proposed Rule: 1/16/2013	12/15/2014 11/22/2013	10/31/2015	10/31/2016
Foreign Supplier Verification Program*	Revised PR: 9/29/2014 Proposed Rule: 7/29/2013	12/15/2014 1/27/2014	10/31/2015	10/31/2016
Third Party Certification of Auditors	Proposed Rule: 7/29/2013	1/27/2014	10/31/2015	10/31/2016
Sanitary Food Transportation Act	Proposed Rule: 2/5/2014	7/30/2014	3/31/2016	3/31/2017
Food Defense	Proposed Rule: 12/24/2013	6/30/2014	5/31/2016	5/31/2017

* *Executive Order 12866 requires the Office of Management and Budget (OMB)'s Office of Information and Regulatory Affairs to review those regulations that are economically significant (an expected annual impact of over $100 million). FDA made revisions to some of the FSMA proposed rules, and the supplemental proposed rules were released in September 2014.*

Overview: Produce Safety Rule

The purpose of the Produce Safety Rule is to establish minimum standards for safety growing, harvesting, packing and holding of produce on farms.

Regulation

For the Purposes of this Proposed Produce Safety Rule

BUSINESS SIZE	ANNUAL FOOD SALES: 3-YEAR ROLLING AVERAGE	COMPLIANCE DATES: FOLLOWING FINAL RULE	COMPLIANCE DATES: PROVISIONS RELATED TO WATER*
Large Businesses	More than $500,000	2 years	4 years
Small Businesses	Above $250,000 & no more than $500,000	3 years	5 years
Very Small Businesses	Above $25,000 & no more than $250,000	4 years	6 years
Excluded	Businesses with $25,000 or less in annual sales (3-year rolling average) of food are excluded from coverage by the Proposed Rule.		

*Delayed implementation applies to water quality [testing, monitoring, and related record keeping requirements] requirements in proposed § 112.44 and related provisions in §§112.45, 112.50(b)(5), 112.50(b)(6), and 112.50(b)(7).

Estimated Farms Affected

	NUMBER OF OPERATIONS	ESTIMATED COST	PERCENT OF DOMESTIC PRODUCE, FARMS AFFECTED (BY STATUS)
Total Domestic Farms	2,076,000	———	———
Total Domestic Produce Farms	189,600	———	———
Domestic Farms Affected	40,500	$459.56 M	21%
Partially Exempt Direct Market Farms (Subject to Labeling Requirement)	75,720	$3.82 M	40%
Farms Not Covered by the Rule • ≤ $25K in Food Sales • Commercially Processed • Rarely Consumed Raw	73,600 • 34,430 • 29,870 • 9,300	———	39%

GAP Certification

CERTIFIED

- In an effort to protect independent retailers and ultimately our guests. Associated Food Stores is requiring that all growers become GAP (Good Agricultural Practices) certified.

73


Areas Covered In the Inspection Process:
• Water
• Manure
• Worker Health and Hygiene
• Field Sanitation
• Packing Facility Practices
• Transportation
• Traceback
CERTIFIED


Websites
• Gapcertification.com
• Qcsinfo.org

My Experience with GAP

Biographical Information:
Jeremy East
East Farms LC.
Layton, UT

Jeremy has been farming his whole life. He runs a 250 acre mixed vegetable farm in Layton Utah and sells both wholesale and retail at farmer's markets. They have been global GAP certified for the past 6 years.

Session Description:
Will cover the basic in and outs of global GAP.

Do's and Don'ts of GAP

Biographical Information:
Christopher Riley
Riley Farms

Christopher Riley from Payson, UT. Third generation fruit grower raising sweet cherries, peaches, apples, tart cherries, and more recently vegetables.

Session Description:
The good and bad of GAP

Is GAP for my operation?

Costs of GAP

Benefits of GAP

Utah Agriculture: Connecting with Small & Urban Farming

Biographical Information:
Commissioner LuAnn Adams
Department of Agriculture & Food
agriculture@utah.gov
Ag.Utah.Gov

LuAnn Adams was appointed commissioner of the Utah Department of Agriculture and Food in 2014. Credited with excellent organizational and collaborative skills, Adams is considered resourceful, conservative, trustworthy and self-motivated as she maintains constructive rapport with regulators, stakeholders and the public with a 'can-do' attitude when pioneering innovative projects. She is passionate for preserving and protecting the healthy growth of agriculture, food safety and economic development of agri-businesses.

Keynote Description:

The commissioner will be talking about the connection between large and small agriculture in Utah and what state programs are available to small growers from the Utah Department of Agriculture and Food. Commissioner Adams will also brief the audience on a recently released study by the U.S. Department of Agriculture relating to trends in local and regional food systems. There's one statistic that sets Utah apart from a majority of states.

A few key pages of the report are attached. The entire report can be found at:

http://www.ers.usda.gov/publications/ap-administrative-publication/ap-068.aspx

United States Department of Agriculture

Economic
Research
Service

Administrative
Publication
Number 068

January 2015

Trends in U.S. Local and Regional Food Systems

Report to Congress

United States Department of Agriculture

Economic Research Service

Administrative Publication Number 068

January 2015

Trends in U.S. Local and Regional Food Systems

A Report to Congress

Sarah A. Low, Aaron Adalja, Elizabeth Beaulieu, Nigel Key, Steve Martinez, Alex Melton, Agnes Perez, Katherine Ralston, Hayden Stewart, Shellye Suttles, and Stephen Vogel, of USDA Economic Research Service, and Becca B.R. Jablonski, of Colorado State University

Abstract

This report provides an overview of local and regional food systems across several dimensions. It details the latest economic information on local food producers, consumers, and policy, relying on findings from several national surveys and a synthesis of recent literature to assess the current size of and recent trends in local and regional food systems. Data are presented on producer characteristics, survival rates and growth, and prices. The local food literature on consumer willingness to pay, environmental impacts, food safety regulations, and local economic impacts is synthesized when nationally representative data are unavailable. Finally, this report provides an overview of Federal and selected State and regional policies designed to support local food systems and collaboration among market participants.

Keywords: local food systems, direct to consumer marketing, intermediated marketing, farm to school, food hubs, farmers' markets, local food prices, Food Safety Modernization Act, Farm Bill, environmental issues, Census of Agriculture, Agricultural Resource Management Survey

Acknowledgments

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United States Department of Agriculture

A report summary from the Economic Research Service January 2015


United States Department of Agriculture
Trends in U.S. Local and Regional Food Systems
Report to Congress

Find the full report at *www.ers.usda.gov/publications/apo-administrative-publication-number/apo-068.aspx*

Trends in U.S. Local and Regional Food Systems: A Report to Congress

Sarah A. Low, Aaron Adalja, Elizabeth Beaulieu, Nigel Key, Steve Martinez, Alex Melton, Agnes Perez, Katherine Ralston, Hayden Stewart, Shellye Suttles, Stephen Vogel, and Becca B.R. Jablonski

What Is the Issue?

This is a congressionally mandated report, written at the request of the House Agriculture Committee as a part of the Fiscal Year 2014 Appropriations Bill, in January 2014. The Committee directed the Economic Research Service (ERS) to provide a report assessing the scope of and trends in local and regional food systems and to make it publicly available on the ERS website.

Local food has been the subject of Federal, State, and local government policy in recent years as consumer interest in and demand for local foods has grown. Because local foods have been linked to the full suite of USDA priorities—including enhancing the rural economy, the environment, food access and nutrition, informing consumer demand, and strengthening agricultural producers and markets—up-to-date information is critical for understanding the evolution and effects of local and regional food systems across the country.

What Did the Study Find?

Producer participation in local food systems is growing, and the value of local food sales, defined as the sale of food for human consumption through both direct-to-consumer (e.g., farmers' markets) and intermediated marketing channels (e.g., sales to institutions or regional distributors), appears to be increasing.

- In 2012, 163,675 farms (7.8 percent of U.S. farms) were marketing foods locally, defined as conducting either direct-to-consumer (DTC) or intermediated sales of food for human consumption, according to census of agriculture data. Of these farms, 70 percent used only DTC marketing channels, which include farmers' markets and community supported agriculture (CSA) arrangements. The other 30 percent used a combination of DTC and intermediated channels or only intermediated channels.
- The number of farms with DTC sales increased by 17 percent and sales increased by 32 percent between 2002 and 2007; however, between 2007 and 2012 the number of farms with DTC sales increased 5.5 percent, with no change in DTC sales. That DTC sales did not increase may be due to plateauing consumer interest or to growth in non-direct sales of local food (i.e., local food sold through intermediated marketing channels like grocery stores or institutions), the value of which is not measured by the census of agriculture.
- Agricultural Resource and Management Survey (ARMS) and census of agriculture data indicate that local food sales totaled an estimated $6.1 billion in 2012. This is only an estimate because neither data source collects complete information on the value of intermediated sales.
- Farms with gross cash farm income below $75,000 accounted for 85 percent of local food farms in 2012, according to census data. These farms are estimated to account for only 13

ERS is a primary source of economic research and analysis from the U.S. Department of Agriculture, providing timely information on economic and policy issues related to agriculture, food, the environment,and rural America.

percent of local food sales. Local food farms with gross cash farm income above $350,000 accounted for 5 percent of local food farms and 67 percent of sales.

- Farms selling local food through DTC marketing channels were more likely to remain in business over 2007-12 than all farms not using DTC marketing channels, according to census of agriculture data. Farms with DTC sales tended to experience smaller increases in sales than all other farms, however.
- It is difficult to draw conclusions about the local economic impact of local foods systems because the existing literature has narrow geographic and market scope, making comparing studies complicated. Data necessary to conduct economic impact analyses are costly to obtain, and researchers have yet to agree on a standard way of accounting for the opportunity costs involved when local foods are produced and purchased or on a standard set of economic modeling assumptions. Many questions surrounding the economic impact of local foods remain unanswered and could be addressed by future research (e.g., Are local food systems good for the rural economy? Might the economic benefits of expanding local food systems be unevenly distributed?)

The Food Safety Modernization Act (FSMA) calls for sweeping changes to the U.S. food safety system. Regulatory focus shifts from response (to contamination) to prevention in order to ensure that the U.S. food supply is safe. This will be the first time that the U.S. Food and Drug Administration (FDA) will have jurisdiction over onfarm activities, and FSMA will impose relative uniformity of standards across suppliers of fresh produce. Currently, food safety in produce is a hodgepodge of decisions by individuals, grower organizations, buyers, and governments that can vary by farm size, commodity, region, and country.

- Although FSMA was passed in 2011, the rulemaking process for FSMA is ongoing and will ultimately include numerous new rules (i.e., regulations) and guidance documents.
- Both the proposed Produce Safety Rule and the proposed Preventive Controls Rule may affect local food farmers; these rules build on prevailing voluntary food safety guidelines. DTC farms apply more manure than all non-DTC farms and thus could be disproportionately affected by any FSMA regulations on the application of biological soil amendments.

Understanding who buys local foods and why is valuable for targeting marketing efforts by producers, grocery stores, restaurants, and others needing information on consumer demand for local food. ERS analysis of the USDA Farm to School Census, 2011-2012, finds farm to school programs exist in more than 4 out of 10 school districts across the country.

ERS analysis of 2006 Nielsen Homescan data finds that selected produce prices at DTC outlets are generally lower, on average, than prices at retail stores in all seasons. Nonetheless, DTC food prices for some product/location combinations were higher than retail store prices.

We draw no conclusion on whether local food production has a different environmental impact but do present some information about environmental practices of farms with and without DTC sales and synthesize literature on the nexus between the environment and local/regional food systems.

Many States and localities are supporting local food system development. While this report does not inventory such activities, we highlight some programs going on at the regional level. Collaboration is a common theme. Communities appear to be leveraging both Federal and State programs, while also partnering with nonprofits, the private sector, and other government entities.

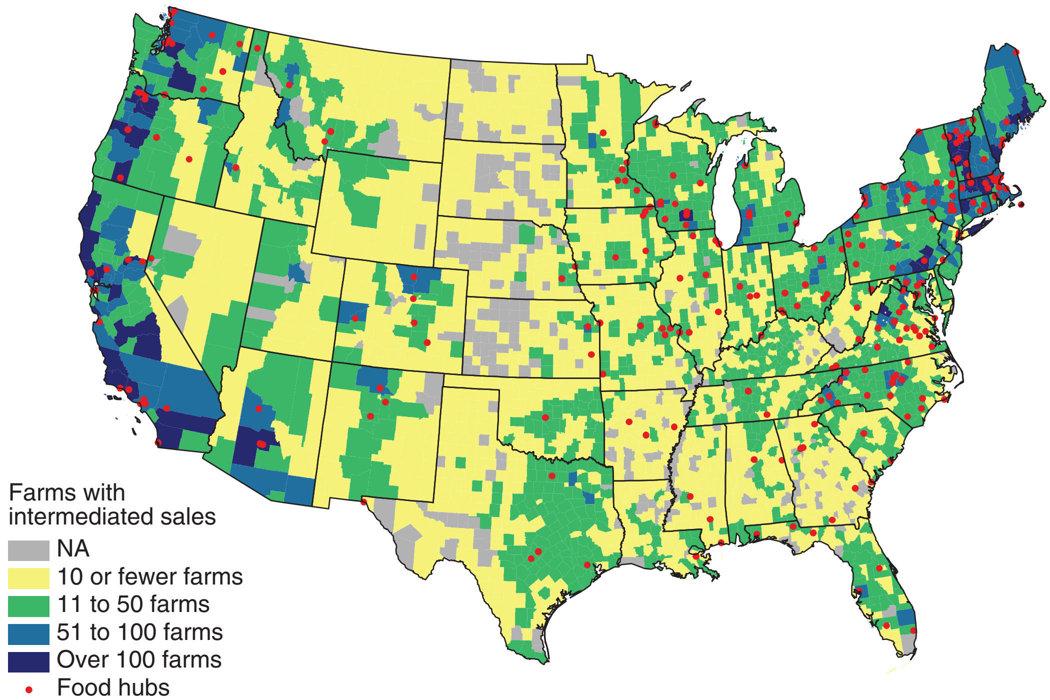
Federal policies related to local and regional food systems were greatly expanded by the Food, Conservation, and Energy Act of 2008, and are further expanded in the Agricultural Act of 2014, which strengthened support for intermediated marketing channels.

How Was the Study Conducted?

This report draws on USDA surveys, censuses, and statistical analyses as well as the available academic literature to provide the latest information on the economics of local and regional food systems. Specifically, this report uses the latest (2012) Census of Agriculture data to describe local food producer characteristics, geography, and farm business survival and growth rates. This report also uses the ERS/NASS Agricultural Resource Management Surveys from 2008 to 2011 to provide a larger sample of local food farms than previous research. The report also summarizes findings from the 2011-12 USDA Farm to School Census. We believe this report is also the first to present a nationally representative comparison of produce prices at direct and conventional retail outlets; for this analysis we use 2006 Nielsen Homescan data.

Figure 4

Farms with direct sales to retail or restaurants, 2012, and food hubs, 2014



Source: USDA Economic Research Service, data from Census of Agriculture, 2012; USDA Agricultural Marketing Service, 2014.

Table 3 presents 2008-11 ARMS estimates and 2012 Census counts of the number of local farms using the three marketing channel options: (i) exclusively using DTC outlets, (ii) using both DTC and intermediated marketing channels, or (iii) exclusively using intermediated marketing channels. The 2012 Census counts 163,675 farmers marketing local foods, of which 70 percent used only DTC channels and 30 percent used intermediated marketing channels only or both types of marketing channels. Averaged over 2008-2011, the smaller ARMS estimate (146,238 farmers) is 11 percent lower than the number of farmers using both marketing channels in the Census and 51 percent lower than the number of farmers in the Census exclusively using intermediated marketing channels. It may be that the ARMS underestimates the number of local food farms exclusively using intermediated marketing channels. It may be that the ARMS also underestimates the value of all local food sales in the United States since farmers using both types of marketing channels or only intermediated marketing channels generate higher sales per farm than farmers relying solely on DTC outlets (Low and Vogel, 2011).

Toward a Synthetic Estimate

Absent a census estimate of the total value of local food sales in the United States, we produce a synthetic estimate using the strengths of both the 2012 Census and pooled ARMS data. The census estimates on number of farms participating in DTC and intermediated marketing channels are comprehensive. The ARMS contain more detailed information on farm characteristics. Accepting the ARMS estimates of average sales per unit as given, a synthetic estimate of the value of local food sales can be obtained by multiplying the number of farms in the 2012 Census by ARMS esti-

Make the Utah Dept of Agriculture Work for You!

Biographical Information:
Miles Maynes
Utah Department of Agriculture and Food

Miles recently graduated from Utah State University with a bachelor's in Horticulture and Soil Science. He works as a compliance specialist for Utah Department of Agriculture in the Salt Lake Area. Miles helps businesses become familiar with the Utah Nursery, Seed, Feed, Pesticide and Fertilizer Acts and assists with international USDA export certification. He also maintains the UDAF website.

Session Description:
Understand the Utah Nursery Act and Utah Seed Act. Learn the opportunities that UDAF provides to local farmers.

Utah Nursery Act

Miles Maynes
Compliance Specialist
Utah Dept. of Agriculture and Food

Benefits

- Registered Nurseries are eligible for free plant pest/disease diagnostics and fertilizer quality testing
- Ask a compliance specialist for an official sample.

Utah Nursery Act

- Passed in 1983 with the help of Nursery Industry in Utah
- Provides:
  - Fairness in the nursery industry by creating a standard set of rules
  - Protection of both wholesale and retail consumers, through labeling and quality standards
  - Mitigation of noxious weeds, agriculturally important, insect pests, and plant diseases in the state.

Website to access the Nursery Act: http://le.utah.gov/UtahCode/section.jsp?code=4-15

Conditions

- Plants sold in the state of Utah mush meet minimum indices for vitality:
  - Woody stem must have moist tissue with viable buds
  - Container plants must be healthy and established in container
  - Non-established plants shall be vigorous.

Licenses Types

Annually expires on December 31

- 1801 NURSERYMAN ($40-$200): any place where nursery stock is propagated and grown for sale or distribution
- 1802 NURSERY AGENT ($50): Nursery Brokers
- 1803 NURSERY OUTLET ($40-$200): any place or location where nursery stock is offered for wholesale or retail sale

Annual Gross Sales License Fee

$ 0 to $ 5,000: $40	$ 100,001 to $ 250,000: $120	$ 500,001 and up: $200
$ 5,001 to $100,000: $80	$ 250,001 to $ 500,000: $160	

Labeling

- All nursery stock or lot must contain a label with the following information:
  - Name (Common or botanical) including variety
  - Origin (State where grown)
  - Grade (Where applicable, i.e. roses)
  - Size (1-5)

Pests

- Weed, insect, and disease pests must be under effective control at the nursery.
  - Stock that is infested with a weed designated as noxious by county, state, or federal authorities
  - Stock that is infested with a quarantined insect pest
  - Stock that is diseased

Annual Plant Sale Fundraisers

- R68-6-6. Organizational Provisional Permit
- Non-profit groups can sell nursery plants as a fundraiser.
- All funds received from sales of such plants shall be used for the benefit of the organization or for improvement or beautification projects within the local community.
- Free Permit will be issued after, approval by UDAF.

Inspection

- Each nursery in Utah will be inspected at least once a year by UDAF. Inspections ensure compliance with the law.
- If nursery conditions do not meet the standards of the law, UDAF encourages correction of the issue(s) within 14 days. If upon reinspection the issue is not resolved, a violation may be issued.

Imports

- Within the United States
  - Meet State of Utah Requirements
  - Title R68. Agriculture and Food, Plant Industry
  - http://www.rules.utah.gov/publicat/code/r068/r068.htm
- International
  - Import Permit obtained from UDAF
  - USDA Phytosanitary Certificate presented
  - Follow-up Inspection from UDAF

Definition

- NURSERY STOCK: all plants, whether field grown, container grown, or collected native plants; trees, shrubs, vines, grass sod; seedlings, perennials, biennials; and buds, cuttings, grafts, or scions grown or collected or kept for propagation, sale, or distribution; except that it shall not mean dormant bulbs, tubers, roots, corms, rhizomes, pips; field, vegetable, or flower seeds; or bedding plants, annual plants, florists' greenhouse or field-grown plants, flowers or cuttings

Exports

- To Other States
  - Meet State Requirements
  - http://nationalplantboard.org/laws-and-regulations/
- International Exports
  - USDA Phytosanitary Certificate
  - Inspection from UDAF
  - https://www.eauth.usda.gov/MainPages/index.aspx

Field Evaluations of Pre-conditioned Transplants

Biographical Information:
Bill Varga
Teton Trees

Bill has been in the nursery/greenhouse landscape business his whole life. In Utah he was a 35 year part of the Plants, Soils, and Climate Department at Utah State University supervising gardens at Farmington and later the Utah Botanical Center. Currently, Bill is a horticultural consultant and runs the family farm in Garland, UT.

Session Description:
Native plants for Utah landscapes, targeting the farmers' market clientele.

Alternative Crop Research at USU

Biographical Information:
Larry Rupp
Utah State University

Larry Rupp is a native of Taylorsville, Utah. He studied Plant Science at Utah State University and Horticulture at Cornell University. He is currently a professor in the Plants, Soils, and Climate Department at Utah State University where he teaches plant propagation, greenhouse management, and arboriculture. He is also Extension Specialist for landscape horticulture where he works primarily in the area of landscape water conservation and specifically on selection and propagation of native plants for use in water conserving landscapes. He helped establish the Center for Water Efficient Landscaping at Utah State University and the Masters of Professional Studies in Horticulture program with its Water Efficient Landscape Management specialization. Larry and his wife, Chris, have five wonderful kids and ten perfect grandkids – most of whom know how to pull weeds.

Session Description:
Session will report on alternative crop research done at USU over the past years.

URBAN & SMALL FARMS CONFERENCE

FEB. 18-20, 2015

Viridian Center | 8030 S. 1825 W., West Jordan, Utah

Alternative Crops for Urban and Small Growers

EXTENSION

UtahStateUniversity

What are alternative farming systems?

- Worms
- Minnows
- Crickets
- Reindeer
- Yaks
- Butterflies
- Boar
- Guard dogs

http://flagstaff-lawyer.com/

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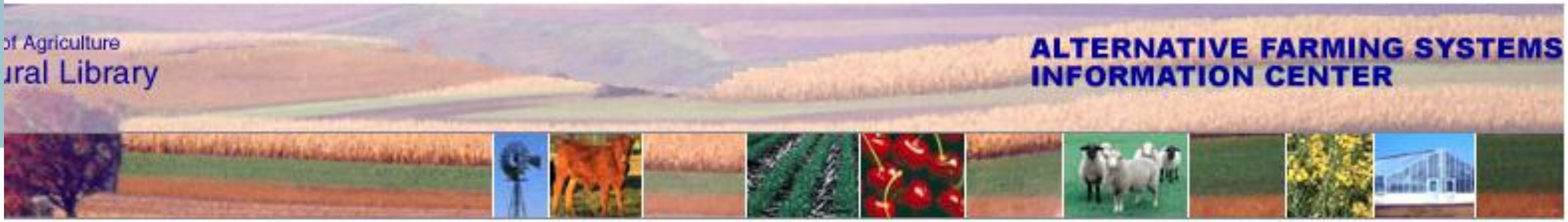

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List of Alternative Crops and Enterprises for Small Farm Diversification

The list:

- Field Crops
  - Feed and Forage
  - Fiber, Fuel, Edible and Industrial Oils
  - Food Grains, Pseudocereals, Legumes, etc.
- Specialty and Ethnic Vegetables (see also Field Crops)
- Fruits and Nuts
- Horticultural/Nursery
- Agroforestry/Forest Products
- Livestock/Animals
  - Game Related
  - Exotic Livestock/Minor Breeds/Special Uses
  - Poultry
  - Aquaculture/Fishfarming
  - Pet and Medicine Related
- Farm and Home Enterprises
  - Services
  - Recreation and Education
  - Value-added Products/On-farm Processing

What are alternative crops?

http://afsic.nal.usda.gov/list-alternative-crops-enterprises-small-farm-diversification

Examples of alternative crops for Utah

- Horticultural / Nursery
  - Bedding plants – annual flowers, herbs, etc.
  - Field grown cut flowers and floral products
  - Flowers for drying
  - Greenhouse production (traditional and hydroponic)
  - Organically grown bedding plants
  - Native plants/wild flowers and seeds
  - Regionally hardy shrubs and perennial flowers

- Agroforestry / Forest Products
  - Christmas trees
  - Firewood
  - Tree seed collection
  - Wild nuts (pine nuts)

http://afsic.nal.usda.gov/list-alternative-crops-enterprises-small-farm-diversification#toc4

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http://afsic.nal.usda.gov/list-alternative-crops-enterprises-small-farm-diversification#toc4

Alternative crops

- Should fulfill niches
  - New crop introductions – until larger growers adopt
    - Potted orchids
    - Fresh herbs
    - Container gardens
  - Low-volume specialty crops
    - Bonsai
    - Aquatic plants for fish tanks
    - Fragrant plants
    - Rare plants for collectors
    - Collections – geranium, carnivorous plants

wallpaperup.com

Alternative crops

- Should fulfill niches
  - Superior quality
    - Florist grade poinsettias and Easter lilies
  - Integration of production and retailing
    - Pick-your-own products at a greenhouse
  - Education
    - Pick-your-own cut flowers combined with floral design classes

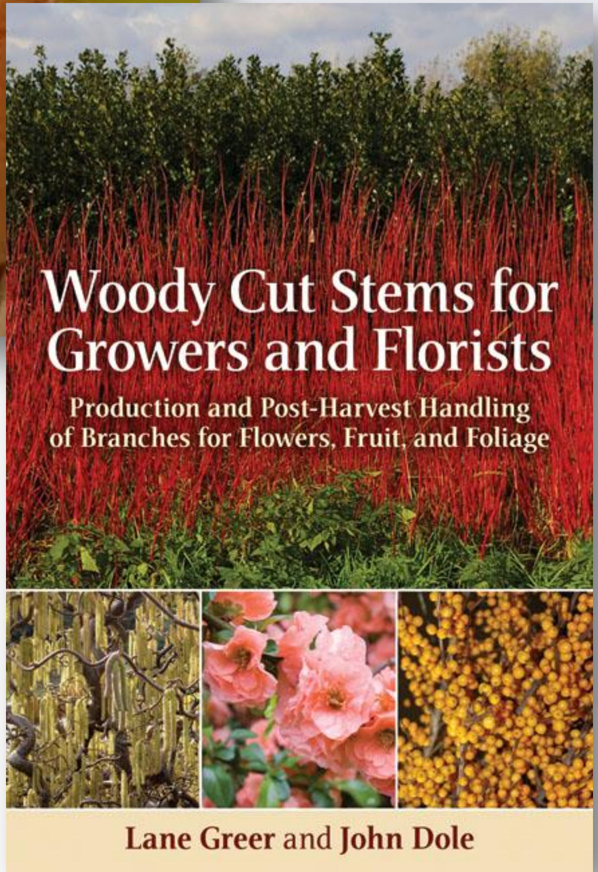
http://bexar-tx.tamu.edu

Potential alternative crops for Utah

- Cut woody floral stems

http://thinkingoutsidetheboxwood.com/?cat=248

www.illinoiswillows.com



Potential alternative crops for Utah

- Dried florals
  - Amaranth
  - Yarrow
  - Oats
  - Wheat
  - Broomcorn
  - Millet
  - Ornamental grasses

Thegardenerseden.com

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Potential alternative crops for Utah

- Field grown cut flowers

Potential alternative crops for Utah

- Nursery crops
  - Propagation
  - Liners
  - Containers
  - Ball and Burlap

Cotoneaster dammeri ‘Coral Beauty’

• Liner (32 cell)	$0.55
• 1 gallon	$4.35
• 5 gallon	$14.50

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Potential alternative crops for Utah

- Seed collecting
  - Oregon grape $89.00/pound (71,000 seeds)
  - Utah Serviceberry $65.00/pound (25,800 seeds)
  - Curlleaf Mahogany $38.00/pound (30,000 seeds)

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Potential alternative crops for Utah

- Pot-in-pot nursery production

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Keys for alternative crops

- Sustainability
- Make sure there is a market
- Focus on uniqueness
  - Cheapest
  - Highest quality
  - Customer service
  - Unusual plants
- Know your costs of production
- Know what customers want
- Start small – grow with opportunities

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Nelson, Greenhouse Operation and Management

URBAN & SMALL FARMS CONFERENCE

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Miles Maynes – Utah Department of Ag and Food
Bill Varga – USU Extension, Retired
Larry Rupp – USU Extension

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Alternative Crop Research at Utah State University

Larry A. Rupp
USU Extension

EXTENSION
UtahStateUniversity

USU High Tunnel Projects

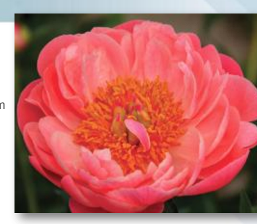
- Dan Drost – Vegetables
- Brent Black – Small Fruits
- Larry Rupp – Cut Flowers

High Tunnel Peonies

- Hypothesis: High tunnels will permit production of peony cut flowers for Mother's Day

High Tunnel Peonies

- Materials and Methods
  - Paeonia 'Coral Charm'
    - Hybrid, semi-double
    - Hybridizers: Samuel Wissing / Roy G. Klehm
    - 36-inch tall
    - Early bloom time
    - Zones 2-8



Klehm's Song Sparrow Nursery

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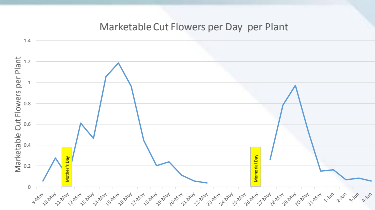
High Tunnel Peonies

- Materials and Methods
  - Time line
    - Planted October 2011
    - First harvest 2014 (year 3)
  - Emergence in field versus high tunnel
    - 2014
      - Emergence in HT, 2 March 2014
      - Emergence in field, 14 March 2014
    - 2015
      - Emergence in HT, 13 February 2015
      - Emergence in field, ?

High Tunnel Peonies

Preliminary Results for 2014 (3rd Leaf)

- Peak high tunnel harvest was May 15 in 2014
- Total blossoms (cuts and culls)
  - 9 / plant for high tunnel
  - 6 / plant for field



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High Tunnel Peonies

- Conclusions
  - In 2014 flowering was advanced by two weeks as compared to field production
  - Peony crops can be scheduled for Mother's Day with high tunnels
  - Further research is needed to fine-tune scheduling for spring holidays


Selecting Native Plants

- Objectives
  - Conserve water while maintaining quality of life enjoyed through landscaping
    - Using native plants
      - Adapted to our climate
      - Water conserving
      - Local ecology (i.e. pollinators)
    - Local production

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Selection Criteria

- Growers
  - Ease of propagation
  - Rate of production
  - Market demand
- Consumers
  - Form
  - Color
  - Flowering
  - Ease of growing
  - Drought tolerant
  - Soil tolerant
  - Pest resistant
  - Non-invasive



Sego Supreme

UtahStateUniversity BOTANICAL CENTER

Sego Supreme™ Plant Introductions

Native and adaptable plants for western landscapes to foster water conservation, aesthetics, and awareness of natural resources.

Utah State University Botanical Center
Center for Water Efficient Landscaping

Sundancer Daisy

- *Tetraneuris acaulis* var. *arizonica*
- Full sun, soil tolerant
- Flowers from May until frost
- Water-wise once established
- Perennial

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Sol Dancer Daisy

- Numerous, 1-2" wide blossoms
- Minimal dead-heading
- 12-18" tall and wide

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Garrett's Firechalice

- *Epilobium canum* ssp. *garrettii*
- Native to intermountain states
- Perennial
- Spreading
- Hairy, green leaves

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Garrett's Firechalice 'Wasatch Fire'

- Slowly spreading
- Red color
- Blooms mid-summer through late fall
- Drought tolerant
- Full sun to partial shade

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Broadleaf Penstemon

- *Penstemon platyphyllus*
- Superior color
- Drought tolerant

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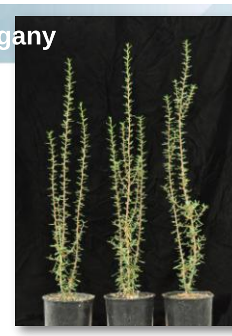
Little-leaf Mountain Mahogany

- *Cercocarpus ledifolius* var. *intricatus*
- Evergreen, very drought tolerant, and actinorhizal.
- Native throughout the state in upland and alpine habitats.
- Currently available as seedling materials.
- Evergreen shrub, hedge, specimen plant.



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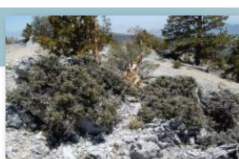
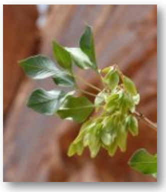


Buffaloberry 'Torrey'

- *Shepherdia* × *utahensis* 'Torrey'
- Evergreen; very drought tolerant; actinorhizal; unique silver color; more adaptable than either parent plant.
- High elevation in southern Utah.
- Currently under development.
- Use as an evergreen specimen shrub in harsh environments.

Single-leaf Ash

- Native, very drought tolerant
- Emerald ash borer may be a problem

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Creeping Oregon Grape

- *Berberis repens*
- Native evergreen groundcover
- Good for dry shade
- Common throughout Utah
- Spreads by rhizomes
- Very drought tolerant
- Seeking glossy-leafed versions

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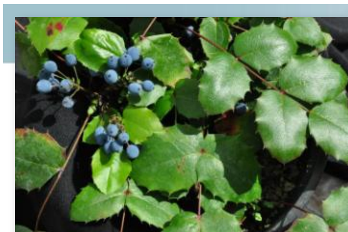


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Bigtooth Maple

- *Acer grandidentatum*
- Deciduous; marketable forms; sturdy wood; fall colors of red, orange, or yellow.
- Native throughout the state in foothills and higher elevations.
- Currently limited production as cultivars; seedlings readily available.
- Patio shade tree.

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- Very genetically diverse

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Seed propagation

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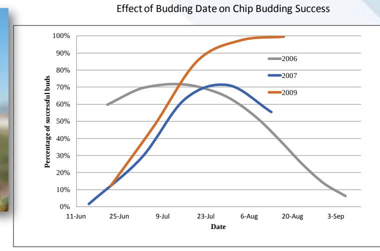
Budding propagation

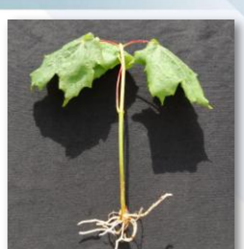
Effect of Budding Date on Chip Budding Success



Commercial budding propagation

J. Frank Schmidt Nursery
USU-ACGR-1004

Cutting propagation



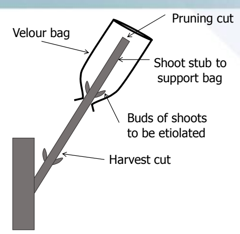


Diagram of technique using velour bag to etiolate new shoots.

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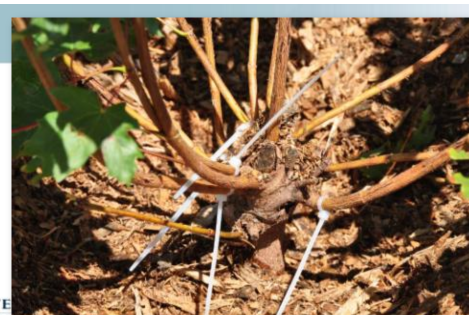
Mound layer propagation



For more information on maple propagation

Propagating Bigtooth Maple

Melody Reed and Larry Rupp

https://extension.usu.edu/files/publications/publication/Horticulture_Trees_2011-03pr.pdf

EXTENSION
UtahStateUniversity

Challenges

- Some plants are difficult (oak, snowbrush, buffaloberry)
- Almost all woody natives are slow growing
- Consistency in propagation
- Natives may need more care
  - Irrigation
  - Competition
  - Soil texture, chemistry, and microflora
  - Over-wintering

EXTENSION
UtahStateUniversity

Acknowledgements

- USU Extension Applied Research Grants
- Utah Agricultural Experiment Station
- Utah State University Botanical Center
- USDA – UDAF Specialty Crop Block Grants
- J. Frank Schmidt Family Foundation
- Melody Reed, Bill Varga, Graham Hunter, Phil Rasmussen, Richard Anderson, JayDee Gunnell, Jerry Goodspeed, and many students

EXTENSION
UtahStateUniversity

Using Alternative Water Systems for Production and Communicating with Customers

Biographical Information:
Cynthia Bee
Jordan valley Water Conservancy District

Like you, Cynthia Bee is a busy professional trying to do more with less. Social media has radically transformed how people communicate and keeping up with the rapid-fire changes while determining how to take advantage of them can be overwhelming. Cynthia has spent the last few years learning, failing, retooling and trying again to learn to communicate with the public through social media in a way that inspires action. She's happy to share what she's learned and, hopefully, shorten your learning curve when it comes to effectively communicating with customers via social media. Cynthia Bee is the Conservation Outreach Coordinator for Jordan Valley Water Conservancy District. She holds a degree in Landscape Architecture from Utah State University. As a long-time blogger and social media fan (not a professional marketer), she has worked to increase the online effectiveness of their conservation marketing efforts through trial, error and change.

Biographical Information:
Luke Peterson
Peterson Family Farm

Petersen Family Farm is the continuation of a 5th generation farming heritage. Luke and Hilarie Petersen are committed to preserving an agricultural tradition for their children and for the community. Riverton has a rich agricultural history that needs to be maintained. At Petersen Family Farm our mission is to Cultivate People, Food, and Community; instilling and preserving traditional values learned best on the farm and providing wholesome, natural food to our friends and neighbors.

Biographical Information:

Thayne Tagge
Tagge's Famous Fruit

In 1979 Thayne was first introduced to agriculture by selling Bear Lake Raspberries. In 1982 Thayne would go up each morning and pick up 50 cases of raspberries and sell them in Sugarhouse. They originally named their business Berry Nice and would sell berries at stands

CONNECTING THROUGH SOCIAL MEDIA

Expanding your horizons via social media.

OTHER "FADS" LIKE SOCIAL MEDIA

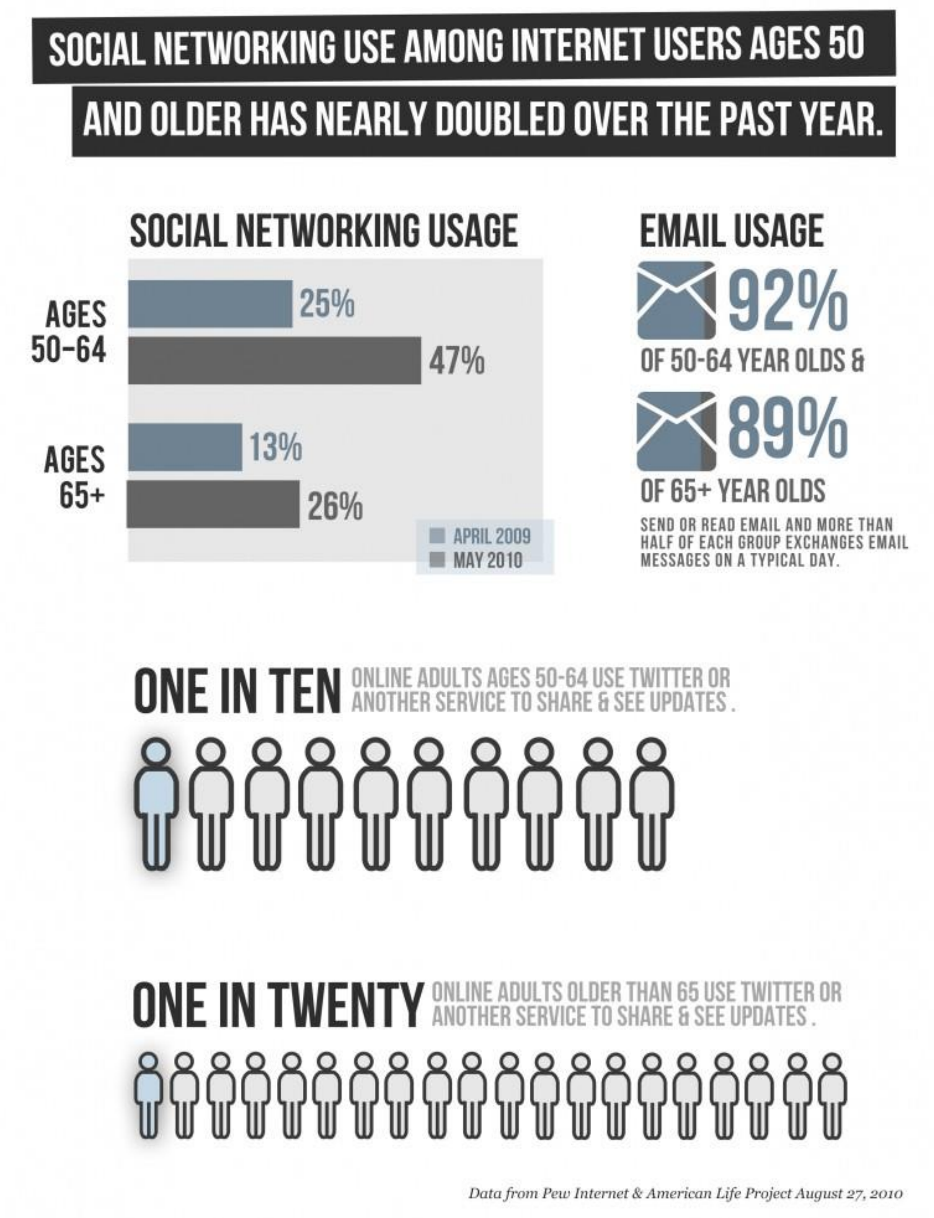
"I think there is a world market for maybe five computers." -- *Thomas Watson, chairman of IBM, 1943.*

"There is no reason anyone would want a computer in their home." -- *Ken Olson, president, chairman and founder of Digital Equipment Corp., 1977.*

NOT JUST FOR YOUNGSTERS!

The fastest growing demographic on Facebook's and Google+'s networks are the 45 to 54 year age bracket at 46% and 56% respectively.

-Global Web Index Study



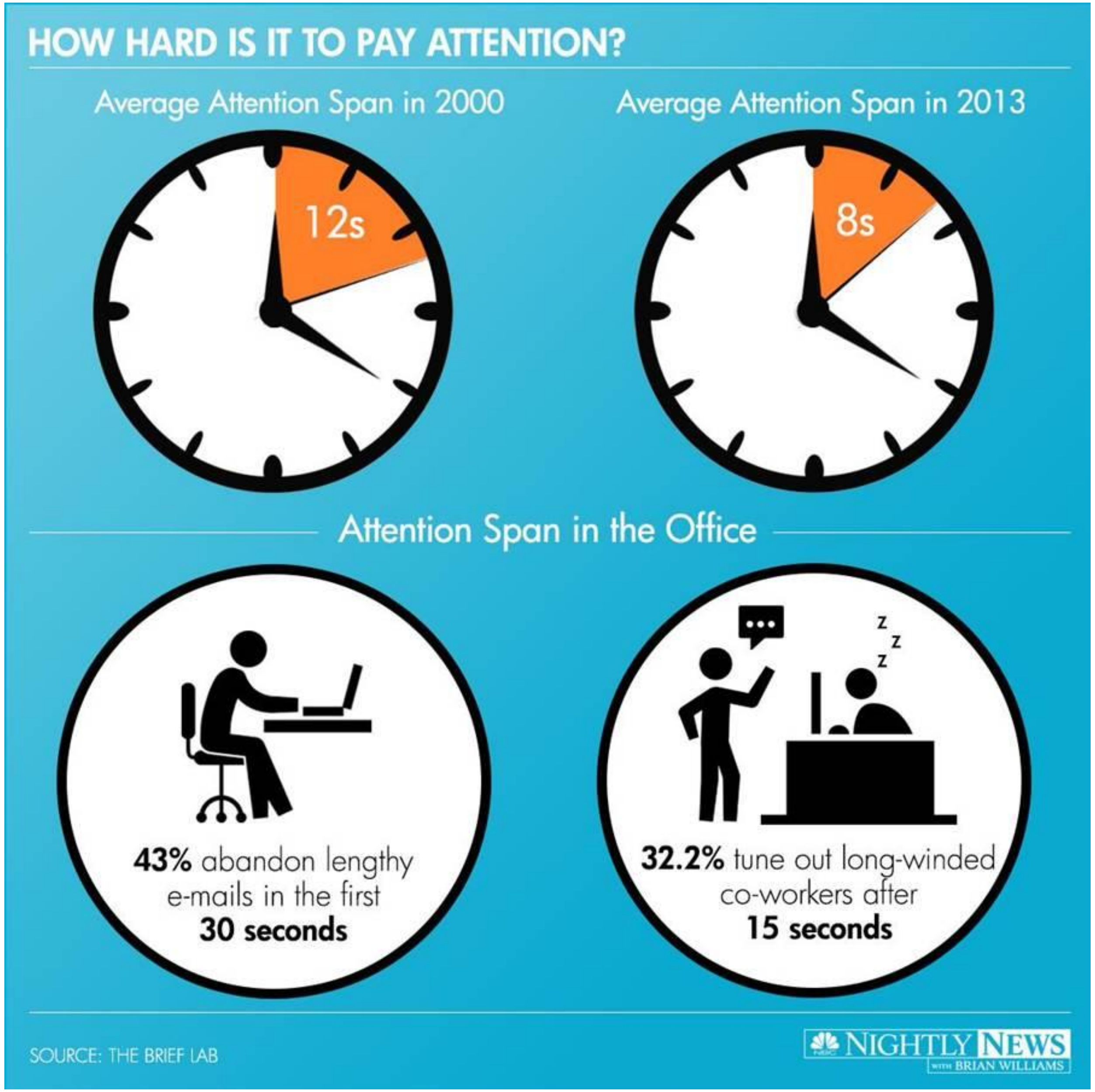
FUNDAMENTAL SHIFT IN HOW WE COMMUNICATE

What always worked, won't always work.

SHORTENED ATTENTION SPANS

The rapid-fire pace of our society and the ability to encapsulate large amounts of data into succinct, 140 character sound bites has decreased the average attention span by 4 seconds over the last decade.

Understanding this should change how you prepare information and presentations to those you support. Text heavy presentations won't get read. If you're still reading the ridiculous amount of text I've added to this slide, raise your hand. I'll bet none of you reading this are enjoying it but now you feel compelled to finish it- even though you're bored. How often do we create reports, presentations and other materials that are text heavy? How much longer do we think this will be effective?



DON'T TELL ME, SHOW ME!

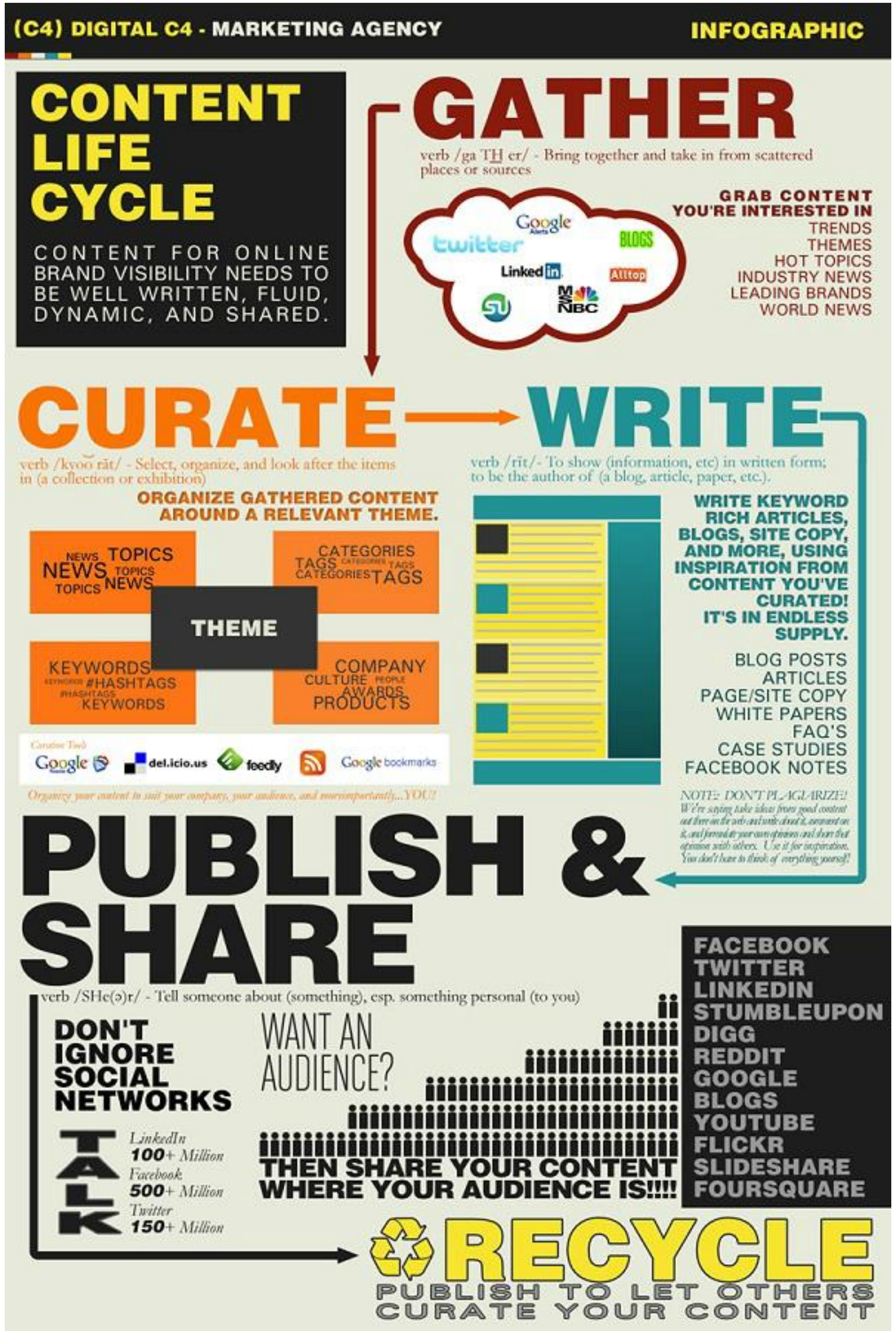
Quick graphic for our Facebook page that got LOTS of interaction!

WHERE TO SHARE

Interact in ways meaningful to audience

CONTENT CREATION

- Quality social media revolves around content.
- Tell the story of your company.
- SHOW the quality of your product.
- Use it to showcase the talents and knowledge of your staff



BLOGS

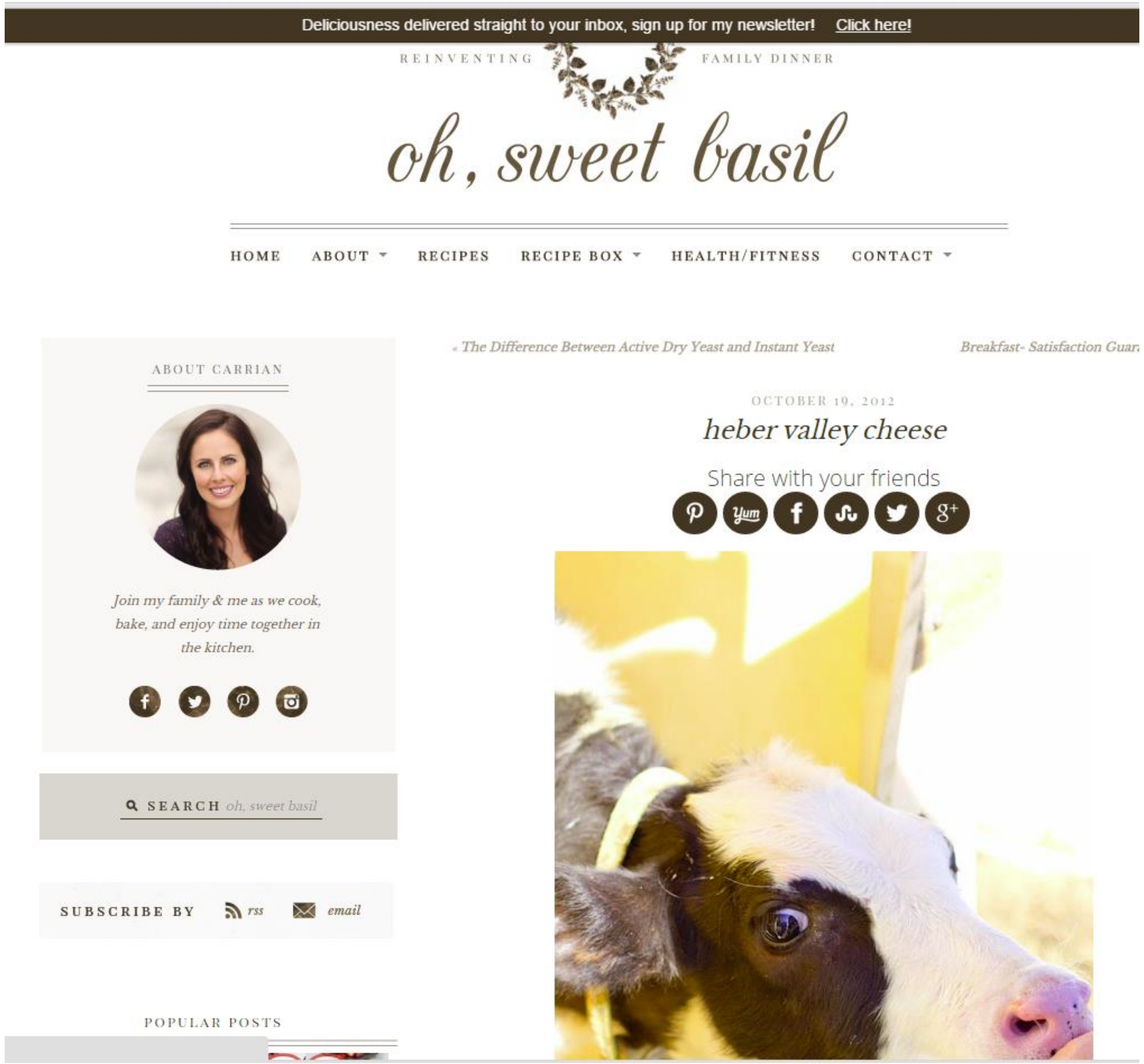
Options:

- Own Company Blog on Website

- Work with local bloggers

Life span of content:

2+ years



VIDEO + CUSTOM ANIMATION

YouTube is the second largest search engine.

Utah is #1 for **Pinterest**.

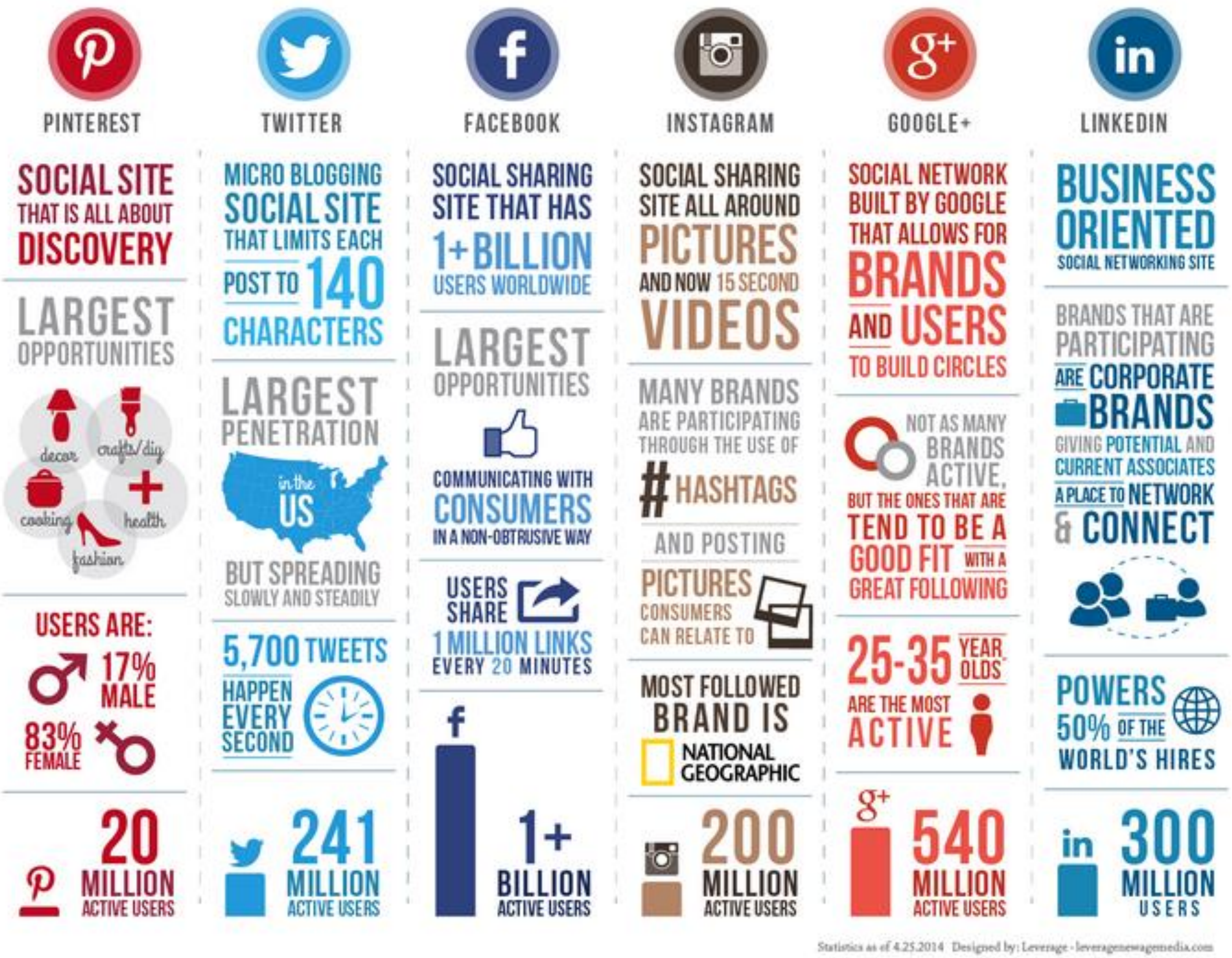
Average "**Tweet**" lasts for > 1 hour.

#1 is still Facebook. MUST HAVE!

Instagram'ers most engaged network.

Google Plus up your Search Rankings.

LinkedIn is a place to network.



WHAT TO SHARE

Creating impactful communication

SHOW SOME PERSONALITY!

Beehive Cheese brings the fun!

BEHIND-THE-SCENES ACCESS

Farm-to-Table Dinner, Northern Utah

COMPANY FOCUSED MESSAGING

Timely Reminders

Oakdell Egg Farms reminds users it's compost time!

Humanize your Operation

Slow Food Utah Farm Mob @ Sandhill Farms

SHOW MORE THAN TELL

Instead of LISTS

Use Photo Collage + Text

TIE INTO TRENDS

Local action/ events in your area?

Tie yourself to RELEVANT current events or local trends.

Only improvement here would be a custom hashtag to capture new followers.

IE: #AfterSundance or #SundanceExperience

WHAT'S IN IT FOR ME?

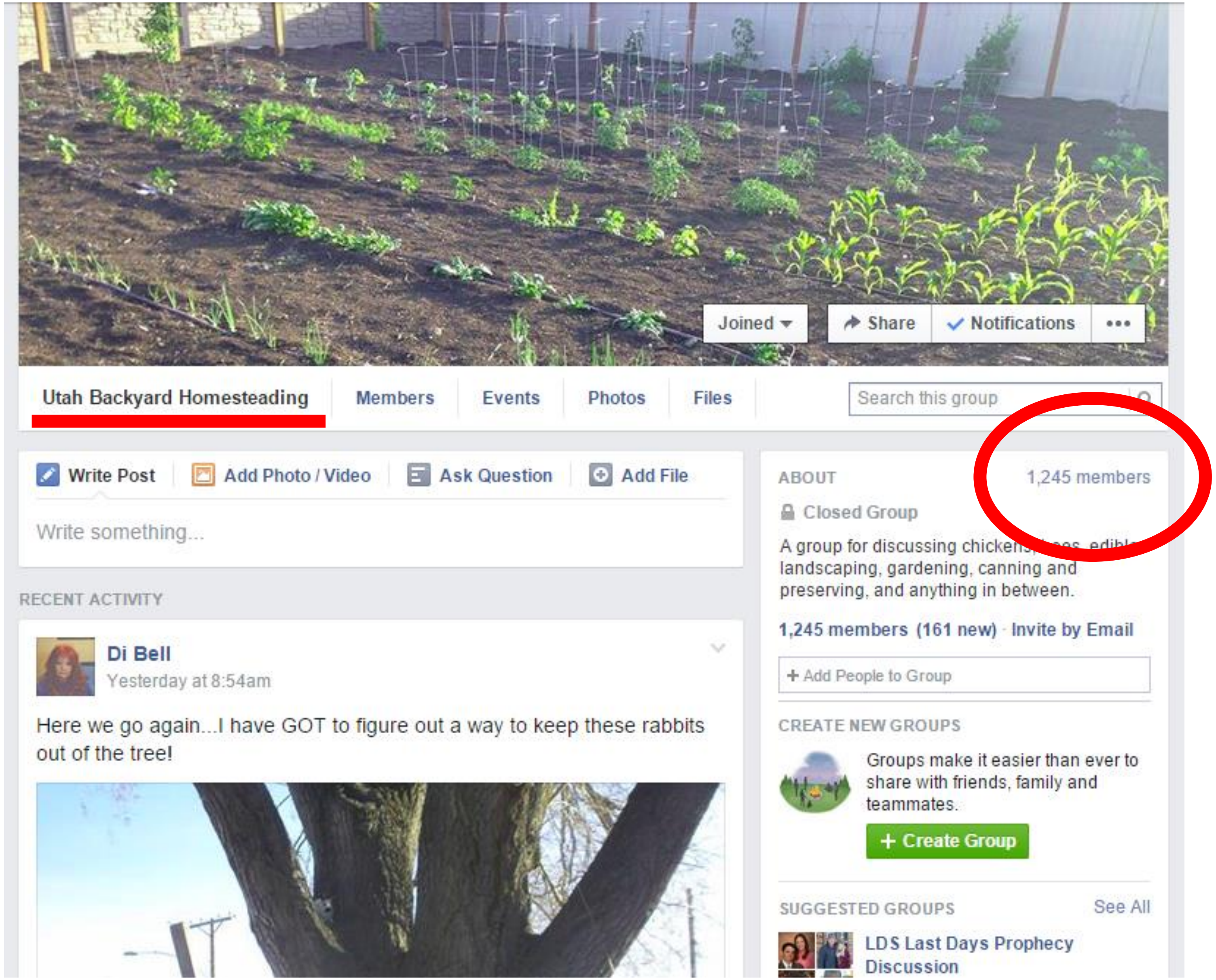
- Giveaways
- Photo Contest
- UN-Selfish Sharing

Give 4x more often than you **ASK.**

BEST KEPT SECRET: FACEBOOK GROUPS!

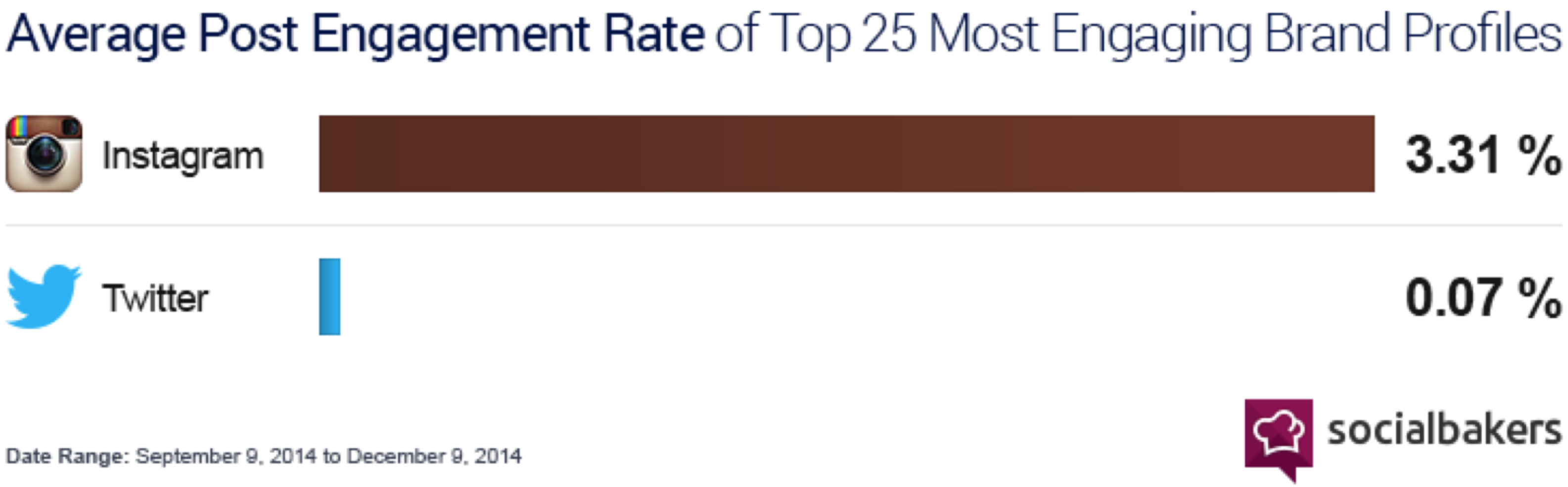
Groups are private and often quite localized.

- Find them
- Join them
- Participate occasionally
- Educate when appropriate
- Notice OTHERS
- Most likely source of brand ambassadors



INSTAGRAM

Instagram followers are the MOST engaged and you can sell in Instagram.



APRIL 5, 2014 2 SPACESUTAH.COM

Advertising supplement produced by Utah MediaOne Group

FEATURE/CONSERVATION GARDEN PARK

by MIKE LORENC, *for Spaces*

Ornamental grasses: A homeowners dream

If you visit Conservation Garden Park during the fall you'll see one type of plant stealing the show: ornamental grasses. Besides being low maintenance and Utah climate friendly, these grasses serve as a focal point and make the flowers near them really stand out. Ornamental grasses are at their best in the fall when most perennial flowers have faded, and they also provide winter interest in the landscape. They have the added benefit of attracting birds that will eat the seed heads.

There are many kinds of ornamental grasses for every landscape: tall, short, striped, some that stand straight up and others that form a mound.

Grasses generally need full sun to look their best but can tolerate partial shade. Once established, they need only light watering, which is best done by a drip system, as sprinklers aren't able to provide the needed uniform watering. Ornamental grasses look good all winter but will need to be cut down in spring. The wider the grass clump is, the higher you will need to cut. Trim 12"-18" high for taller grasses like maiden grasses and 4"-6" high for smaller grasses like Little Bluestem. It's best to cut before new green stalks begin to grow, usually in early spring. As the grass bundle grows bigger the middle of it will start to die out, which means it's time to divide it into smaller clumps.

Here are just four of our favorites among the many ornamental grasses from which to choose:

Ravenna Grass, *Saccharum ravennae*: Grows 9' to 12' tall. Its prairie grass-looking plumes appear in late summer on solid thick stalks resembling bamboo. Narrow green stalks with a single white stripe down the middle tend to "rustle" in wind, making a gentle soothing sound.

Flame Grass, *Miscanthus 'Purpurascens'*: Grows 3' to 4' tall. This maiden grass is compact and upright. Its light green stalks have a reddish tinge and turn a bright red in the fall and burgundy in the winter. Its tassel-like seed heads appear reddish in late summer and become creamy white by fall and continuing into the winter.

Dallas Blues Switch Grass, *Panicum virgatum* 'Dallas Blues': Grows 5' tall and very dense. Its wider than normal grey-blue stalks form a vase-shaped cluster. The stalks take on a rust color in the fall and turn golden in the winter. The seed plumes are light and airy in late summer, forming a cloud-like appearance at the top of the grass and are also a good source of winter food for birds.

Little Bluestem, *Schizachyrium scoparium*: Grows 18"-24" tall. A Midwest native, the Little Bluestem is the smallest of the ornamental grasses on our list. Its green stalks and blue base turn bright copper-red in the fall and stay that color all winter long.


Ravenna Grass


Dallas Blues Switch Grass


Flame Grass


Little Bluestem

EARNED MEDIA

GOOD JOB ON SOCIAL CAN = FREE TRADITIONAL MEDIA

"Spaces" Section, SL Tribune

Annual Value:

$1,200 per week x 52 weeks = $62,400

Cost to Us: Staff Time (2 hours per week)

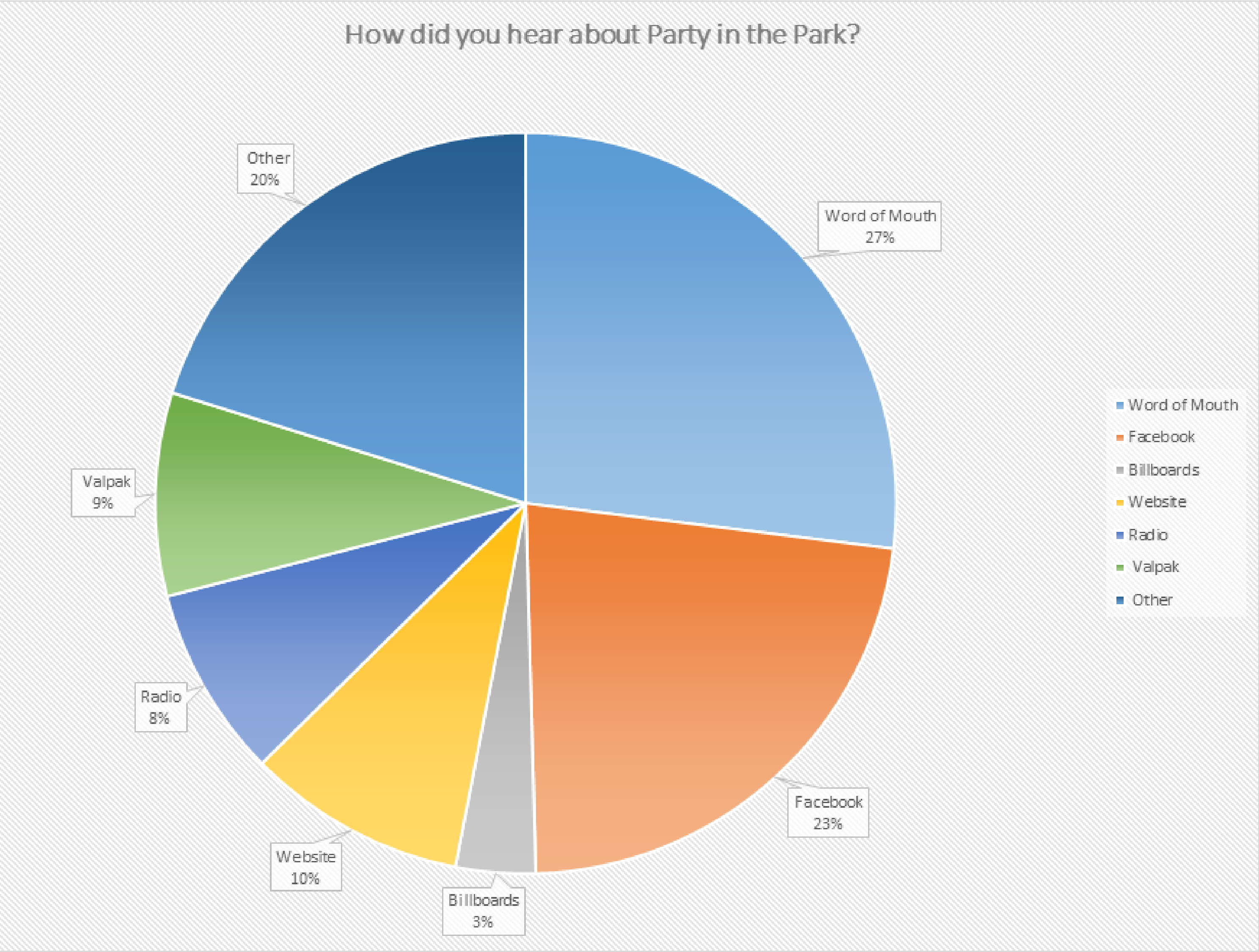
MEASURE RESULTS

It's about MORE than simply sharing!


Social Media Strategy Framework
Beta version 1
LEARN
USE social media yourself
STUDY relevant case studies
EDUCATE senior executives
HEAR from practitioners
EXPLORE the latest trends
PRIORITIZE OBJECTIVES
IMPROVE customer engagement
ENHANCE brand and reputation management
ACCELERATE customer-driven innovation
ATTRACT talented employees
INCREASE sales
ESTABLISH GOVERNANCE
IDENTIFY opportunities
UNDERSTAND risks
CLARIFY risk of NOT engaging
SET clear social media policies
COMMUNICATE policies internally
DEFINE ACTIVITIES
DEFINE first and subsequent phases
TARGET initial platforms
IDENTIFY resources required
ESTABLISH responsibilities and time commitment
LINK to offline marketing activities
DEVELOP CAPABILITIES
IDENTIFY internal 'champions' for social media
TRAIN and support champions and staff
KEEP abreast of developments
ESTABLISH pilot program
DEVELOP a culture of responsible transparency
MEASURE AND REFINE
SET relevant measures of success
MONITOR measures
CAPTURE and communicate success stories
REPORT to senior executives
REFINE your strategy and measures
ENGAGE IN CONVERSATION
ENTER the conversation
PROVIDE relevant content
ADD value to communities
ENGAGE with influencers
RESPOND positively
LISTEN
IDENTIFY relevant social media monitoring tools
LEARN how you can best use the tools
DISCOVER what's said about you and your market
FIND relevant communities and conversations
UNCOVER key influencers
facebook
twitter
reddit
myspace.com
Blogger
flickr
delicious
Ning
StumbleUpon
LinkedIn
friendfeed
YouTube
digg
imeem
Second Life
Wikipedia
yelp
Creative Commons Attribution-ShareAlike 3.0 License
Advanced Human Technologies
Advanced Human Technologies helps organizations to establish and implement social media strategies
www.ahtgroup.com

"PARTY IN THE PARK" ADVERTISING

- Spent 5% of the total ad budget on Facebook "boosts" for our event.
- Facebook Boosted Post= 23% of the attendance.
- Another 27% heard through "word of mouth" which also includes Facebook.
- 80% of ad budget spent on radio = 9% of attendees.



A/B TESTING

GRAPHIC A
20%- 176 Post Engagements

GRAPHIC B
80%- 878 Post Engagements

(1) All Campaigns

https://www.facebook.com/ads/manage/home/?account_id=3856825341943

Bee

sights

Tracking

ory

upport

Notifications

You don't have any notifications

Daily Spend ? See Billing Activity

You didn't have any spend during the last 5 days

April 30, 2012 - October 28, 2014

Campaigns | Ad Sets | Ads | All Except Deleted | Edit Campaigns | View Report | View History

1-50 of 65 Results

Status ?	Campaign Name ?	Delivery ?	Results ?	Cost ?	Reach ?	Spent Today ?	Total Spent ?	Start Date ?	End Date ?
	Post: "Unsure how to mix plants to create flower beds..."	Not Delivering Ad Set Completed	101 Post Engagements	$0.40 Per Post Engagement	5,475	$0.00	$40.00 of $40.00	10/17/2014 12:04pm	10/18/2014 12:04pm
	Post: "Our final class of the season is coming up on..."	Not Delivering Ad Set Completed	52 Post Engagements	$0.58 Per Post Engagement	4,358	$0.00	$30.00 of $30.00	10/06/2014 10:01am	10/08/2014 10:01am
	Post: "Sections of the Garden are getting a "Makeover"...."	Not Delivering Ad Set Completed	176 Post Engagements	$0.17 Per Post Engagement	2,871	$0.00	$29.88 of $30.00	09/16/2014 8:17am	09/19/2014 8:17am
	Post: "FREE family event this Saturday! Butterfly..."	Not Delivering Ad Set Completed	878 Post Engagements	$0.34 Per Post Engagement	25,756	$0.00	$300.00 of $300.00	08/12/2014 8:29am	08/15/2014 8:29am
	Post: "Free Family Event: Join us for a great day of..."	Not Delivering Ad Set Completed	141 Post Engagements	$0.28 Per Post Engagement	4,886	$0.00	$40.00 of $40.00	08/11/2014 9:49am	08/12/2014 9:49am
	Post: "Party in the Park"	Not Delivering Ad Set Completed	67 Event Responses	$2.99 Per Event Response	48,935	$0.00	$200.00 of $200.00	08/08/2014 9:35am	08/09/2014 9:35am
	Post: "Sharing some of the landscape mistakes homeowners..."	Not Delivering Ad Set Completed	117 Post Engagements	$0.17 Per Post Engagement	3,731	$0.00	$20.00 of $20.00	08/05/2014 11:01am	08/06/2014 11:01am
	Post: "Attracting Butterflies To Your Garden"	Not Delivering Ad Set Completed	7 Event Responses	$2.86 Per Event Response	9,492	$0.00	$20.00 of $20.00	08/05/2014 11:00am	08/06/2014 11:00am
	Post: "FREE CLASS: Do-It-Yourself Irrigation Systems"	Not Delivering	4	$11.76 Per Event	7,408	$0.00	$47.04 of $60.00	07/07/20	

Report a Problem

social_media_analyti....jpg | sm-strategy-image.jpg | slide-community-m....jpg | what-is-an-infograp....jpg | stock-vector-retro-in....jpg | Show all downloads...

10:13 PM
10/28/2014

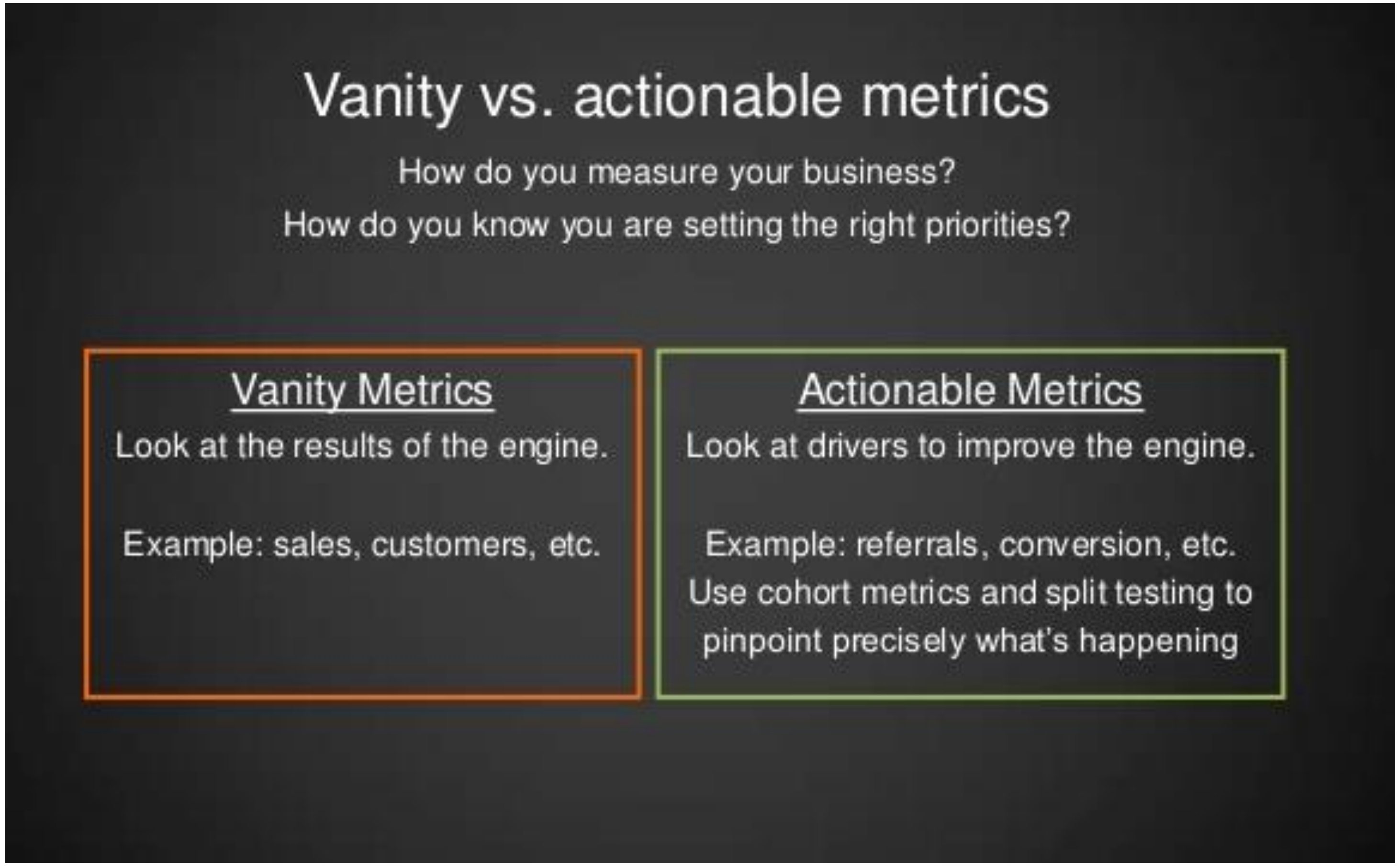
BEWARE "VANITY METRICS"

Vanity Metric=

- Number of Likes
- Number of page hits

Actionable Metrics=

- Post Engagement
- Post Shares
- A/B Testing
- Time spent on website
- Click through rate



TOOLS THAT MAKE THINGS EASY!

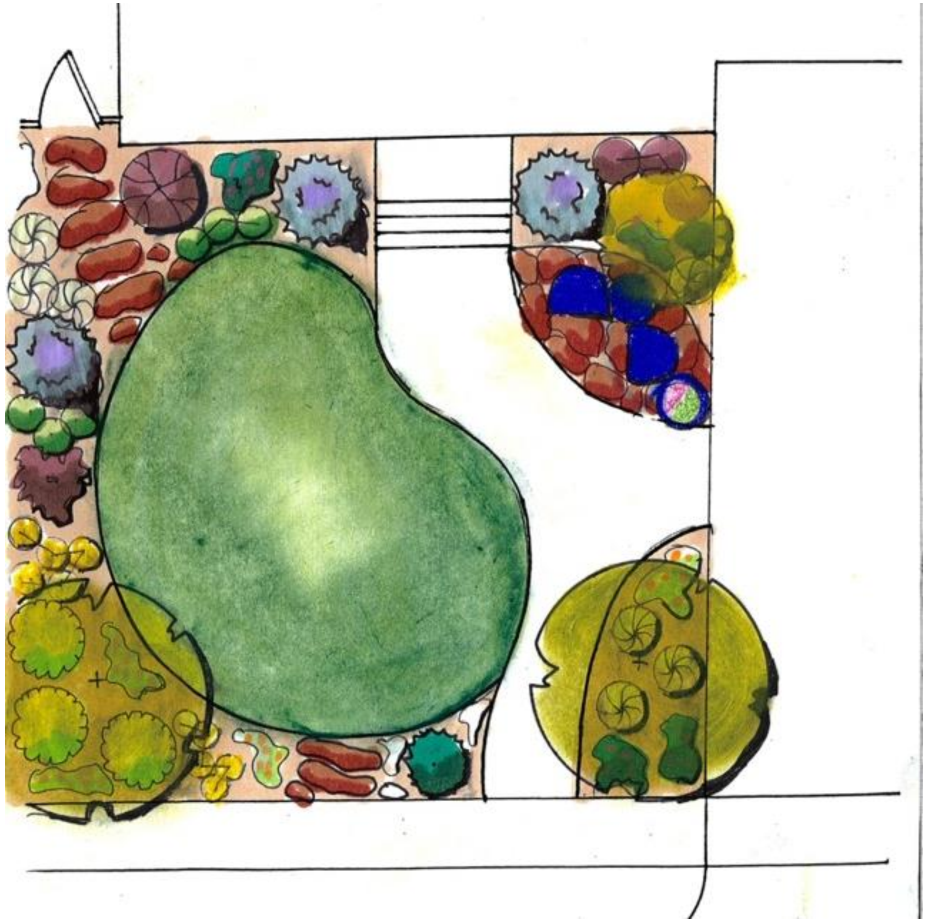
Tools the non-graphic artist can use to create branded social graphics.

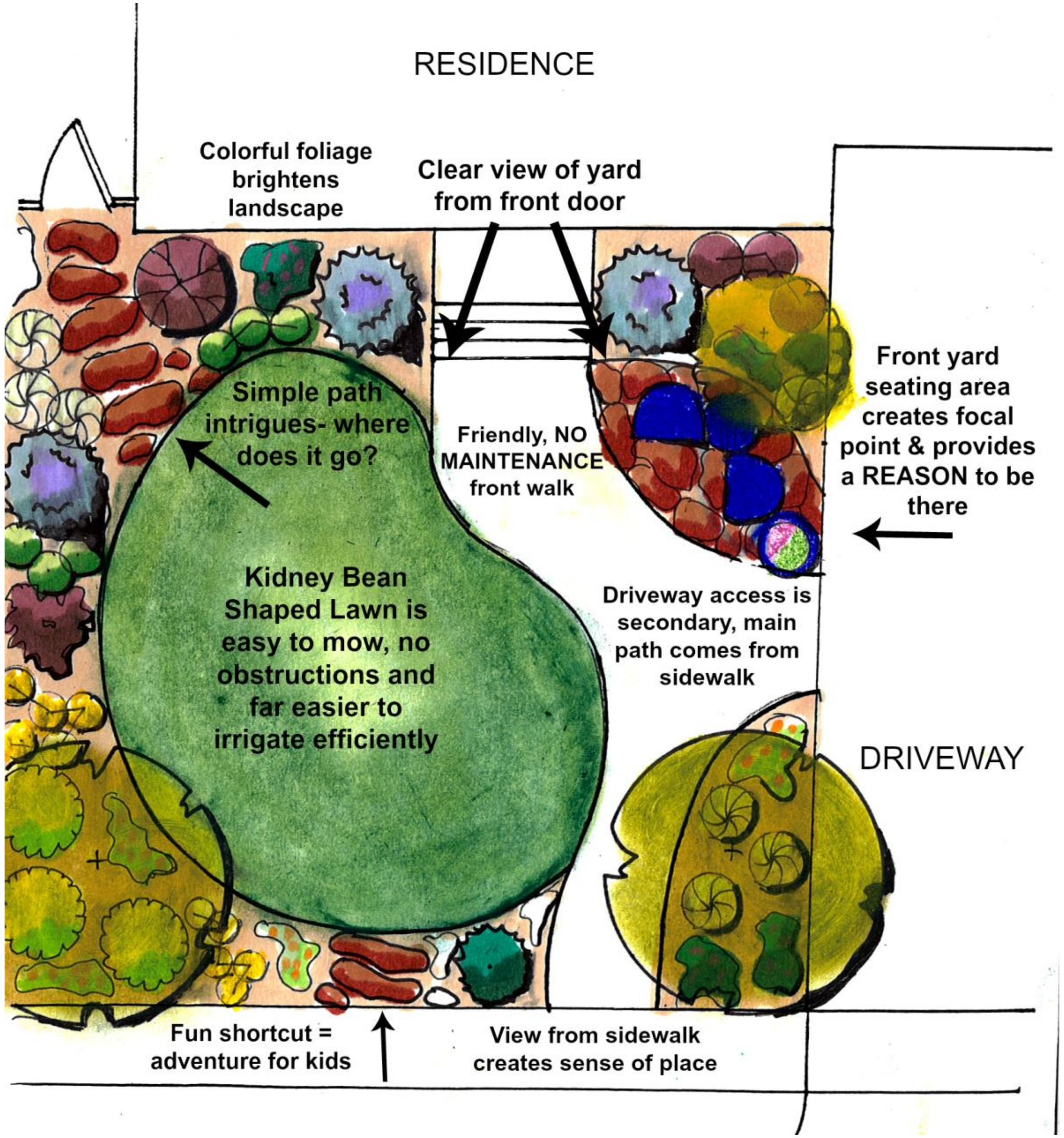
PHOTO EDITING

PicMonkey is a fast, FREE and easy-to-learn solution that will fit almost all your needs!

SHOW + TELL
DON'T FORGET THE STORY!

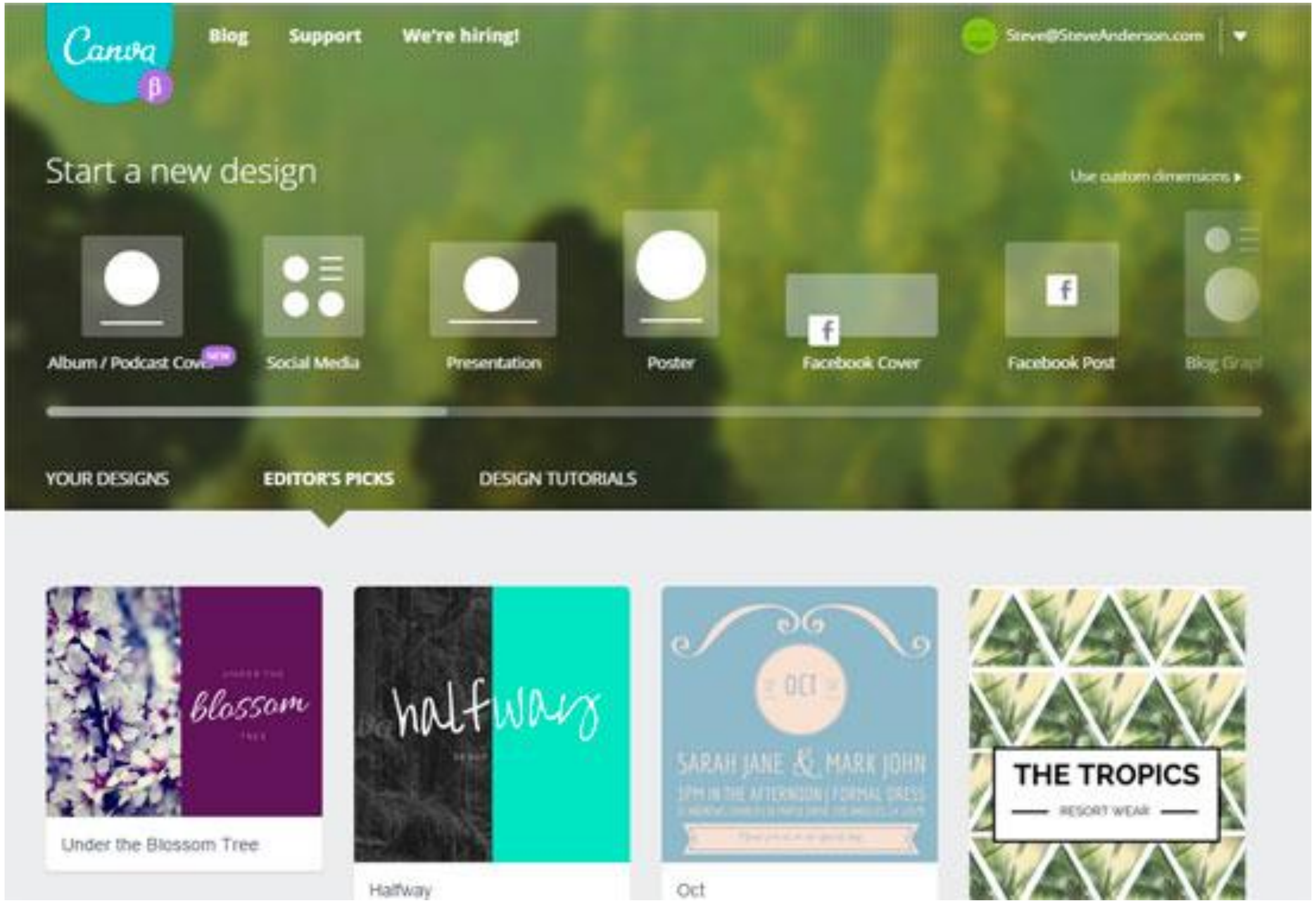
ADD TEXT TO PHOTOS





Always watermark, hashtag or otherwise name and ID your photos!

CANVA.COM FOR BASIC GRAPHIC "SHARABLES"

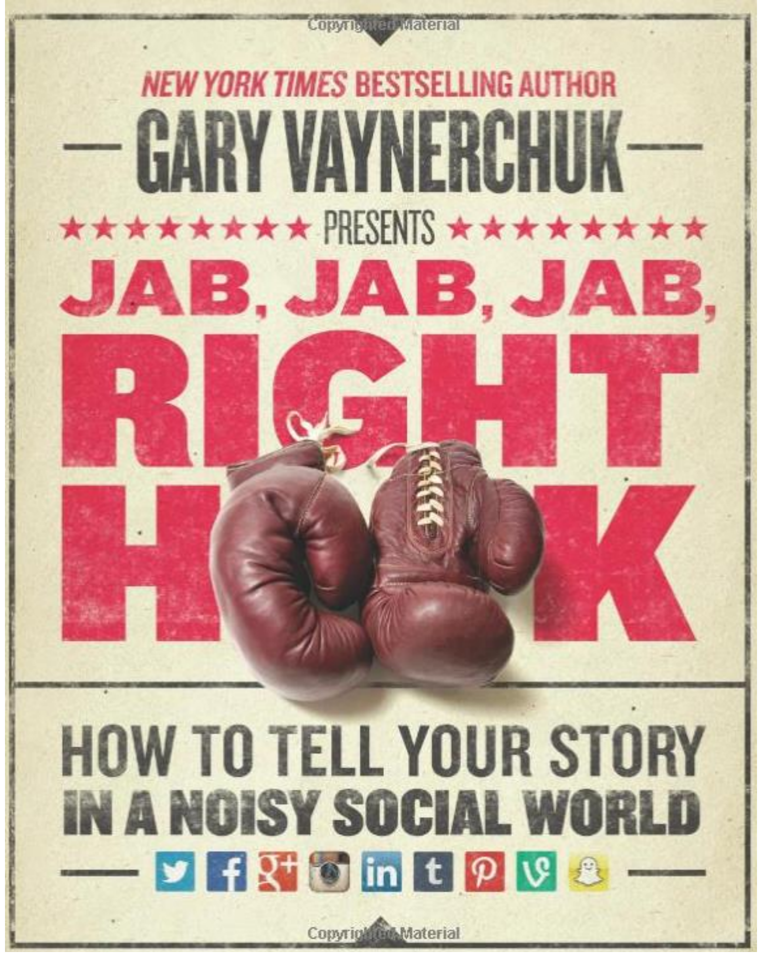


MAKE IT YOUR OWN

MAKE SURE GREAT STUFF CAN TRACK BACK TO YOU & GET PEOPLE EXCITED

A great photo becomes a brand-centered promotion with a 5 minute Canva graphic.

LEARN MORE: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NEW YORK TIMES BESTSELLING AUTHOR
GARY VAYNERCHUK
PRESENTS
JAB, JAB, JAB,
RIGHT
HOOK
HOW TO TELL YOUR STORY
IN A NOISY SOCIAL WORLD
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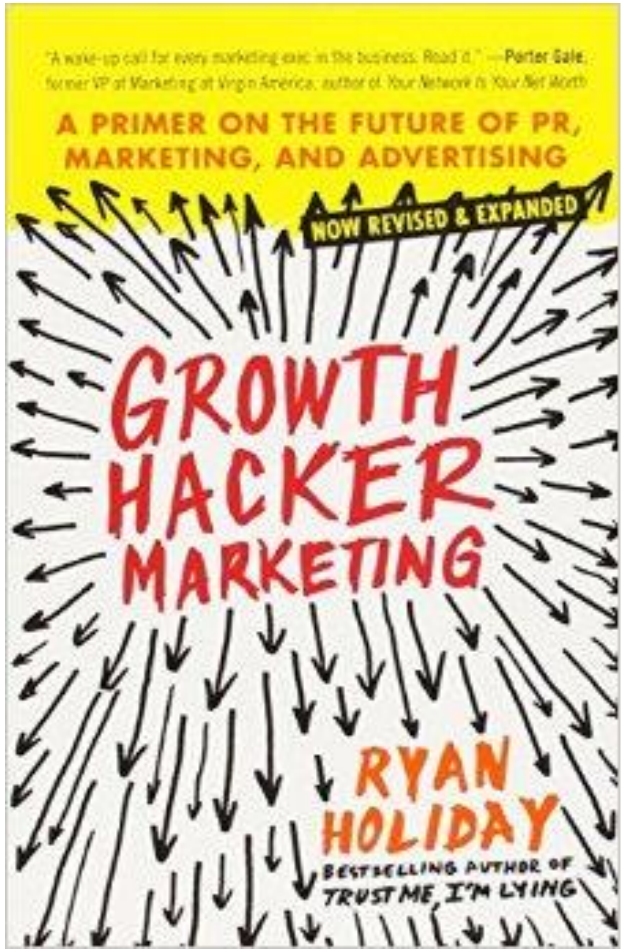
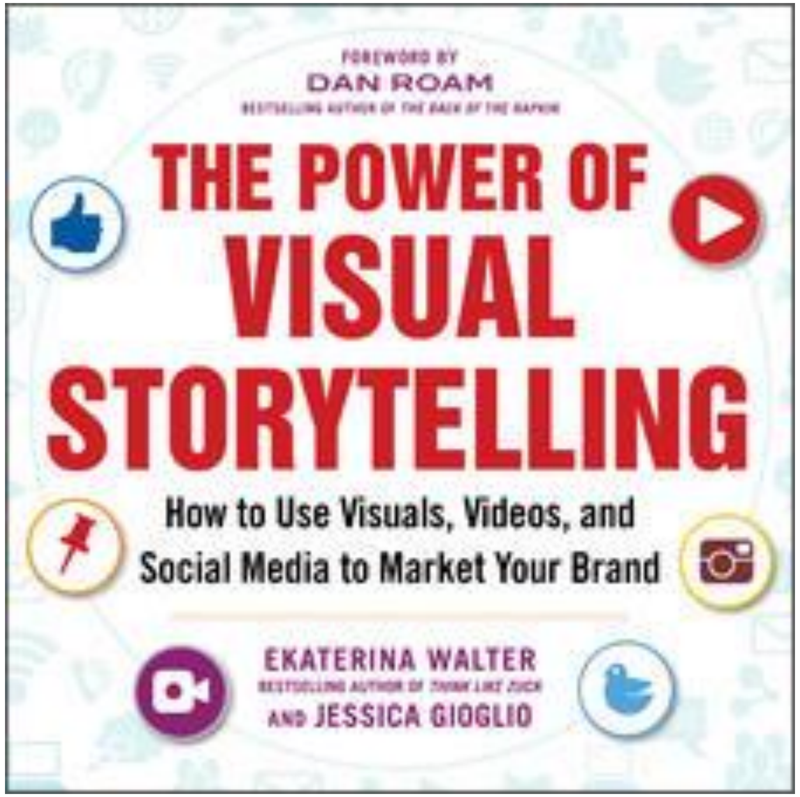

"A wake-up call for every marketing exec in the business. Read it." —Porter Gale, former VP of Marketing at Virgin America, author of Your Network Is Your Net Worth
A PRIMER ON THE FUTURE OF PR, MARKETING, AND ADVERTISING
NOW REVISED & EXPANDED
GROWTH HACKER MARKETING
RYAN HOLIDAY
BESTSELLING AUTHOR OF TRUST ME, I'M LYING


FOREWORD BY
DAN ROAM
THE POWER OF VISUAL STORYTELLING
How to Use Visuals, Videos, and Social Media to Market Your Brand
EKATERINA WALTER
AND JESSICA GIOGLIO

AND MORE:

Social Media Examiner (newsletter)

http://www.socialmediaexaminer.com/

John Haydon

http://www.johnhaydon.com/

Social Fresh

http://www.socialfresh.com

Ryan Holiday

http://ryanholiday.net/

and farmers' markets. Thayne Tagge went from being a CPA to being a farmer when he purchased his first farm in 1997. It was a 38-acre orchard in Perry, UT. When they bought the orchard they changed their business name to Thayne and Cari Tagge's Famous Fruit. Now they own and farm 68 acres in Perry and Willard and rent another 60 acres for row crops. All of their orchards are on a drip irrigation system. They now sell at farmers' markets and have a CSA that continues to grow. They also produce and sell value added products.

Session Description:
More than ever, people care about where their food comes from. Small producers can create their own advantages in the marketplace by using free and low-cost social media tools to connect with their audience. We'll explore local social success stories while learning practical strategies that will help create and nurture community connections through social media.

This session will also discuss consumer interest in and value of using different water systems. Specifically if the consumer is willing to pay more for produce grown under drip-irrigation or other water saving methods.

Green House Production Basics

Biographical Information:
Michael Caron
Utah State University

Michael Caron is an Assistant Professor of Extension in Horticulture with Utah State University, located at Thanksgiving Point in Lehi, UT. Michael earned his B.S. in Ornamental Horticulture from Utah State University in 1996, and his M.S. in Plant Science from Utah State in 1998. From there he went to New Mexico to work as a grower for a large hydroponic greenhouse vegetable operation before joining the faculty at USU. Over the past 15 years he has taught a myriad of classes for students seeking a degree in Horticulture at Utah State, Master Gardener classes, and many other classes and workshops on a variety of subjects. He enjoys gardening, greenhouse growing, photography, hiking, and building things.

Session Description:

Greenhouse Growing Basics

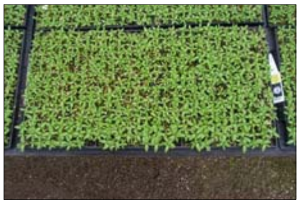
- Basics depend on
  - What you are growing
  - How you are growing it
  - What you are going to do with it when it is grown
  - What kind of greenhouse you have
- Determining the above points are key challenges for producers

Things to decide

- Are you growing only plants to sell?
- Are you harvesting fruit or plants at maturity in your greenhouse/high tunnel?
- Are you growing in the ground? Pots? Hydroponics?
- What kind of irrigation system(s) will you implement?
- What kind of automation will you need?
- Will you grow different crops in the same space at the same time?

Typical Crops

- Bedding plants
  - Marigolds, petunias, etc.
  - Usually started 6-12 weeks before last frost
- Herbaceous Perennials
  - Hosta, Echinacea, etc.
  - Can be started almost anytime
  - Can also be started in late summer and overwintered in unheated greenhouse



Typical Crops

- Vegetable Transplants
  - Tomatoes, onions, peppers, squash, etc.
  - Usually started 4-6 weeks before last frost

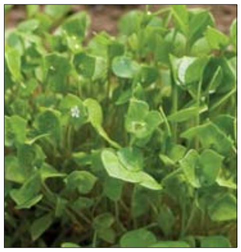
Long-term Crops

- Plants that go from seed to harvest or consumption all within the greenhouse
  - Lettuce, radish, green onions, chard, cabbage, cauliflower
  - Tomatoes*
  - Peas, beets, turnips?

*like all warm-season plants these will need supplemental heat and are not recommended for solar greenhouses

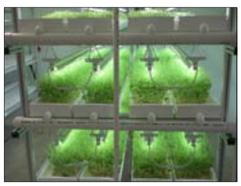
Idea Crops

- Aquaponics
- Root Vegetables
- Tomatoes
- Cut Flowers
- Herbs
  - Cut or whole
- Lettuce
  - Cut or whole
- Claytonia



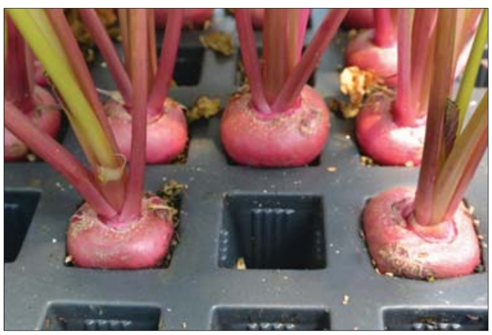
Idea Crops

- Micro-greens
  - Carrot
  - Arugula
  - Radish
  - Mustard
- Baby-greens
- Spinach, Kale
- Salanova Lettuce



Root Vegetables

- New idea in using greenhouse hydroponics
- Root crops grown to maturity in plug trays
- Fine roots grow between trays and bench, which is kept moist
- Harvestable crop is in the trays



Aquaponics

- A biosystem that grows flowers, herbs. Or vegetables using fish waste as the nutrient source
- System should focus on one or the other for the cash-generation
- The most popular fish is Tilapia
  - Not allowed in Utah
- https://attra.ncat.org/attra-pub/summaries/summary.php?pub=56

Organic Greenhouse Production

- Is not as readily achieved as outdoor organic programs
  - Greenhouse plant growth AND pest development is rapid
  - Crops are grown is small volumes of soil
  - Crops need frequent irrigation and nutrient application
  - Most organic fertilizers are NOT compatible with traditional fertilizer delivery systems

Organic Greenhouse Production

- Often relies on making a lot of your own compost
  - So finding large quantities of organic compost is important
- The only real choice for post-plant organic fertilizers are fish-based
- Some good articles on this
  - http://www.greenhousegrower.com/production/crop-inputs/fertilization/organic-fertilizers-in-greenhouse-and-nursery-production/
  - https://extension.umass.edu/floriculture/fact-sheets/organic-growing-media-and-fertilizers-greenhouses
  - https://extension.usu.edu/files/publications/factsheet/HG-510.pdf

Some Pre-plant Organic Fertilizers

Fertilizer material	Estimated NPK	Nutrient release
Alfalfa meal	2.5-0.5-2.0	Medium-fast
Blood meal	12.5-1.5-0.6	Slow
Cottonseed meal	7.0-2.5-1.5	Slow-medium
Crab meal	10.0-0.3-0.1	Slow
Feather meal	15.0-0.0-0.0	Slow
Fish meal	10.0-5.0-0.0	Medium
Granite meal	0.0-0.0-4.5	Very slow
Greensand	0.0-1.5-5.0	Very slow
Bat guano	5.5-8.6-1.5	Medium
Kelp meal	1.0-0.5-8.0	Slow
Dried manure	Variable	Medium
Seabird guano	12.3-11.0-2.5	Slow-medium
Rock phosphate	0.0-18.0-0.0	Slow-very slow
Soybean meal	6.5-1.5-2.4	Slow-medium
Wood ash	0.0-2.5-5.0	Fast
Worm castings	1.5-2.5-1.3	Medium

From www. extension.umass.edu/

Traditional Fertilizers

- Diverse array of formulations, types, concentrations, etc.
- Fertigation
  - Fertilizers added to irrigation water
- Slow-release
  - Usually incorporated into the soil

Fertilizer Injectors

Irrigation

Proper Irrigation is Absolutely Critical!

Problems

- Underwatering
  - Wilt
  - Leaf burn
  - Leaf abscission
- Overwatering
  - Soft growth
  - Poor root quality
  - Wilt

Rules of Watering

- Use a well-drained potting media
  - Water and aeration must balance
- Water just before moisture stress occurs
  - Pots get very light, plants look dull or bluish-green
- Water thoroughly each time
  - Double-water as soilless mixes repel water if allowed to dry too much
- Allow some water to run-through (leaching)
  - Unless using sub-irrigation

Irrigation Systems- Hand

- Hand
  - Expensive
  - Boring & time consuming
  - Use high quality breaker nozzle
  - Very good way to observe plants

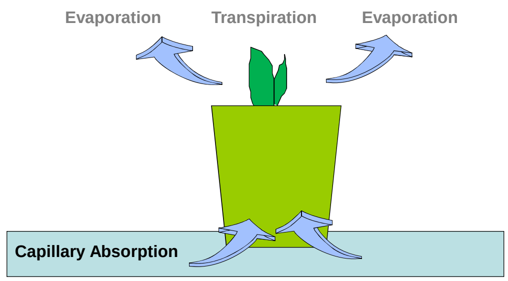
Drip

- Also called spaghetti tubes
- Basically a main supply line fitted with numerous small tubes that irrigate individual plants
- Some systems have pressure drop at end
- New systems are pressure compensating
- Must filter water –small tubes plug easily

Sub-Irrigation

- Applying water to pots from below
- Water moves from wet pad or standing water into potting soil by capillary action
- Basic kinds are
  - Capillary mats
  - Ebb-and-flood on benches and floors
  - Trough or tray (NFT)
- Huge advantage is all pot sizes are watered properly, even if on the same zone

Subirrigation



Capillary mat

Ebb-and-Flood

Nutrient Film Technique (NFT)

Green Urban Lunchbox

Biographical Information:
Shawn Peterson
The Green Urban Lunch Box

http://thegreenurbanlunchbox.com/

Shawn is a fifth generation farmer who planted and harvested his own garden when he was 12 years old. He began gardening with youth in 2011 when he founded The Green Urban Lunch Box. He is a very creative person who learns by doing. Shawn also has a history of living his dreams. Shawn taught himself how to sail and then sailed from the US to Fiji. He has also motorcycled from the US to Central America. His latest dream includes educating youth and the general public about urban agriculture through The Green Urban Lunch Box. Shawn is passionate about creating a food system that is more sustainable and healthy. He believes to do so we must look at problems and farming in new ways.

Session Description:
Shawn will be discussing the challenges facing farmers and using creative tools to overcome them. Shawn will focus on his experience with Green Urban Lunchbox. The Green Urban Lunchbox is a not-for-profit program in Salt Lake City that focuses on issues pertaining to urban agriculture, sustainability and food security. They started out growing a garden in a school bus as an educational tool. They hope to educate and motivate individuals regarding issues related to food production and healthy eating. They have many programs which are listed below.

- Mobile Greenhouse – 35 foot school bus converted to a mobile greenhouse. It is used as an educational tool

- Community farm and Orchard – 37 acre abandoned orchard. The orchard was reclaimed and part remains an orchard and the rest is an incubator farm. It is used to provide farmer training programs which help community members develop and maintain small farm plots, growing fresh produce for local markets.

- Back-Farm Program – provides elderly community members with local volunteers to work together to convert backyard space into urban farms. The vegetables grown are divided equally between the homeowner, volunteers and Green Urban Lunchbox.

- Fruit Share Program - GULB has partnered with SLCgreen, Real Food Rising and Tree Utah to help better utilize fruit trees in residential areas around Salt Lake City. By registering their trees, residents receive help from knowledgeable volunteers in maintaining their trees for optimal growth and yield as well as help in harvesting. In return, excess fruit is shared with local food-assistance programs.

Research Update: High Tunnel Blackberry

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.

Session Description:
We previously showed that high tunnels could be a useful management tool for fall raspberry production. This presentation will overview our recent research using high tunnels for blackberry production.

Blackberry Research Update

Dr. Brent Black
Utah State University

Temperature Management

- During crop growth
  - Aim to keep night temperatures above 40 F
  - Optimum range: 75 to 85 F
- Ventilation needed even on cold days
- Several levels of ventilation
  - Gable vents, doors, lifting sides
- Shade cloth can be put on tunnel supports
  - Reduce sun-burn and high temperatures

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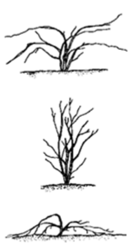
extension.usu.edu

Characteristics



- Semi-erect
  - Most cold hardy (locally adapted)
  - Suited to narrow training
  - Relatively late harvest season
- Erect
  - Relatively cold hardy
  - Nice quality fruit
  - Need wider rows
- Trailing
  - Narrow row training
  - Early ripening, very high quality fruit
  - Not cold hardy
- Primocane-fruiting
  - Cold hardiness not applicable
  - Late season production
  - Thorny

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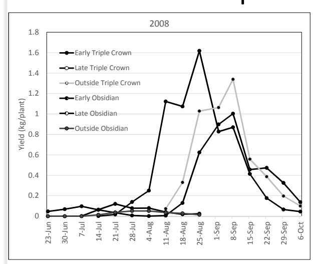
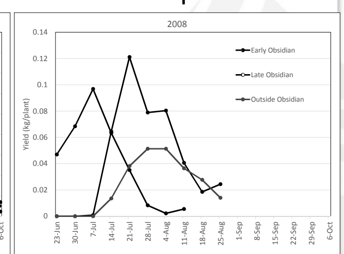
First Experiment – first crop





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First Experiment – second crop

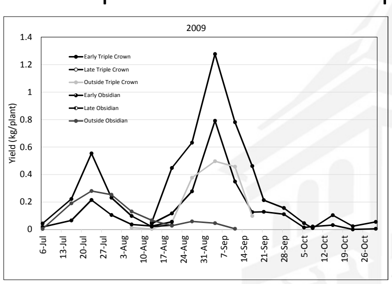

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Table 2. Total seasonal yield (lbs/plant) by cultivar over 4 years.

Type	Cultivar	2009	2010	2011	2012	4 yr Avg.
Primocane	Prime-Ark 45	0.0	0.0	0.1	2.0	0.5
Primocane	Prime Jan	1.0	0.3	1.5	4.1	1.7
Primocane	Prine Jim	0.6	0.7	6.2	2.8	2.6
Trailing	Metolius	1.6	0.8	1.5	3.7	1.9
Trailing	ORUS 1939-4	0.3	0.3	0.4	0.9	0.5
Trailing	Siskyou	0.0	0.2	0.1	0.5	0.2
Semi-erect	Chester	5.7	7.8	12.3	23.0	12.2
Semi-erect	Hull	7.3	15.7	0.6	24.1	11.9
Semi-erect	Lochness	3.9	7.7	8.1	11.4	7.8
Erect	Apache	0.1	0.6	0.6	2.4	0.9
Erect	Arapaho	3.8	1.9	1.3	1.9	2.2
Erect	Navaho	10.3	5.8	2.2	8.4	6.6

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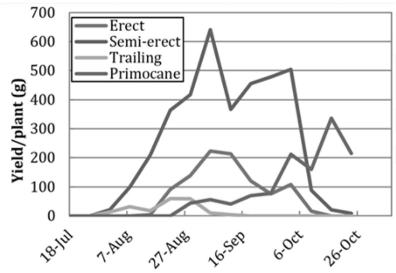

Figure 1. Time course of each growth type in 2011. The best performing cultivar from each type is shown. They are Navaho, Lochness, Metolius, and Prime Jan.

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Blackberry hardiness: Kaysville field trial

Table 1. Winter cane survival of blackberry cultivars at the Kaysville Research Farm (% cane survival).

	Year							
cultivar	2007	2008	2009	2010	2011	2012	mean	rank
Illini Hardy	100	90	93	95	93	90	93	1
Chester	73	73	93	95	72	93	83	2
Apache		67	75	98	92		83	3
Navajo	78	65	70	95	88	75	78	4
Arapaho	93	40	73	98	93	73	78	5
Tr. Crown		38	83	95	85		75	6
Hull	55	20	90	75	50	98	65	7
Ouachita	100	15	70	90	85	18	63	8
Doyle's	68	5	73	65	58	90	60	9
ORUS 1324		0	78	48	83	80	58	10
Loch Ness	35	15	85	60	73	78	58	10
Siskyou		17	58	90	50		54	12
B. Diamond		0	75	18	8	60	32	13
Obsidian	65	5	60	35	5	15	31	14
ORUS 1793		0	65	43	5	23	27	15
ORUS 1939		0	60	40	33	0	27	16
Metolius	0	0	30	38	5	55	21	17
Marion	50	15	38	12	0	5	20	18
Kiowa	10	0	45	25	5	13	16	19

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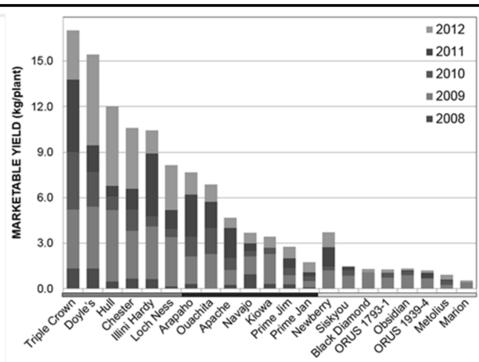

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Conclusions

- Earlier production?
  Inconsistent. Generally not.
- Later production?
  - With late-fruiting varieties
- Winter protection?
  - Definitely not with 4-season tunnel
- My recommendation
  - Late-season production
  - Two-season tunnel
  - Semi-erect types
  - Primocane types

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Resources http://tunnel.usu.edu

January 2015 Horticulture/HighTunnels/2015-01pr

High Tunnel Blackberry Production For Northern Utah

Reagan Wytsalucy, Student, *Tiffany Maughan*, Research Associate, and *Dr. Brent Black*, Extension Fruit Specialist

Introduction
High tunnels have been effective in extending the growing season for numerous crops in Utah. Blackberries can be grown under high tunnels as a method of frost protection and extending the season later

winds, reducing the chance of damage to the structure. If multiple tunnels are used at one site, enough space should be left between tunnels to minimize shading, and allow at least 8 hours of sunlight daily. This can be 10 to 15 feet between tunnels, depending on tunnel height.

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Resources http://tunnel.usu.edu

June 2014 Horticulture/HighTunnels/2014-05

Constructing a Low-Cost High Tunnel for Tall Crops (14.5' wide by 10' tall)

Tiffany Maughan, Research Associate, *Daniel Rowley*, Former Graduate Student, *Brent Black*, Extension Fruit Specialist, *Dan Drost*, Extension Vegetable Specialist

High tunnels can be effective for both season extension and frost protection. There are many different designs and materials used for high tunnel construction. When deciding what high tunnel you

sledge hammer, ladder, and a measuring tape. Table 1 provides the materials list for constructing the tunnels. The cost of wood materials was determined by averaging 2014 prices across three Logan, Utah

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Raspberry Viruses

Biographical Information:

Claudia Nischwitz
Utah State University

Assistant Professor and extension Specialist at USU since August 2010

I work on diseases of plants with focus on vegetable and fruit tree diseases. In addition, I do diagnostics for the UPPDL lab.

Session Description:
I will cover raspberry viruses that occur in Utah or have to potential to occur here.

Raspberry viruses

Claudia Nischwitz
Assistant Professor and Extension Specialist
Email: claudia.nischwitz@usu.edu
UtahStateUniversity
COOPERATIVE EXTENSION

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.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

Tomato ringspot virus

- Significant yield losses
- Transmitted by *Xiphinema americanum* (dagger nematode)
- Symptoms
  - Mosaic or ringspots on leaves on some cultivars
  - Reduced yield
  - Low vigor
  - Crumbly fruit
  - Some varieties are dwarfed or die quickly after infection

Tomato ringspot virus

Tomato ringspot virus - Management

- Test soil before planting berries for *Xiphinema* sp.
- Weed removal (dandelion)
- Use certified disease-free plants
- Remove infected plants and five plants to each side
- Clean equipment to remove soil between fields
- Establish grass alley ways to reduce soil movement

Raspberry mosaic virus complex

- Caused by five viruses
- Transmitted by the large raspberry aphid
- Symptoms
  - – Mottling or mosaic of leaves
  - – Delayed leafing out
  - – Clusters of shoots from the same node
  - – Plants may die within a few years

Raspberry mosaic virus complex

www.oardc.ohio-state.edu

http://www.fruit.cornell.edu/berrytool/raspberry/leavesstems/Raspmosaic.htm

Raspberry mosaic virus complex - management

- Plant disease-free plants
- Resistant varieties
  - Red raspberry varieties: 'Canby', 'Chilliwack', 'Comox', 'Nootka', 'Skeena‘, ‘Titan’, ‘Reveille’
  - Purple and black raspberry varieties: ‘Black Hawk’, ‘Bristol’, ‘New Logan’

Raspberry leaf curl virus

- Transmitted by the small raspberry aphid
- Symptoms:
  - Leaves curled tightly downward
  - Leaves at tip of canes are rounded and dwarfed
  - Fruiting lateral shortened
  - Crumbly fruit
  - Over the years plants lose vigor and shoots get shorter and shorter
  - New infected shoots become stiff and brittle and will not branch

Raspberry leaf curl virus

- Causes 20-70% yield loss
- Management
  - Remove infected plants
  - Good weed control

Unknown problem

Courtesy of Sheriden Hansen

Varieties most affected: Brice and Treasure

Thank you!

Iron Nutrition in Raspberries: Why Some Products Work Better than Others

Biographical Information:
Jace Johnson
Utah State University

Jace grew up raising sugar beets near Twin Falls, ID. He earned a BS in Horticulture Production at BYU-Idaho in 2011. Jace is currently writing his thesis regarding iron nutrition, rootstock selection, and autumn defoliation of Utah fruit crops. In May, he will move with his wife and 2 children to Marsing, ID and begin working for Symms Fruit Ranch in Caldwell.

Session Description:
Jace will be explaining the results of a small iron fertilization trial performed in chlorotic raspberries in Payson, as well as offering a brief explanation of why certain iron fertilization tactic do not work in most Utah soils.

Overcoming Iron Chlorosis in Raspberries

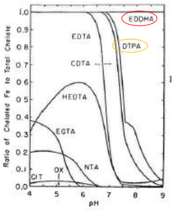
Iron in the Plant

- Cofactor for many enzymes
  - **chlorophyll production**
  - Respiration
  - Metabolism
- Energy Transfer
- Nitrogen Fixation

Factors that limit Fe availability

- **High pH**
  - $Fe(OH)_3$ precipitate
- **Soil Texture**
  - Compacted
  - Saturated
- Premature Spring irrigation
- Low Organic Matter
- High nitrate
  - Raises pH of Rhizosphere
- Soil nutrient imbalance
  - Fe:Zn
  - Fe:Mn
  - K:Fe
  - Fe:Mo
- Excess Phosophorous
  - $FePO_4$ precipitate

Chelates



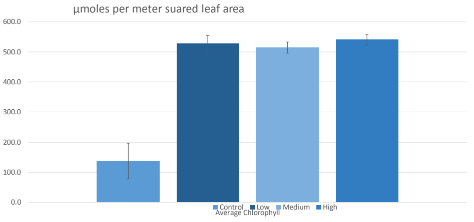
Mortvedt, et al., 1972

- Complex molecules with high affinity for Fe
- Plant takes up and breaks down
- EDDHA
  - AKA Iron 138; Miller's Ferriplus; 'red' iron
- DTPA
  - AKA Iron 330; 'yellow' iron

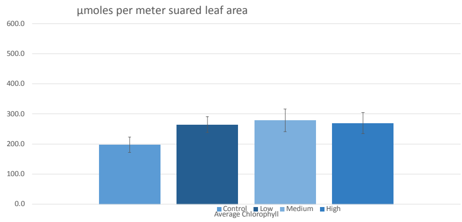
Our Studies

- 1 experiment in Payson, Utah
  - 5 foot row segments
  - Control
    - No Iron Applied
  - Low
    - 4 oz EDDHA chelate
  - Medium
    - 8 oz EDDHA chelate
  - High
    - 16 oz EDDHA chelate

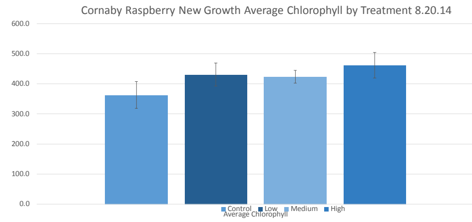
Results – new growth chlorophyll (15d)



Results – old growth chlorophyll (15d)



Results – new growth chlorophyll (22d)



Expenses

- 2 lbs/100 ft
  - $1,090 per acre
- 1/2 lb/100 ft
  - $275 per acre

Aluminet Shading for Raspberries

Biographical Information:
David Cornaby
Cornabys

David Cornaby, owner of Cornabys Farm, a 20 acre raspberry patch in Salem, Ut. The operation is equipped with an underground drip irrigation that serves to water, fertilize, and at times deliver insecticides. I have one of the few raspberry harvesting machines in the state. One of my objectives is to never let a berry go to waste, so in addition to harvesting for the fresh market I am part owner of Cornaby's LLC, a specialty food business that produces jams, jellies, syrups, smoothie mixes, and bakery fillings along with thickeners and jam mixes.

Session Description:
Aluminet shade cloth is a high quality reflective metalized HDPE knotted screen. It is used in greenhouse thermal screen and as an alternative to black shade cloth. This session will cover a raspberry growers experience in using aluminet shading for raspberries.

Leafhopper and Currant Borer Management

Biographical Information:
Marion Murray
Utah State University

Marion has been the IPM Project Leader at Utah State University Cooperative Extension, Logan, since 2006. She conducts Extension outreach and research in integrated pest management in fruits and vegetables. She distributes periodic pest advisories for tree fruits, landscape ornamentals, and vegetables. Prior to coming to USU, she spent 10 years in public horticulture education and landscape management. She received her Master's degree in plant pathology from Oregon State University and is originally from North Carolina.

Session Description:
Two sporadic pests of raspberry and currant—leafhoppers and currant borer—have very different life cycles and management options, but can both be devastating pests. Learn about their biology and habits and how to manage or prevent them from becoming a problem.

Leafhoppers and Currant Borers

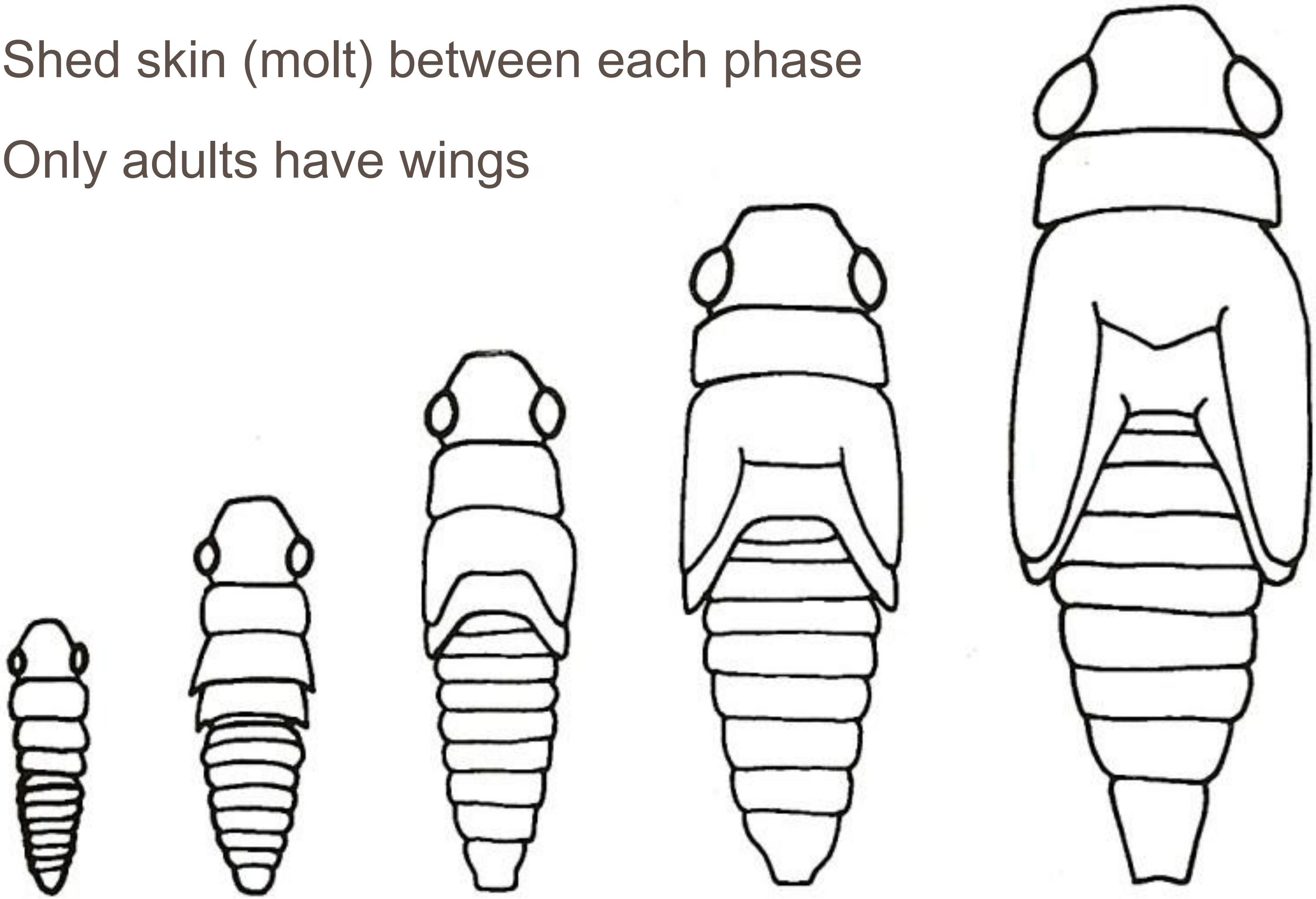
Marion Murray

Leafhoppers

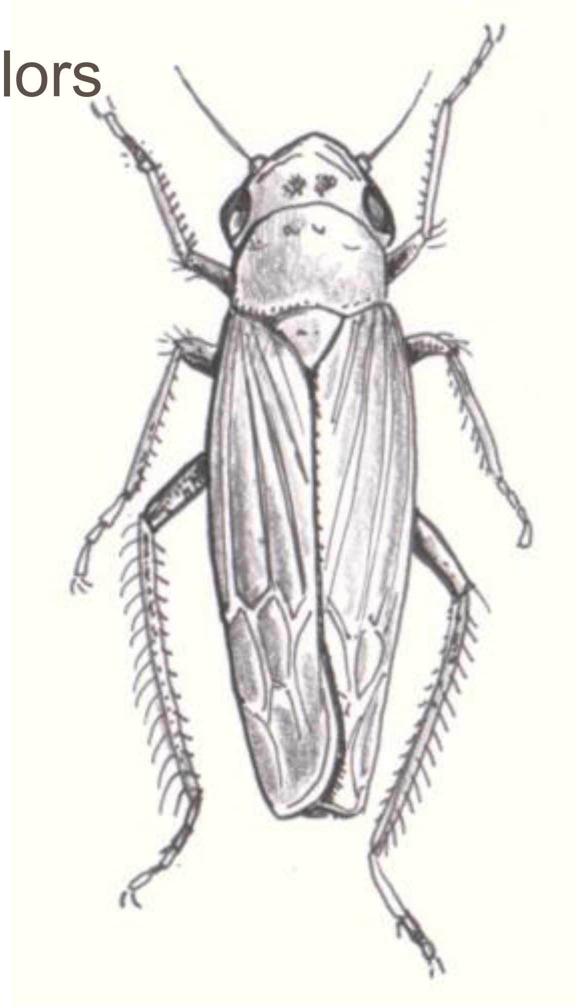
- Piercing-sucking mouthparts
- Feed on undersides of leaves, along veins
- Some feed on phloem, others feed on mesophyll cell contents
- Somewhat host specific
- Not known to vector viruses in Utah

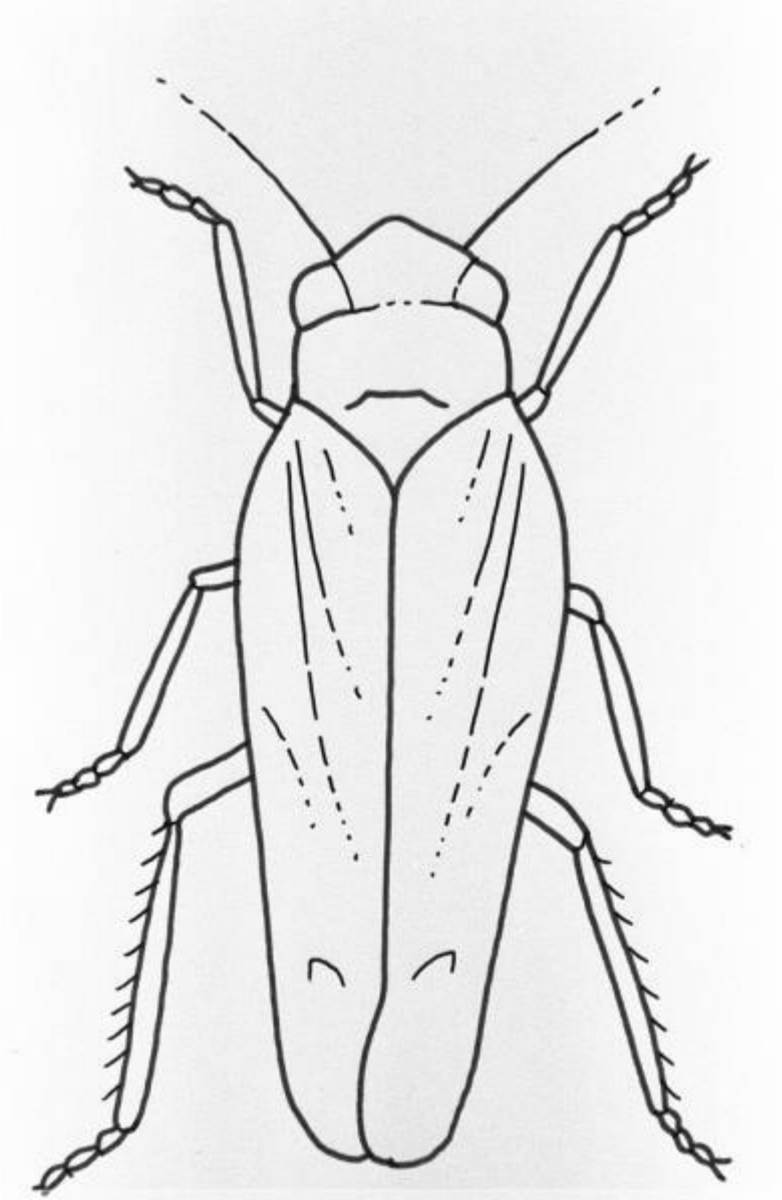
Incomplete Metamorphosis

- 4-5 instars
- Shed skin (molt) between each phase
- Only adults have wings



- Adults 1/8 – 1/4 inch in size
- 2 pairs wings
- Varying colors





Leafhopper species

- Rose leafhopper
- White apple leafhopper
- *Erythroneura* species (related to grape leafhopper)

Rose Leafhopper

- *Edwardsiana rosae*
- Widely distributed in U.S.
- Overwintering hosts:
  - wild and cultivated rose, blackberry, raspberry
- Also feed on:
  - apple, crabapple, oak, hawthorn, poplar, elm, maple, dogwood

Rose Leafhopper

- Overwinter as eggs inserted just under skin of soft canes
- Egg-hatch in early spring
- Nymphs feed 3-4 weeks
- Adults disperse in late spring to other hosts
- Second generation of nymphs appear in mid summer.

White Apple Leafhopper

- *Typhlocyba pomaria*
- Widely distributed in U.S.
- Overwintering host:
  - apple
- Other hosts:
  - caneberries, grape, cherry, peach, prune, hawthorn

White Apple Leafhopper

- Overwinter as eggs under skin of young apple twigs
- Hatch is over by petal fall
- Nymphs feed on apples
- Adults disperse to other hosts mid to late spring
- Return to apples to lay eggs
- Two generations

Erythroneura species

Extension UtahStateUniversity

- Newly identified on raspberries, Cache County, 2014
- Related to grape leafhopper
- Exact species unknown

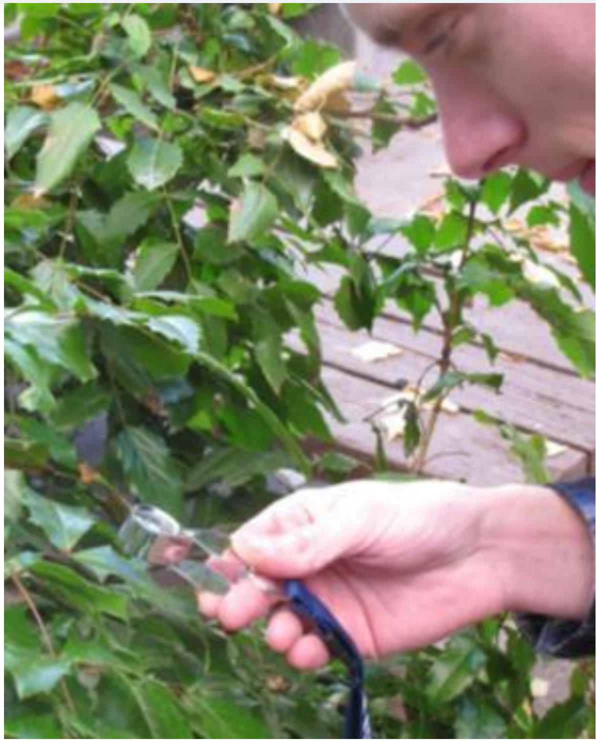

Erythroneura species

Extension Utah State University

- *Erythroneura* subspecies *Eratoneura*
  - 50 very related species
  - most are associated with grape
  - also occur on shade trees, native trees and shrubs
- Probably have toxin in saliva that causes “hopper burn”
- Overwinter as adults on the ground

Leafhopper Management

- Typically treatment not needed
- Use hand lens to monitor for presence
- Treatment may be warranted when there are more than 18 per leaf



Natural Enemies - *Anagrus* species

Natural Enemies – Generalist Predators

Leafhopper Insecticides

- Insecticidal soap (contact, nymphs)
- Assail (acetamiprid)
- Actara (thiamethoxam)
- Avoid pyrethroids

Currant Borer

Currants - General

Extension UtahStateUniversity

“The currant takes the same place among fruits that the mule occupies among draught animals- being modest in its demands as to feed, shelter, and care, yet doing good service.”

-19th Century Horticulturist

Currants - General

Black currants (*Ribes nigrum*)

Red and White Currants (*Ribes rubrum, R. petraeum, R. sativum*)

- Can tolerate mid-winter lows of -40 F or lower
- USDA Hardiness zone: 3-5
- Will tolerate part-sun
- Drought tolerant
- Few pests, except….

Currant borer

- *Synanthedon tipuliformis*: clearwing moth in family Sesiidae
- Occurs whereever currants are grown; most widespread of all clearwing species
- AKA currant clearwing

Currant borer life cycle

Overwinters as larva within pith near base of canes

Currant borer life cycle

Mid-spring, larva cuts an emergence hole with a flap; then pupates in a silken cocoon within stem at hole opening

Currant borer life cycle

Mid to late spring:

Pupa moves to emergence hole by flexing abdomen, and leaves pupal case behind

Currant borer life cycle

- Females mate and lay eggs with 3 days of emerging
- Lay eggs on 1 or 2-yr old branches; never on current shoots
  - Egg-laying from late May to late July
- Eggs hatch and larvae bore up and down lower portion of cane all summer

Hosts

Most susceptible

- red currant
- white currant
- black currant

Moderately susceptible

- gooseberry
- ornamental currant, black elder, sumac

Damage

Infested canes are not directly killed

- weak, spindly, chlorotic foliage
- stunted plants
- shoot dieback due to prolonged water/ nutrient depletion
- stems more susceptible to winter damage

Damage

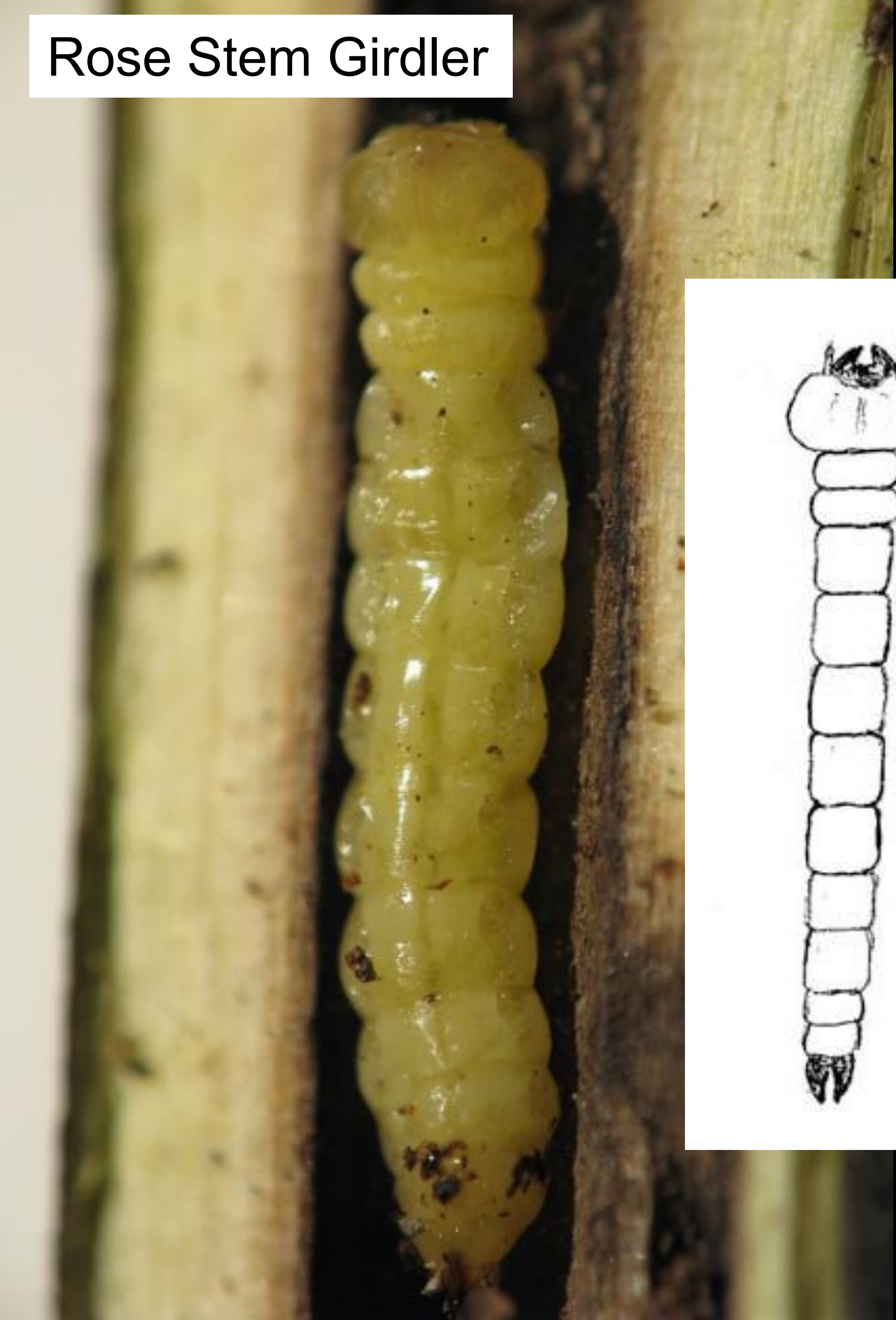
- Uneven bud break
- Fruit yield reduction by up to 50%

Management

Monitor

- damage/examine piths of spindly canes for frass
- pheromone traps

Rose Stem Girdler

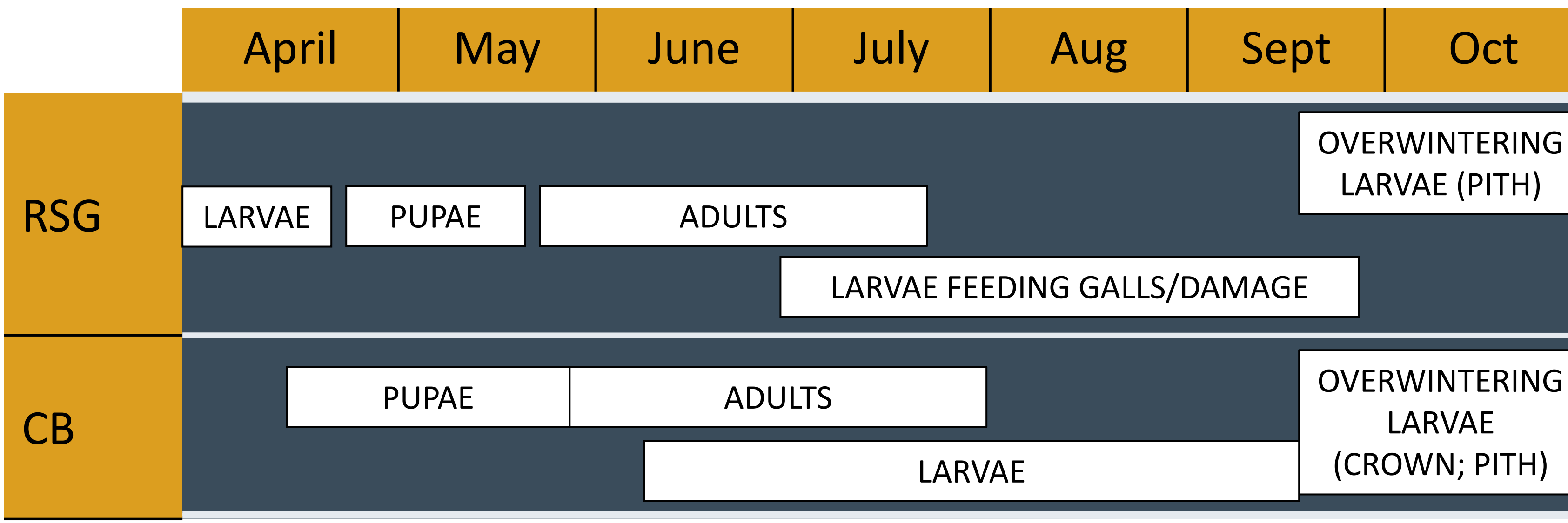


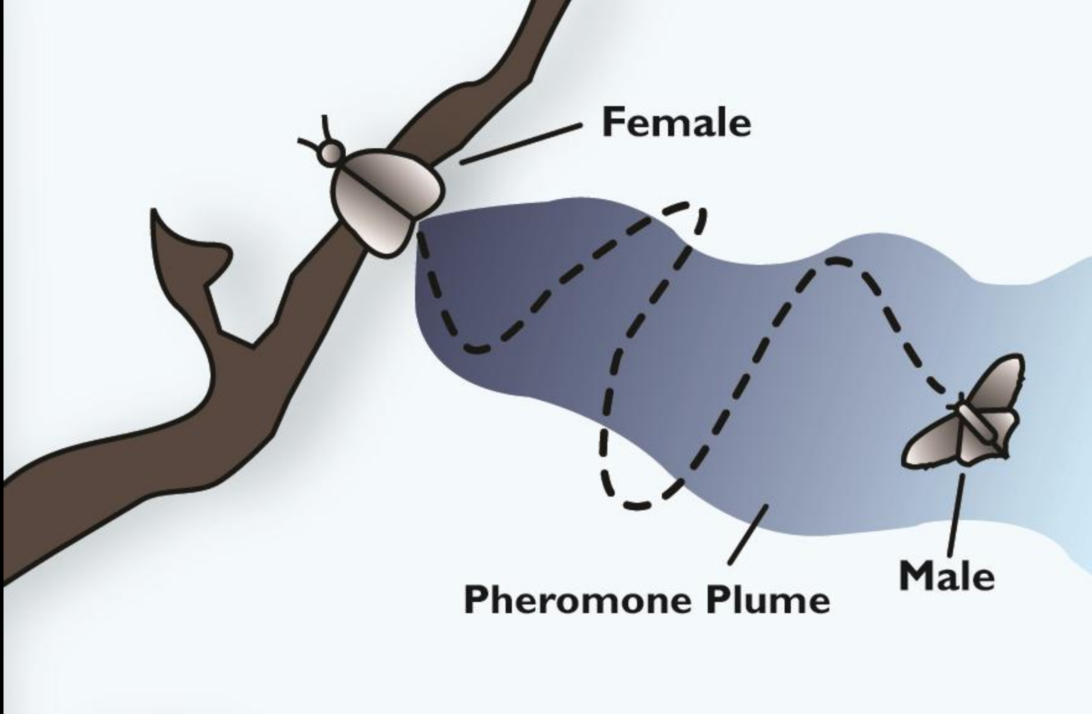
Management

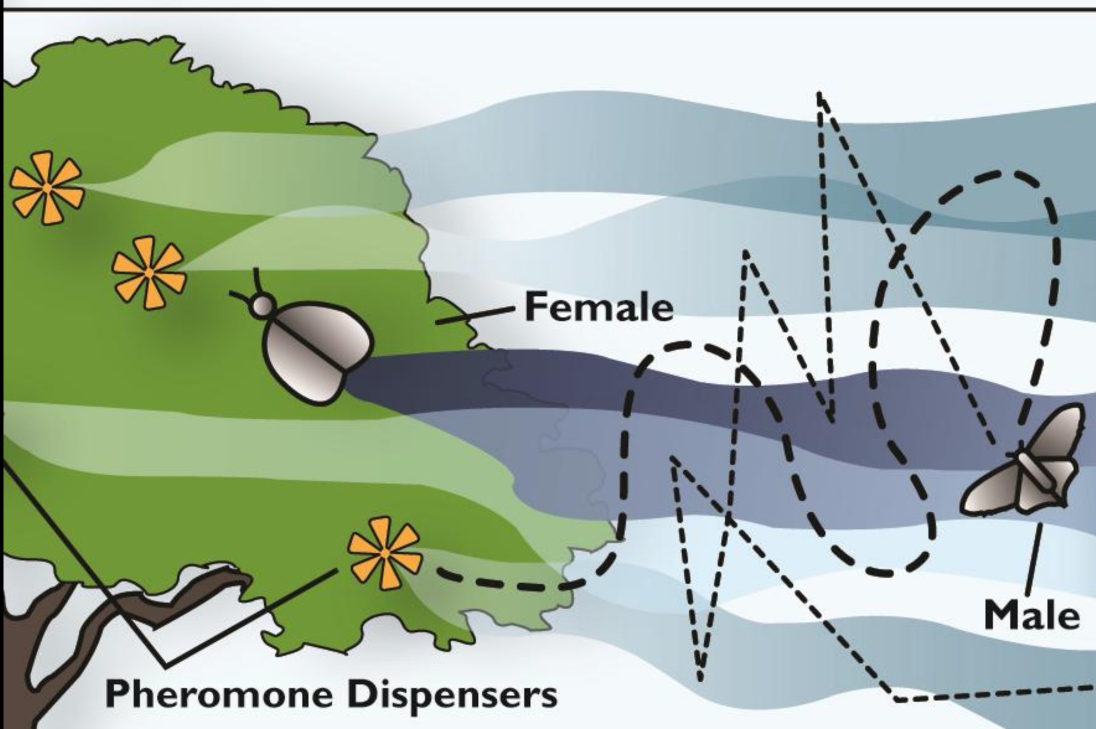
- Prune damaged/weak canes before May and destroy
- Mow/control weeds
- USDA-ARS in Corvallis, OR are looking at currant cultivars that are resistant

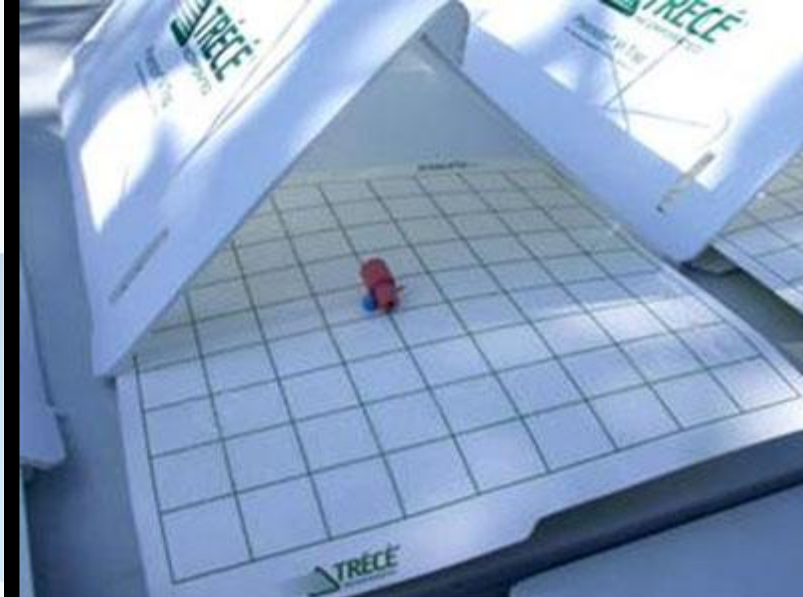
Management

- Insecticides (for adults):
  - Danitol
  - Sevin, Malathion
  - Pyrellin









Minimum 5 acres

Square field (least

amount of edges

Lower population sizes

Mating Disruption

Isomate-GRB

- grape root borer + currant borer
- 200/acre
- $40-50/acre

Used in Europe, New Zealand, CT, WA

- tested in UT

ISOMATE® GRB

A MATING DISRUPTION FORMULATION FOR GRAPE ROOT BORER *(Vitacea polistiformis)* AND CURRANT BORER (*Synanthedon tipuliformis*)

FOR ORGANIC PRODUCTION

ACTIVE INGREDIENTS:	
(E,Z)-2,13-Octadecadien-1-yl Acetate	78.69 %
(E,Z)-3,13-Octadecadien-1-yl Acetate	3.92 %
OTHER INGREDIENTS	17.39 %
TOTAL	100.00 %

80.43 mg active ingredients per dispenser


Treated Field
Control Field
Traps
500 m

Collected 100 canes in spring (pre-treatment) and fall (post-treatment)

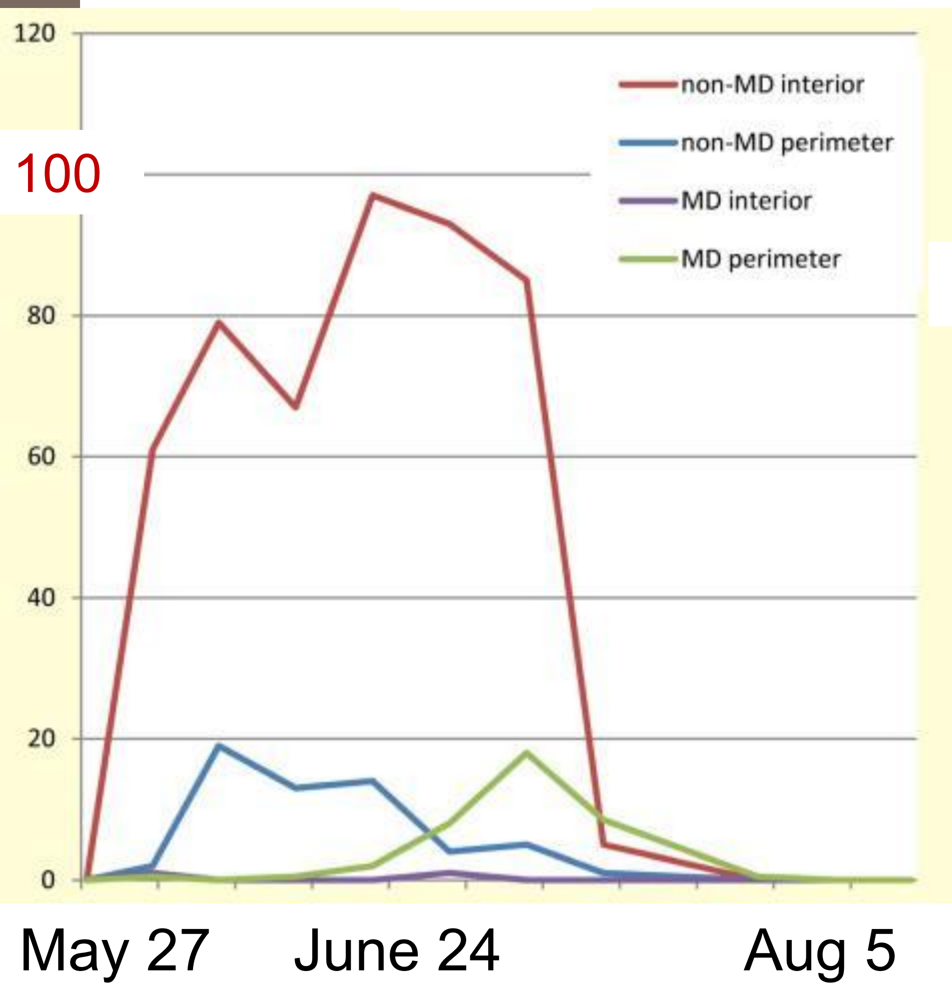
Cane Infestation

Percentage of canes infested with larvae and pupae

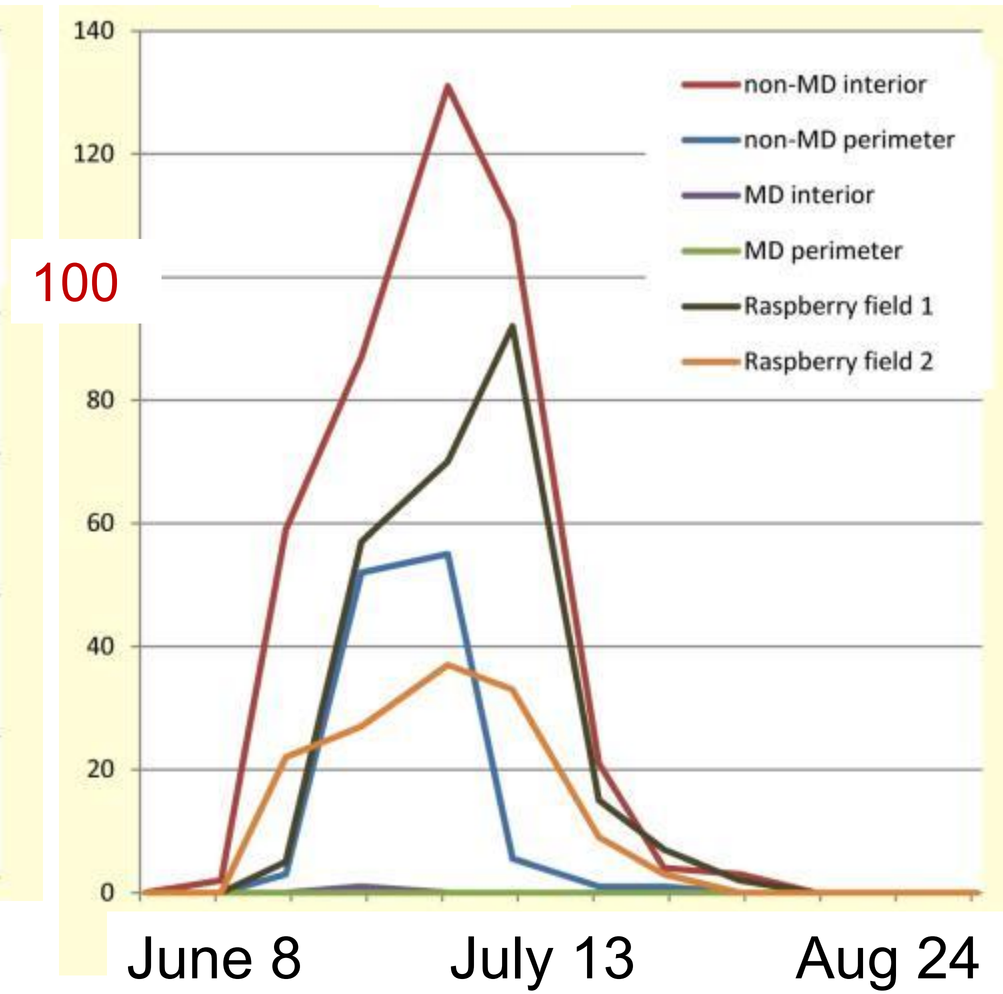
Treatment	2009	2010
MD-spring	24%	51%
MD-fall	72%	80%
Control-spring	12%	35%
Control-fall	50%	43%

Average Weekly Trap Catch

2009



2010



Mating Disruption Issues

- Initial population too high
- Field size too small
- Moths can fly from up to 1.5 miles away
- Blackberry: possible additional host

Natural Enemies

Natural Enemies - Pathogens

UtahState University
COOPERATIVE EXTENSION

UTAH PESTS

Marion Murray
IPM Project Leader

marion.murray@usu.edu
435-797-0776

Horntail Control

Biographical Information:
Craig Floyd
Floyd Family Raspberry Farm/Chads Raspberry Kitchen

Jane (mother) and Chad (blind son) started making raspberry pop cycles using berries raised in our garden and selling them at drive-inns around Bear Lake in the 1990s. This gave Chad a small income as well as purposeful activity given his limitations in a small community. In 2000 one of the customers whose family had raised raspberries and made jams for years was tired of the business. She invited us to buy the appliances and try our luck. We converted a horse pasture into a raspberry farm and started learning the business of farming and marketing. Chad passed away in 2013 and in 2014 our youngest son bought Chads Raspberry Kitchen and has been expanding it.

A challenge we had to address was to find a berry that resisted RBDV, tolerated the Bear Lake climate and could be machine harvested. We tested six promising varieties and eventually chose to put the main acreage into Cowichin. Our crop is harvested using a Korvan 930 mechanical harvester. We typically pick three times each week during the harvest. You can watch us by going to the website. Chadsbearlake.com, under "about us", "in the kitchen"

Craig retired from the public school system in 2005 to run the farm and do financial planning.

Session Description:

Horntail is a cane-boring wasp that can cause crop loss to raspberries. This session will discuss how they have controlled Horntail in raspberries.

Insect & Spider Mite Control

Biographical Information:
Diane Alston
Utah State University

I have worked as an extension entomologist at Utah State University for over 25 years. I research and deliver outreach education on integrated pest management (IPM) strategies for insect and mite pests of fruits and vegetables. Check out our website, "UtahPests" for publications, videos, slideshows, an image gallery, and other useable knowledge.

Session Description:
I will discuss management of key pests of raspberries in Utah, including raspberry horntail, crown borer, rose stem girdler, and spider mites.

Raspberry Cane Borer and Spider Mite Management Updates

Diane Alston, Entomologist, Utah State University

UtahState University

Urban & Small Farms Conference
February 19, 2015
Viridian Center, West Jordan, UT

Raspberry Topics

- Cane Borers
  - Raspberry Horntail
  - Raspberry Crown Borer
  - Rose Stem Girdler
- Spider Mites

Utah Pests Online Resources

www.utahpests.usu.edu

Raspberry Horntail

6 years of Utah research

1) Biology & Life Cycle
2) Predict Adult Emergence/Egg-Laying Period
3) Natural Enemies
4) Raspberry Cultivar Resistance

Raspberry Horntail Research Summary Article

Utah Pests News
Quarterly Newsletter
www.utahpests.usu.edu
Fall 2014
Vol. 8: 4-5, & 11

Free subscription sign-up to IPM Advisories & Utah Pests News
www.ipm.usu.edu

USU Fact Sheets

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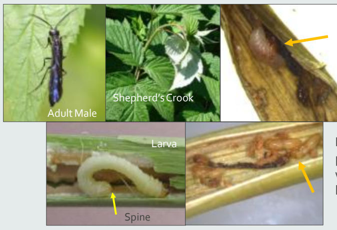
Raspberry Horntail, *Hartigia cressonii*

- Major cane-boring pest in Utah
- Wasp (Hymenoptera)
  - Stem sawfly (Cephidae)
  - Attacks first-year primocanes
  - Intermountain West & CA
- Infested canes
  - Lower yield
  - Lower vigor
  - Lower winter survival



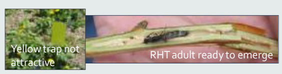
Natural parasitoid wasps kill RHT

Raspberry Horntail Biology

- One generation per year (late May – early Sep)
- Overwinter in canes within a silk-lined chamber
  - Mature larva
- Pupate within the chamber in the spring
- Adults chew a hole, emerge
  - Temperature dependent
- Eggs inserted under epidermis of young primocanes
- Young larva (winding) tunnels upwards in cambium just under epidermis
  - At cane tip, consumes pith – tip wilting
  - One larva per cane tip
  - U-turn and tunnels down in pith
- Mature larva forms overwintering chamber 1 – 1.5 ft above cane base

Clockwise from top left: larva in silk-lined chamber, adult emerging from cane, larva & frass at cane tip, male (left) & female

Adult Emergence

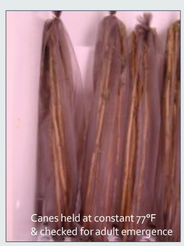


Degree-Day Model to predict timing of egg-laying

Predict emergence of RHT adults from overwintering chambers in canes

Study sites (3 years):
Laketown, Richmond, Paradise, Wellsville, Kaysville, & Alpine

Emergence:
Base 50°F since Jan 1
500 to 1800 DD
Average dates:
June 12 to August 3



Natural Enemies (Biological Control)

- 3 species of parasitic wasps attacking horntail larvae
- Parasitism occurred near cane tip (smaller diameter, horntail larva consumes pith, softer cane tissue facilitates insertion of the parasitoid's ovipositor, space for parasitoid to develop)
- Some cane injury already occurs before parasitism

Parasitism of RHT Larvae

Percentage of horntail larvae parasitized, Kaysville, UT (Davis Co.), 2009 & 2010

Date	Summer Cultivars		Fall Cultivars	
	2009	2010	2009	2010
June 24	0	-	9.1	-
July 1	-	0	-	25.6
Jul 15	35.1	25.8	41.7	20.0
Jul 22	-	73.1	-	47.1
Jul 29	98.4	59.1	100	33.3
Aug 5	61.5	80.0	25.0	0
Aug 13	70.0	-	40.0	-

Parasitoid I

- Ichnuemonidae
- Long ovipositor
- Ectoparasite
- Solitary

Parasitoid II

- Pteromalidae
- Ectoparasite
- Gregarious
- ~3-20 larvae/horntail

Parasitoid III

- Less common
- Eurytomidae
- *Tenuipetiolus* sp.
- This genus known to parasitize gall midges & gall wasps

Summer (Floricane-Fruiting) Raspberry Cultivar Resistance Trials
USU Research Farm, Kaysville, UT (Davis Co.)

2009-2011
Mean no. RHT per row-ft

Cultivar	RHT	Cultivar	RHT
Royalty	0.25 a	Reveille	2.85 abc
Moutere	0. 80 a	Chemainus	2.95 abc
Cascade Dawn	1.25 ab	Canby	3.25 bc
Cowichan	1.55 abc	Georgia	3.65 c
Coho	1.60 abc	Cascade Bounty	3.75 cd
Cascade Delight	1.75 abc	Titan	4.10 cd
Lauren	1.85 abc	Willamette	5.10 cd
Tulameen	2.20 abc	Saanich	5.95 d

2013-2014
Mean no. RHT per row-ft

Cultivar	RHT	Cultivar	RHT
Octavia	0.01 a	Prelude	0.26 ab
Cascade Gold	0.05 a	Cascade Bounty	0.68 ab
1142-1	0.12 a	Nova	1.07 b
Chemainus	0.18 a		

Horntail population pressure declined in 2013-2014 as compared to 2009-2011: successive years of cane removal as part of the sampling process. Suggests that frequent pruning is an effective management tactic.

Cultivars with greater winter hardiness, cane vigor, & yields were more resistant to horntail.

Fall (Primocane-Fruiting) Raspberry Cultivar Resistance Trials
USU Research Farm, Kaysville, UT (Davis Co.)

2009-2011
Mean no. RHT per row-ft

Cultivar	RHT	Cultivar	RHT
Polana	0.4	Joan J	0.7
Caroline	0.6	Ruby	0.7
Polka	0.6	Himbo Top	0.8
Summit	0.6	Heritage	0.9
Jaclyn	0.6	Anne	1.0

2013-2014
Mean no. RHT per row-ft

Cultivar	RHT	Cultivar	RHT
Autumn Treasure	0.03	Polana	0.23
Josephine	0.06	Autumn Bliss	0.30
Brice	0.08	Joan J	0.34
Vintage	0.14	Dinkum	0.50
Autumn Britten	0.18		

For fall-bearing cultivars, horntail infestation $\leq$ 1 larva per row-ft, and there were no statistical differences among cultivars.

Horntail infestation was substantially lower in fall- than summer-bearing cultivars:
- fall-bearing canes were removed at ground level in the spring before overwintered horntail adults emerged
- horntails seem to avoid thin canes which are more common in fall-bearing cultivars

Raspberry Horntail IPM

- Select cultivars with more resistance
  - Fall-bearing are less susceptible than summer-bearing cultivars
- Prune out infested canes before adults emerge (by May)
  - Remove fall-bearing canes at ground level
  - Remove floricane-fruiting canes with a horntail tunnel in pith
- If warranted, apply insecticide beginning at 500 DD to prevent egg-laying; repeat based on protection interval of product (emergence ends by 1800 DD)
  - Carbamate: carbaryl (Sevin)
  - Pyrethroids: bifenthrin (Brigade, Capture), esfenvalerate (Asana), fenpropathrin (Danitol), zeta-cypermethrin (Mustang Max), pyrethrin
  - Organophosphates: diazinon (Diazinon, RUP), malathion (Malathion)
  - Don't spray when bees are active! Follow all product label protections for pollinators
- Frequent pruning of infested cane tips during summer can lower the horntail population in a field
- Conserve parasitoid wasps by avoiding unnecessary insecticide applications

Raspberry Crown Borer

Raspberry Crown Borer

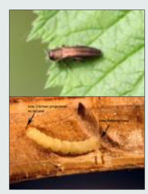
- Two-year life cycle
- Year 1:
  - In late summer, day-flying clearwing moth (resembles yellow jacket) emerges from cane, lays eggs on lower leaves
  - Larva overwinters by tunneling into base of cane
- Year 2:
  - Larva tunnels into crown/upper root during summer, spends 2nd winter in roots
    - Overlapping generations
- Infestation symptoms (2nd year):
  - Canes become spindly and wilt during summer
  - Canes break-off easily at the crown
  - Holes in the crown/upper roots with sawdust-like frass

Raspbery Crown Borer Management

- Only use clean planting stock
- Don't transplant canes between fields
- If infestation is localized in a field, dig and destroy infested crowns/roots
- Monitor by observation of brittle/wilted canes and enlarged crowns
  - Tested sex pheromone lure (British Columbia, Canada) – too volatile, short-lasting
- Insecticides – apply as heavy drench/soak to base/crown/roots for $\geq$ 2 consecutive years
  - Mid-October to target first year larvae
  - In spring before bud break, to target overwintered larvae before they tunnel deeply into the crown/roots
    - Bifenthrin (Brigade 2 EC) (PHI 3 days; only 1 pre-bloom application allowed per year)
    - Pyrethrin (organic option; short residual)
    - Chlorantraniliprole (Altacor) (PHI 3 days)
    - Diazinon 50W (PHI 7 days; restricted use; only 1 application allowed per year)

Rose Stem Girdler

Rose Stem Girdler



- Metallic, flatheaded beetle
  - Adults emerge from canes in May-June
- Larva is white, flattened head, two short spines on tail end
- Larva tunnels 2-5 spiral grooves in the cambium (just under the bark)
  - Gall-like swelling
- Cane girdling leads to wilt, breakage, and loss
- First-year canes most susceptible to attack

Rose Stem Girdler Management

- Remove nearby roses (wild and climbing) – excellent alternate host
- Prune out and destroy infested canes in spring and summer to remove larvae
- Apply insecticides just after bud break to kill adults and prevent egg-laying
  - Control timing may overlap with first horntail emergence
  - Full cover spray to canes
  - Don't spray when bees are active
  - Same insecticide recommendations as for raspberry horntail

Spider Mites: How Do They Make a Living?

Twospotted Spider Mite, *Tetranychus urticae*

- Prefer undersides of leaves
- Form colonies, webbing: eggs, nymphs & adults
- Very small (0.02 inch length)
- Overwinter as dormant females (orange color) at base of canes & on weeds
- 10-14 day life cycle in summer
- Suck plant sap: fine, gray stippling on leaves

Spider Mites: Caneberry Symptoms

"Mite Burn"

- Hot, dry conditions promote mites
- "Mite burn": yellow, brown bronzing, begins on lower leaves first
- Mites move up from (broadleaf) weeds on the ground
- Raspberry leaves are sensitive to mite feeding
- Fruiting canes: reduces vigor & berry yield
- Primocanes: weakens, predisposes to winter injury

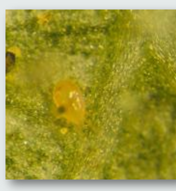
Spider Mite Management: Cultural Control

- Plant vegetation in alleyways (grass)
  - Minimize broadleaf weeds
    - field bindweed, common mallow
- Overhead sprinklers (cool & wet)
- Avoid disturbing ground cover (avoid dust)
- Avoid plant stress – water!
- Macro-tunnels:
  - Good venting, temperature mgmt.
  - Avoid hot, dry conditions
- Cultivar resistance:
  - Heavily pubescent leaves reduce mites

Spider mite-induced defoliation

Spider Mite Management: Biological Control

- Predatory mite
  - *Galendromus (Typhlodromus) occidentalis*
  - western predatory mite
- Other predators:
  - thrips, pirate & big-eyed bugs, ladybeetles, lacewings
- Naturally occurring
  - Supplemental releases – predatory mite
- Avoid insecticides & miticides toxic to beneficial insects & mites



Western predatory mite, note tear-drop-shaped body

Spider Mite Management: Chemical Control

Less disruptive & organic miticides

- insecticidal soap (M-Pede, others) – physical
- horticultural oil (JMS Stylet Oil, others) - physical
- azadirachtin/neem oil (Trilogy, others) – Unkn*
- cottonseed+clove+garlic oil (GC-Mite) – physical
- Sulfur (do not use above 90°F)

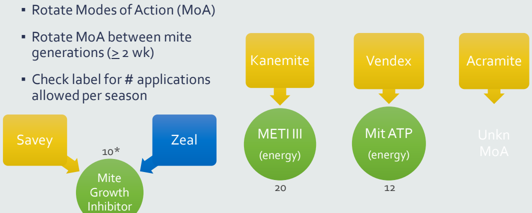
Commercial miticides

- acequinocyl (Kanemite) – 20B*
  - adults, eggs, nymphs; 1 day PHI
- bifenazate (Acramite 50WS) – Unkn*
  - adults, eggs, nymphs; 1 day PHI
- etoxazole (Zeal) – 10B*
  - eggs, early nymphs; 1 day PHI
- hexythiazox (Savey) – 10A*
  - eggs, nymphs; 3 day PHI
- fenbutatin-oxide (Vendex 50WP) – 12B*
  - adults, nymphs; 3 day PHI (raspberry only)

*IRAC MoA groups

Rotate Chemical Groups to Manage Resistance

- Rotate Modes of Action (MoA)
- Rotate MoA between mite generations (≥ 2 wk)
- Check label for # applications allowed per season



*IRAC MoA groups

Berry Spider Mite IPM

Scout leaves on lower canes for mite injury when temperatures rise

- Avoid plant stress
- Water!
- Good plant nutrition
- Scout for early signs of mite feeding
- Intervene early:
  1. irrigate & cooling, prevent mite dispersal & dust
  2. apply less disruptive miticide early in mite population increase
  3. Apply stronger miticide, if needed
- Observe Pre-Harvest Intervals

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Small Fruit & Vegetable IPM Advisory – Free Newsletter

Acknowledge

- Collaborators: Brent Black & Thor Lindstrom
- Students in the Alston IPM Lab
- Grower cooperators
- Funding:
  - Utah Agricultural Experiment Station
  - Utah Specialty Crop Block Grant Program (USDA)

UtahStateUniversity AGRICULTURAL EXPERIMENT STATION

UTAH PESTS

Slideshow Available

Insects – Tree Fruit and Small Fruit

www.utahpests.usu.edu

Organic Peach Research

Biographical Information:
Jennifer Reeve
Utah State University

Jennifer Reeve is associate professor of Organic and Sustainable Agriculture in the department of Plants Soils and Climate at Utah State University (USU). Her current research focuses on nutrient management and soil health in organic and integrated tree fruit, vegetable, pasture and grain systems. She is also chair of the Southern Coordinating Committee: Quantifying the linkages among soil health, organic farming and food. In 2012 she received an award of civically engaged scholar from the Utah Campus Compact for her work with the USU Student Organic Farm. Originally from England she earned a Bachelor of Science in Ecology from the University of Sheffield in 1995 followed by a MS in Soil Science from Washington State University in 2003 and a PhD in Soil Science from Washington State University in 2007.

Session Description:
An update will be given on the organic peach research project at Utah State University. This presentation will focus on differences in tree growth, yield and fruit quality among six different organic orchard floor management systems compared with a conventional control.

An Update of Organic Peach Research at Utah State University

Jennifer Reeve; Brent Black, Diane Alston, Corey Ransom, Mae Culumber, Andrew Tebeau, and Thor Lindstrom

UtahState UNIVERSITY

Challenges Facing Agriculture in Utah and the Intermountain West

- Short growing season
- Cold winters and hot summers
- Arid environment
- Shallow alkaline soils
- Prime fruit growing area
- Under pressure from rapid urbanization

Map used with permission www.utahwild.com

Orchard Treatments

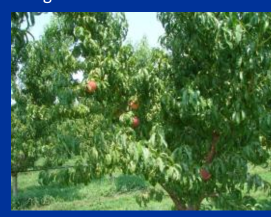
- Peach orchards planted 2008 and 2009

Organic orchard		Conventional orchard	
In-row	Alley	In-row	Fertility
Straw mulch	Grass	Bare-ground	NPK
Straw mulch	Legume	Bare-ground	Compost
Living mulch	Grass	Paper	NPK
Living mulch	Legume	Paper	Compost
Tillage	Grass		
Weed Fabric	Grass		

Overall Goals

1) Characterize the benefits and tradeoffs of orchard floor management in the context of a whole system

2) Develop organic production practices suited to fruit growing conditions of Intermountain West



Systems Interactions

Soil health

Fruit quality and flavor

Ground cover mgmt.

Tree growth and fertility

Economic return

Weeds and Arthropods

Water use efficiency

Orchard Management 2008-2010

- Varieties: Starfire and Coralstar on Lovell rootstock
- Spacing: 8 x 16ft
- Chicken and paunch manure compost: 0.6, 0.9 and 1.12 oz total N tree
- Trace elements: Albion Zinc (Zn), multi-mineral, manganese (Mn), iron (Fe), calcium (Ca), magnesium (Mg)
- Disintegrating sulfur applied in 2010 to soil 0.42lb / tree

Orchard Management: 2011-2014

- Compost applied to meet P needs only ~ 8lb per tree wet weight
- Feather meal applied differently per treatment
- Total N applied 0.3-0.5 lb N per tree.
- Legume biomass 0.25 lb N per tree

Organic Pesticide Applications

- Nordox 75WG, coryneum, spring and fall
- Stylet Oil, coryneum, spring and fall
- Dipel Pro, peach twig borer, 1-2 apps. per gen.
- M-Pede 1% solution, green peach aphids

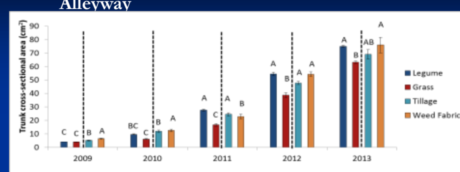
Orchard Irrigation

Suspended irrigation lines installed 2012

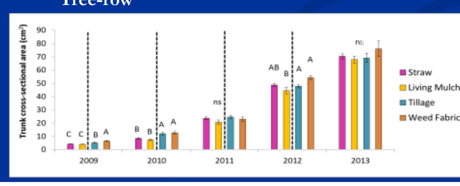
Micro-sprinklers
360°, 19.8 gph (12)
180°, 10.5 gph (6)

Organic Orchard: Tree growth

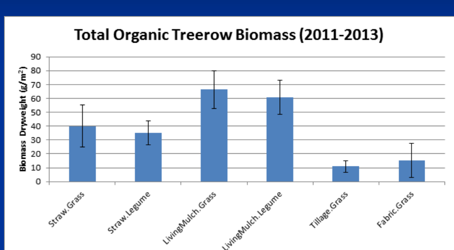
Alleyway



Tree-row

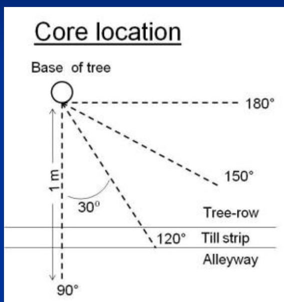


In Row Weed/Living Mulch Biomass



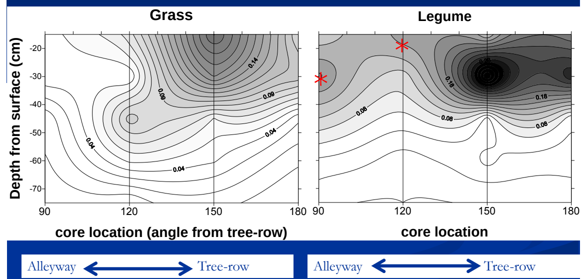
Organic Orchard 3rd leaf trees

Organic Orchard: Tree Root Distribution

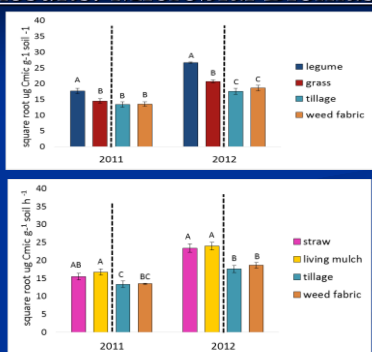


- 4 cores per plot
- 0-60 cm depth
- Roots sorted in 10 cm sections
  - -dry wt. cm3
  - -root length density

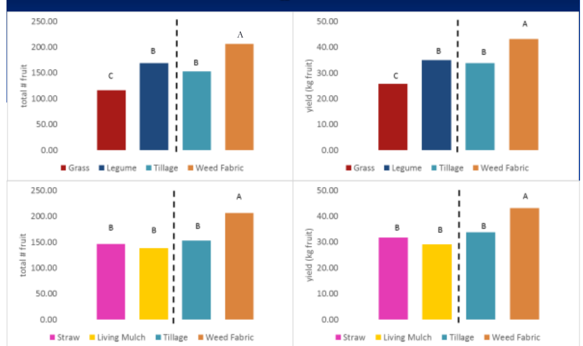
Organic Orchard: Tree Roots (g cm^3)



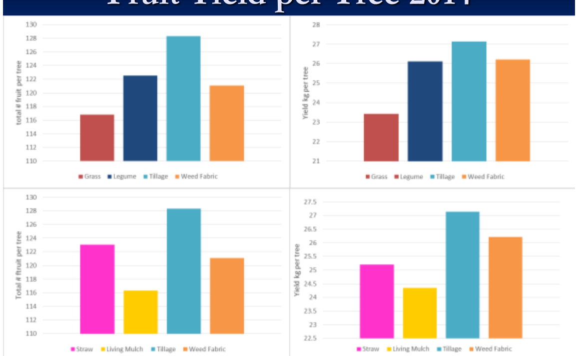
Results: Microbial Biomass



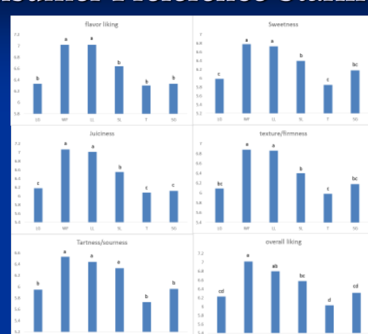
Fruit Yield per Tree 2013



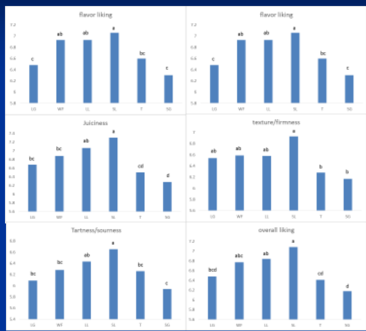
Fruit Yield per Tree 2014



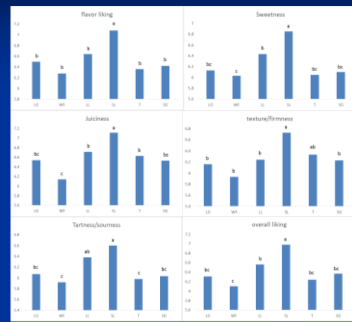
Consumer Preference Starfire 2013



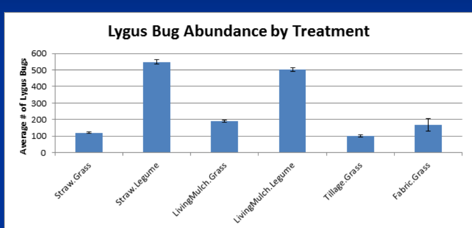
Consumer Preference Coralstar 2013



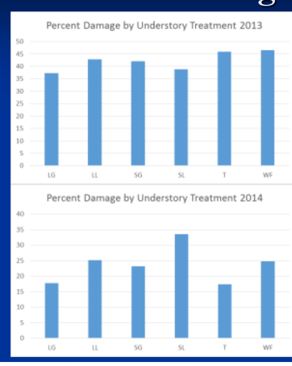
Consumer Preference Coralstar 2014



Lygus Bug Abundance



Total Fruit Damage



Conclusions

- Organic tree growth (tillage, weed fabric and legume alleyway) equivalent to conventional
- Legumes in alley way overcome weed competition and reduce management costs
- Soil health greatest with legumes
- Yield highest in legume and weed fabric plots in 2013 but lower than tillage in 2014
- Legumes may increase pest damage

Capitol Reef National Park

Biographical Information:
Wayne Hanks
Capitol Reef National Park

Wayne has been Orchard Manager at Capitol Reef Nation Park since 2006. Capitol Reef NP has 3000 fruit trees, mostly of heirloom varieties, and are maintained as a Historic Landscape. Orchars are opened under a U-Pick operation during fruit season.

Session Description:
Wayne will be giving a brief overview of an organic ground cover experimental test plot within a 2.5 acre orchard at Capitol Reef.
He will present a slide show of Capitol Reef orchards to share information of what we do and of issues and problems we face.

National Park Service
U.S. Department of the Interior

Capitol Reef National Park

Wayne Hanks, Orchard Manager

Urban and Small Farms Conference

West Jordan, Utah
February 19, 2015

Carrell Orchard

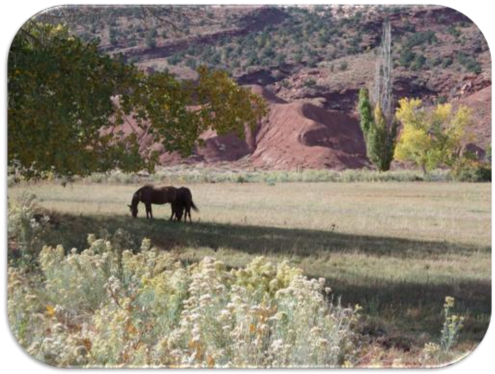
Carrell Orchard

Carrell Orchard

Carrell Orchard

Carrell Orchard

Carrell Orchard



Pendleton Field

Mulford Orchard

Mulford Orchard

Irrigation Works near Campground

Chesnut Orchard

Chesnut Orchard

Gifford Place

Gifford Place

Jorgenson Pasture

Johnson Orchard

Johnson Orchard

Johnson Orchard


Jackson Orchard


Jackson Orchard


Jackson Orchard


Guy Smith Orchard


Guy Smith Orchard

Guy Smith Orchard

Jackson Orchard

Kreuger Orchard

Kreuger Orchard

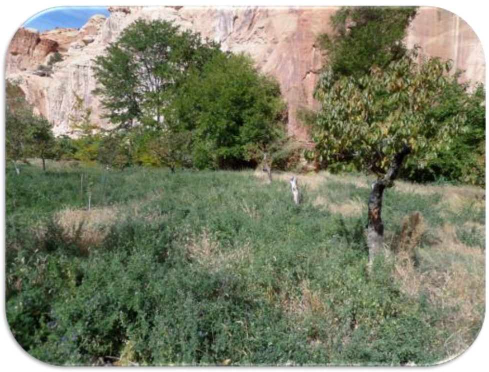
Kreuger Orchard

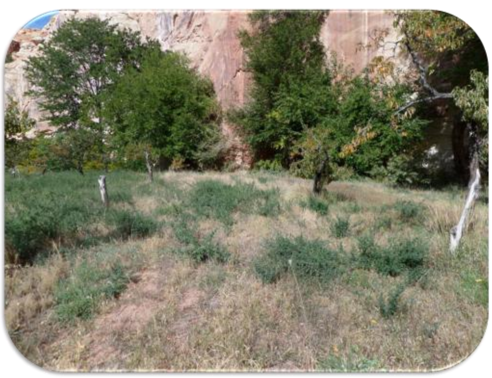
Kreuger Orchard


Kreuger Orchard


Kreuger Orchard


Kreuger Orchard


Kreuger Orchard


Kreuger Orchard


Kreuger Orchard

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Kreuger Orchard

Questions ?

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Grower Panel Organic Production

Biographical Information:
Marc Rowley
Tintic Farm

Marc grew up on his family farm. He went to school at Utah State University. and graduated with a masters degree in plant science. Marc currently manages the Tintic farm. They grow cherrys, apples, peaches, alfalfa, and pumpkins on 800 acres in Santaquin and Tintic.

Session Description:
This session will showcase Utah fruit growers that have been using organic production practices in their orchards. They will discuss their experiences and answer questions.

Organic Peach Economics

Biographical Information:
Trevor Knudsen
Utah State University

Trevor is a graduate student at pursuing an MBA from the Royal Agricultural University of Cirencester England and an M.S. degree in International Food and Agribusiness from Utah State University. The main area of his research has been on the economics and risks of various methods of peach production. He has worked on a variety of farming operations including a walnut farm, small-scale vegetable operations, dairies, range cattle, and with horses.

Session Description:
Trevor will present the results of a recent study looking at the economic feasibility and risk analysis of producing organic, eco-friendly, and conventional peaches in Northern Utah.

Economic Assessment of Organic, Eco-Friendly, and Conventional Peach Production Methods in Northern Utah

Trevor D. Knudsen

Contents

Background

- Utah Agriculture Acreage is Shrinking
  - Decreased by 750,000 acres from 2002-2012
- Number of Farms Increasing
  - Decreases in Farm Size
- Increased Urbanization/Competition for Resources
- Competing Against Cheaper Imports

Literature Review

- Farmers can gain a premium for alternate forms of production
- Organic
  - Sales grew from $1 billion in 1990 to over $26 billion in 2010 (Organic Trade Association, 2011)
  - Organic sales help small farms become profitable (Oberholtzer et al., 2005)
  - Consumers pay between 15%-100% more than conventional (Smith, 2010; Lin et al., 2008; Zhender et al., 2003)
  - Production can cost 10-40% more (Winter & Davis, 2006)
  - Yields can be up to 50% lower (de Ponti et al., 2012)

Literature Review

- Eco-Friendly (IPM)
  - Consumers pay between 5-54% more than conventional (Bazoche et al., 2013; Combris et al., 2011; Loureiro et al., 2002)
  - Some consumers will pay the same or higher for "natural" products than organic (Onken, 2010)
  - Eco-Friendly or IPM labelling may be ambiguous to consumers (Biguzzi et al., 2014; Moser & Raffaelli, 2012; Loureiro et al., 2002)

WTP Study

- Utahns WTP for eco-friendly and organic peaches
  - Consumers paid 14% more for eco-friendly peaches ($5.12/lb)
  - Consumers paid 21% more for organic peaches ($5.42/lb)
  - Knowing origin of food and supporting local farmers were important to consumers
    - 20-80% more for locally grown produce (Curtis et al., 2014)
- Production Costs and Returns
  - Literature varies on which form of production is most profitable (Baldock et al., 2014; Pimental et al., 2005; Bolda et al., 2004, 2006)

Research Goal

- What is the risk-return profile of each method of production (organic, eco-friendly, and conventional)?
  - Cost of production for each production method
  - Potential revenues for each production method
  - What is the risk of each production method

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Costs and Returns

- Production Assumptions
  - Input prices from local producers and dealers

	Weeds	Pests	Fertility
Organic	Mulch, Tillage	USDA Cert Pesticides	Compost, Feathermill, MultiMineral
Eco-Friendly*	Mulch, Herbicide	USDA Cert Pesticides	Compost, Conventional Fertilizer, MultiMineral
Conventional	Herbicide	Conventional Chemical Pesticides	Conventional Fertilizer, MultiMineral

*Eco-Friendly (or IPM) may not require scheduled sprayings/ control. Budgets assume similar spraying schedule as organic or conventional

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Costs and Returns

- Price Assumptions
  - Prices received for peaches from farmers' markets (CO & UT) and wholesale market observations (UT)

Market	Price per Pound-Organic	Price per Pound-Eco-Friendly	Price per Pound-Conventional
Wholesale (20%)	$2.08	$1.22[a]	$1.06
Direct Markets (80%)	$3.87	$2.61	$2.23

[a] Eco-friendly prices were not available in wholesale market, and were calculated based on average percentage increase over conventional prices observed at farmers' markets

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Costs and Returns

Yield Assumptions

Year	Organic	Eco-Friendly	Convetional
Year 1-3	-	-	-
Year 4	4,290	4,565	5,500
Year 5	10,725	11,412	13,750
Year 6	15,015	15,977	19,250
Year 7	7,507	7,988	9,625
Year 8	15,015	15,977	19,250
Year 9	15,015	15,977	19,250
Year 10	7,507	7,988	9,625
Year 11	15,015	15,977	19,250
Year 12	15,015	15,977	19,250
Year 13	7,507	7,988	9,625
Year 14	15,015	15,977	19,250
Year 15	15,015	15,977	19,250
Year 16	7,507	7,988	9,625
Year 17	15,015	15,977	19,250
Year 18	12,870	13,695	16,500
Year 19	4,290	4,565	5,500
Year 20	8,580	9,130	11,000

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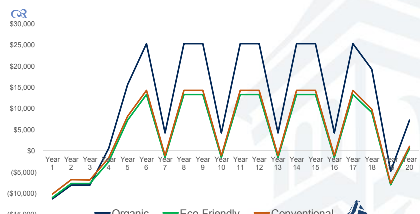
Costs and Returns

- Net Returns (Per Acre)



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Costs and Returns

Year	Cumulative Net Returns per Acre: Organic	Eco-Friendly	Conventional
Year 1	($11,380)	($11,083)	($10,264)
Year 2	($19,497)	($18,827)	($17,139)
Year 3	($27,665)	($26,624)	($24,067)
Year 4	($27,147)	($29,253)	($25,772)
Year 5	($11,557)	($22,088)	($17,648)
Year 6	**$13,691**	($8,871)	($3,475)
Year 7	$17,845	($10,560)	($4,671)
Year 8	$43,094	**$2,657**	**$9,502**
Year 9	$68,342	$15,873	$23,675
Year 10	$72,497	$14,185	$22,478
Year 11	$97,745	$27,401	$36,651
Year 12	$122,994	$40,617	$50,824
Year 13	$127,148	$38,929	$49,628
Year 14	$152,396	$52,146	$63,801
Year 15	$177,645	$65,362	$77,974
Year 16	$181,799	$63,674	$76,777
Year 17	$207,047	$76,890	$90,950
Year 18	$226,269	$85,849	$100,732
Year 19	$221,385	$77,775	$92,949
Year 20	**$228,553**	**$78,218**	**$93,948**
NPV (5%)	**$122,689**	**$37,290**	**$47,204**

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Costs and Returns

Organic DM prices $2.70 (21% above conventional)

	Cumulative Net Returns per Acre		
Year	Organic	Eco-Friendly	Conventional
Year 1	($11,380)	($11,083)	($10,264)
Year 2	($19,497)	($18,827)	($17,139)
Year 3	($27,665)	($26,624)	($24,067)
Year 4	($30,359)	($29,253)	($25,772)
Year 5	($22,800)	($22,088)	($17,648)
Year 6	($8,795)	($8,871)	($3,475)
Year 7	($10,262)	($10,560)	($4,671)
Year 8	**$3,743**	**$2,657**	**$9,502**
Year 9	$17,748	$15,873	$23,675
Year 10	$16,281	$14,185	$22,478
Year 11	$30,286	$27,401	$36,651
Year 12	$44,292	$40,617	$50,824
Year 13	$42,824	$38,929	$49,628
Year 14	$56,830	$52,146	$63,801
Year 15	$70,835	$65,362	$77,974
Year 16	$69,368	$63,674	$76,777
Year 17	$83,373	$76,890	$90,950
Year 18	$92,958	$85,849	$100,732
Year 19	$84,861	$77,775	$92,949
Year 20	**$85,605**	**$78,218**	**$93,948**
NPV (5%)	**$40,439**	**$37,290**	**$47,204**

Risk Assessment

- Simulation allows for more than "good, average, or poor" (point estimates)
  - Simulation allows more complete assessment of associated risks of a decision
    - Gives better estimate (probability) of likely outcomes than simple costs and returns study
    - Better reflection of volatility in market, production
  - Estimates distribution of economic returns for methods of production

Risk Assessment

Stochastic Variables Assigned

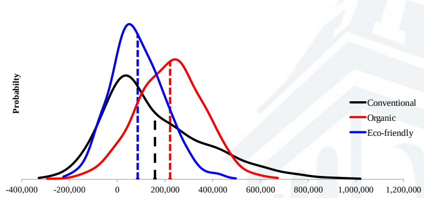
- Price
  - GRKS Distribution for Prices
    - Min, Max, Mean (Locally observed prices)
- Yield
  - Normally Distributed Yields
    - 5.76% StDev (USDA, 2014)
- Pack-out Rate
  - Normally Distributed Pack-Out Rate
    - 80% Mean, 5% StDev (Grower Surveys)

Risk Assessment

- Stochastic simulation run 1000 times
  - Cumulative net returns per acre

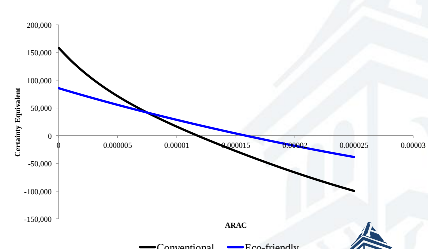
	Organic	Eco-Friendly	Conventional
Min	-$294,214	**-$224,985**	-$329,108
Mean	**$221,560**	$85,719	$158,224
Max	$672,679	$496,166	**$1,018,937**
Std Dev	$141,102	**$113,281**	$216,653
CV	**64**	132	137

Risk Assessment

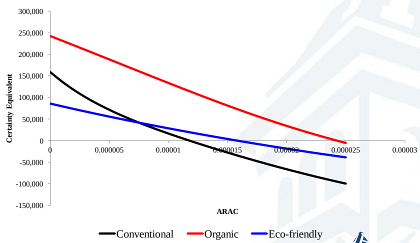


Risk Assessment

SERF Chart



Risk Assessment



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Risk Assessment

- Sensitivity Analysis
  - Increasing yield variation of organic did not change results
  - Unless wholesale and direct market prices were \$1.85/lb and \$3.43/lb, respectively, producers would opt for organic peach production
  - High organic prices provide greater average returns, least risk
- Wide range of conventional prices, increases risk to producer

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Limitations

- Based on Utah production
  - Results may benefit only those in Intermountain West
- Utah can only support 44 organic orchards, 41 eco-friendly orchards, or 34 conventional orchards
  - Quantity sold at given prices may not be feasible
  - About 10% of produce purchased is organic, meaning Utah could only support 4-5 organic orchards

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Conclusions

- Organic peach production may pose least risk to producers, with the highest average returns
  - May be optimal option for producers in Utah looking to increase profitability of operation
- Decreased risk may be attained through eco-friendly (IPM) production, though consumer education may be needed
- Future investigation may look into quantity that could be sold at farmers' markets/direct markets
- May consider stochastic costs
- Future investigation into extrinsic benefits of various forms of production

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Questions?

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Appendix A
Conventional Budget Costs & Returns

Year	Total Cost per Acre	Total Revenue Per Acre	Returns per Acre	Cumulative Net Returns per Acre
Year 1	\$10,264	\$0	(\$10,264)	(\$10,264)
Year 2	\$6,875	\$0	(\$6,875)	(\$17,139)
Year 3	\$6,928	\$0	(\$6,928)	(\$24,067)
Year 4	\$10,487	\$8,782	(\$1,705)	(\$25,772)
Year 5	\$13,832	\$21,956	\$8,124	(\$17,648)
Year 6	\$16,566	\$30,738	\$14,173	(\$3,475)
Year 7	\$16,566	\$15,369	(\$1,196)	(\$4,671)
Year 8	\$16,566	\$30,738	\$14,173	\$9,502
Year 9	\$16,566	\$30,738	\$14,173	\$23,675
Year 10	\$16,566	\$15,369	(\$1,196)	\$22,478
Year 11	\$16,566	\$30,738	\$14,173	\$36,651
Year 12	\$16,566	\$30,738	\$14,173	\$50,824
Year 13	\$16,566	\$15,369	(\$1,196)	\$49,628
Year 14	\$16,566	\$30,738	\$14,173	\$63,801
Year 15	\$16,566	\$30,738	\$14,173	\$77,974
Year 16	\$16,566	\$15,369	(\$1,196)	\$76,777
Year 17	\$16,566	\$30,738	\$14,173	\$90,950
Year 18	\$16,566	\$26,347	\$9,782	\$100,732
Year 19	\$16,566	\$8,782	(\$7,783)	\$92,949
Year 20	\$16,566	\$17,565	\$999	\$93,948

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Appendix B
Eco-Friendly Budget Costs & Returns

Year	Total Cost per Acre	Total Revenue Per Acre	Returns per Acre	Cumulative Net Returns per Acre
Year 1	$11,083	$0	($11,083)	($11,083)
Year 2	$7,744	$0	($7,744)	($18,827)
Year 3	$7,796	$0	($7,796)	($26,624)
Year 4	$11,146	$8,516	($2,630)	($29,253)
Year 5	$14,125	$21,290	$7,166	($22,088)
Year 6	$16,590	$29,807	$13,216	($8,871)
Year 7	$16,590	$14,902	($1,688)	($10,560)
Year 8	$16,590	$29,807	$13,216	$2,657
Year 9	$16,590	$29,807	$13,216	$15,873
Year 10	$16,590	$14,902	($1,688)	$14,185
Year 11	$16,590	$29,807	$13,216	$27,401
Year 12	$16,590	$29,807	$13,216	$40,617
Year 13	$16,590	$14,902	($1,688)	$38,929
Year 14	$16,590	$29,807	$13,216	$52,146
Year 15	$16,590	$29,807	$13,216	$65,362
Year 16	$16,590	$14,902	($1,688)	$63,674
Year 17	$16,590	$29,807	$13,216	$76,890
Year 18	$16,590	$25,549	$8,959	$85,849
Year 19	$16,590	$8,516	($8,074)	$77,775
Year 20	$16,590	$17,033	$442	$78,218

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Appendix C
Organic Budget Costs & Returns

Year	Total Cost per Acre	Total Revenue Per Acre	Returns per Acre	Cumulative Net Returns per Acre
Year 1	$11,380	$0	($11,380)	($11,380)
Year 2	$8,116	$0	($8,116)	($19,497)
Year 3	$8,168	$0	($8,168)	($27,665)
Year 4	$11,535	$12,053	$518	($27,147)
Year 5	$14,543	$30,133	$15,589	($11,557)
Year 6	$16,938	$42,186	$25,249	$13,691
Year 7	$16,938	$21,092	$4,154	$17,845
Year 8	$16,938	$42,186	$25,249	$43,094
Year 9	$16,938	$42,186	$25,249	$68,342
Year 10	$16,938	$21,092	$4,154	$72,497
Year 11	$16,938	$42,186	$25,249	$97,745
Year 12	$16,938	$42,186	$25,249	$122,994
Year 13	$16,938	$21,092	$4,154	$127,148
Year 14	$16,938	$42,186	$25,249	$152,396
Year 15	$16,938	$42,186	$25,249	$177,645
Year 16	$16,938	$21,092	$4,154	$181,799
Year 17	$16,938	$42,186	$25,249	$207,047
Year 18	$16,938	$36,160	$19,222	$226,269
Year 19	$16,938	$12,053	($4,884)	$221,385
Year 20	$16,938	$24,106	$7,169	$228,553

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Online and Print Resources for Successfully Implementing IPM

Biographical Information:
Marion Murray
Utah State University

Marion has been the IPM Project Leader at Utah State University Cooperative Extension, Logan, since 2006. She conducts Extension outreach and research in integrated pest management in fruits and vegetables. She distributes periodic pest advisories for tree fruits, landscape ornamentals, and vegetables. Prior to coming to USU, she spent 10 years in public horticulture education and landscape management. She received her Master's degree in plant pathology from Oregon State University and is originally from North Carolina.

Session Description:
There are many resources available to help organic agricultural operations grow healthy crops. Learn which USU-recommended websites, apps, and books provide the most helpful information.

Soil Testing

Biographical Information:
Esther Thomsen
Utah State University

Esther Thomsen is a master's student in Soil Science with an emphasis on Sustainable Agriculture at Utah State University. She is currently researching simple soil quality tests, which can be conducted on site. The ultimate goal of this research is to provide an easier tool for farmers to evaluate the long-term health and quality trends of their soils. After receiving her Bachelors in Environmental Policy and Law, and obtaining her permaculture design certificate, she worked in environmental consultancies and also volunteered on farms in India, New York and Utah. Her work in India is what drove her to return to school. She found that many farmers were abandoning farms due to land degradation; she wanted to learn the ways farmers could avoid this situation.

Session Description:
The importance of soil quality and testing strategies will be presented. The emphasis of the testing strategies will be on methods that can be done on site, what the goals are when testing and what could be some of the influencing components in these tests.

Simple On-Site Soil Quality Testing

Esther Thomsen

Overview

- Soil quality
- Importance of soil quality
- Measuring soil quality
- Options for measuring soil quality
- Conclusion

What is soil quality?

Properties affected by management

- Capacity to:
  - Filter and buffer
  - Maintain or improve air and water quality
  - Support plant and animal health, productivity and biodiversity

Friedman, D., Hubbs, M., Tugel, A., Seybold, C., and Sucik, M. (2001). Guidelines for Soil Quality Assessment in Conservation Planning. NRCS. USDA. Web. Jan. 2014.

Measuring Soil Quality

- Defining a minimum data set
- Physical – texture, structure, infiltration, aeration
- Chemical- nutrients, pH, salinity
- Biological- macro and microflora

How does this affect farmers?

Moderate to severe erosion on ~80% worlds farmland (Pimental 2006)

6% of agricultural land requires major capitol investment to restore its original productivity (Doran et. al, 1996).

Enhancing soil quality can increase yield by 3-12%.
reduce costs from inputs (fossil fuel use, herbicide and manure application) by 41-79% (Liebman et al., 2003

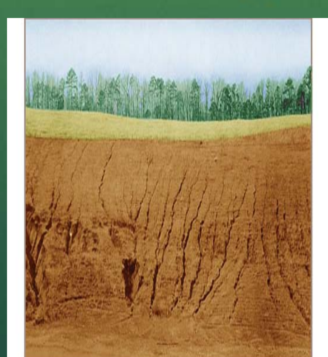

Photo credit: Paul Preuss UC Berkeley

Options to test soil…

Soil Test Kit

Soil Health Card

Structural quality	Sq1, very good structure, friable	Sq2, good structure	Sq3, adequate structure	Sq4 compact structure	Sq5, poor structure
Distinguishing feature	Fine aggregates	High aggregate porosity	Low aggregate porosity	Distinct macropores	Grey-blue colour
Broken-up soil					

(Ball, B., 2009)

Indicator Table

Indicator	Poor	Medium	Good
Earthworms	0-1 worms in shovelful of top foot of soil. No casts or holes.	2-10 in shovelful. Few casts, holes, or worms.	10+ in top foot of soil. Lots of casts and holes in tilled clods. Birds behind tillage.
Organic Matter Color	Topsoil color similar to subsoil color.	Surface color closer to subsoil color.	Topsoil clearly defined, darker than subsoil.
Organic Matter Roots/Residue	No visible residue or roots	Some residue few roots	Noticeable roots and residue
Subsurface Compaction	Wire breaks or bends when inserting flag.	Have to push hard, need fist to push flag in.	Flag goes in easily with fingers to twice the depth of plow layer.
Soil Tilth Mellowness Friability	Looks dead. Like brick or concrete, cloddy. Either blows apart or hard to pull drill through.	Somewhat cloddy, balls up, rough pulling seedbed.	Soil crumbles well, can slice through, like cutting butter. Spongy when you walk on it.
Erosion	Large gullies over 2 inches deep joined to others, thin or no topsoil, rapid run-off the color of soil.	Few rills or gullies, gullies up to two inches deep. Some swift runoff, colored water.	No gullies or rills, clear or no runoff.
Water Holding Capacity	Plant stress two days after a good rain.	Water runs out after a week or so.	Holds water for a long period of time without puddling.
Drainage, Infiltration	Water lays for a long time, evaporates more than drains, always very wet ground.	Water lays for short period of time, eventually drains.	No ponding, no runoff, water moves through soil steadily. Soil not too wet, not too dry.
Crop Condition (How well it grows)	Problem growing throughout season, poor growth, yellow or purple color.	Fair growth, spots in field different, medium green color.	Normal healthy dark green color, excellent growth all season, across field.
pH	Hard to correct for desired crop.	Easily correctable.	Proper pH for crop.
Nutrient Holding Capacity	Soil tests dropping with more fertilizer applied than crops used.	Little change or slow down trend.	Soil tests trending up in relation to fertilizer applied and crop harvested.

Laboratory Analysis

Biological

Arthropod diversity
Litter bag tests,
Solvita

Slaking test/
Aggregate stability

Tests

Photo Credit: University of Nebraska Extension

Rapid test kits,
Lamotte test kits

Physical

Chemical

DYI Slaking Test


2
2.5
3
3.5
4
5
LOW LEVEL CO2
for soil and grain
Fluorescent Light
High CO2
Woods End Laboratories, Inc
VITA

Soil texture

- Clay and silt sized particles protects soil organic matter from decomposition
  - Fine textured soil will typically contain more carbon than coarse textured soil.
- Fine textured soils tend to be more fertile
  - likely influenced by increased water storing abilities.
- Increase of clay generally means an increase in soil microbial biomass. (Franzluebbers et al., 1996)

Goal is to enable farmers/ landowners to easily

- Compare management practices against each other
- Determine long term trends

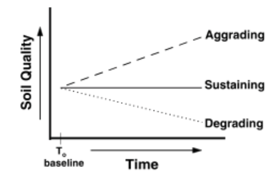

Fig. 1. Conceptual changes in temporal soil quality indicating degradation, maintenance, or improvement (adapted from Seybold *et al.* 1998).

Wienhold, B. J., S. S. Andrews, and D. L. Karlen. (2004) Soil Quality: A Review of the Science and Experiences in the USA. Environmental Geochemistry and Health 26, no. 2: 89–95. doi:10.1023/B:EGAH.0000039571.59640.3c.

Conclusion

- Maintaining soil quality promotes long term soil and plant productivity
- Accurate assessment of soil quality needs to include chemical, physical and biological properties.
- Testing soil quality can be done in a lab, with soil test kits either purchased or made.
- Ultimate goal in using tests is to compare management practices and determine long term soil quality trends

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Questions?

USDA Rural Development

Biographical Information:
Perry Mathews
Business and Cooperative Program (B&CP) Director
USDA, Rural Development

Perry was born in Miami, Oklahoma (home town), and is an enrolled member of the Quapaw Tribe, and the Seneca-Cayuga Tribe of Oklahoma. Graduated from Oklahoma State University, married (Lori) with three beautiful girls (Acacia, Charity, Danielle), and two grandchildren (Rocky, Sadie).

Perry has served as the USDA – Rural Development (RD) B&CP Director, since May 2008; and the American Indian Coordinator, since joining the Agency in May 2004. Prior to joining USDA, Perry spent more than 3 years in the foundation & non-profit sector (Daniels Fund & Enterprise Foundation), 11 years in Indian Affairs for two State governments (Utah & Wyoming), and 9 years in the corporate industry (BP Amoco) & private sector (M&M concessions).

Rural Development accomplishes its mission of assisting rural areas create prosperity by delivering Federal loans, grants, and loan guarantees to rural communities. More than 40 programs from across the mission area are implemented at the local and national level through the Rural Business Service, Rural Housing Service, and Rural Utilities Service. These programs assist businesses grow and innovate, support community infrastructure and emergency services, help finance homeownership, provide rental housing assistance, encourage renewable energy production, improve water and wastewater systems, expand rural utilities, and much more.

Session Description:
Overview and funding opportunities regarding USDA, Rural Development’s Rural Energy for America Program (REAP), Value-Added Producer Grant (VAPG), and Business and Industry (B&I) guaranteed loan programs.

Rural Energy for America Program

REAP

Renewable Energy Systems & Energy Efficiency Improvements Program

USDA United States Department of Agriculture | Rural Business-Cooperative Service Energy Programs

Eligible Applicants

Agricultural Producer	Rural Small Business
• **Individual or entity that receives 51 percent or more of their gross income from agricultural production** – crops, livestock, aquaculture, forestry operations, nurseries, dairies	• **For-profit small business** - as defined by the Small Business Administration (SBA) • **Rural area or non-metro community of ≤ 50,000**

USDA United States Department of Agriculture | Rural Business-Cooperative Service Energy Programs

Improve Profits for Your Rural Small Business, Farm or Ranch with REAP

Energy Efficiency	Renewable Energy
Lighting	Solar
Heating	Wind
Cooling	Small Hydroelectric
Ventilation	Anaerobic Digesters
Fans	Biomass
Automated Controls	Geothermal
Insulation	Wave/Ocean Power

The technology must be commercially available. Research and development projects do not qualify.

USDA United States Department of Agriculture | Rural Business-Cooperative Service Energy Programs

✔ Eligible Project Costs	Ineligible Project Costs

• **Equipment**:
  • Purchase & installation
  • New or refurbished
• **Post-application construction & facility improvements**
• **Retrofitting**
• **Professional service fees**
• **Permits & license fees**
• **Working capital, land acquisition (Guarantee loan ONLY with restrictions)**
	• **Residential energy projects**
	• **Equipment:**
	  • Farm tillage equipment
	  • Used equipment
	  • Vehicles
	• **Pre-application construction & facility improvements**
	• **Application preparation or grant writer fees**
	• **Line of credit**
	• **Lease payments**
	• **Payment to the applicant/business owner, beneficiary, or relative**

USDA United States Department of Agriculture | Rural Business-Cooperative Service Energy Programs

REAP Grant Assistance

Up to 25%

of Eligible Project Costs

Renewable Energy Systems		Energy Efficiency Improvements	
Minimum Grant Request	**$2,500** Total eligible project costs ≥ $10,000	Minimum Grant Request	**$1,500** Total eligible project costs ≥ $6,000
Maximum Grant Request	**$500,000** Total eligible project costs ≥ $2 million	Maximum Grant Request	**$250,000** Total eligible project costs ≥ $1 million

USDA United States Department of Agriculture | Rural Business-Cooperative Service Energy Programs

REAP Guaranteed Loan Assistance

Up to 75%

of Eligible Project Costs

Minimum Loan Amount	**$5,000** Total eligible project costs ≥ $6,667
Maximum Loan Amount	**$25 million** Total eligible project costs ≥ $33.4 million
Details	• USDA guarantees a commercial loan; applicant must have a willing lender. • Terms are negotiated between the lender and borrower. • Fees, appraisals, equity & collateral requirements apply.

REAP Application Window Closing Deadlines

April 30, 2015	➢ Set Aside Fund Competition-Grant Request $20,000 or less ➢ Grant Request > $20,000 ➢ Combination Grant/Loan Request
June 30, 2015	➢ Grant Request $20,000 or less not competing for set aside ➢ Grant Request > $20,000 ➢ Combination Grant/Loan Request
Continuous Application Cycle	➢ Guaranteed Loans *Loan must score a minimum of 50 to compete monthly *First monthly competition held once 8 applications on file

USDA United States Department of Agriculture
Rural Business-Cooperative Service Energy Programs

Energy Efficiency

Chicken Farm

Radiant heat, fans, vents & computerized controls

- $99,293 Total Cost
- $20,000 REAP Grant
- $79,293 Commercial Loan

Improved egg production, reduced time and labor, energy savings

USDA United States Department of Agriculture
Rural Business-Cooperative Service Energy Programs

Renewable Energy

Veterinary Hospital

Rooftop solar panels

- $148,050 Total Cost
- $ 20,000 REAP Grant
- $128,050 Applicant Funds

30-40% reduction in operating expenses

USDA United States Department of Agriculture
Rural Business-Cooperative Service Energy Programs

Energy Efficiency

Rural Manufacturer	Grocery Store
Efficient lighting system	Energy efficient cooler doors
• $78,511 Total Cost	• $41,363 Total Cost
• $19,695 REAP Grant	• $8,827 REAP Grant
• $58,816 Applicant Funds	• $2,950 Electric Co-op Rebate
50% savings on lighting bill	$500 per month savings

USDA United States Department of Agriculture
Rural Business-Cooperative Service Energy Programs

Renewable Energy

Grocery Store

Geothermal heat, energy efficient coolers & lighting

- $198,600 Total Cost
- $49,650 REAP Grant
- $148,950 Commercial Loan

40% reduction in energy costs

USDA United States Department of Agriculture
Rural Business-Cooperative Service Energy Programs

Additional Funding & Technical Assistance

- State Agencies & Programs
- Incentives From Local Utilities
- Commercial Lenders

Rural Energy for America Program (REAP)

www.rd.usda.gov/reap

Rural Business-Cooperative Service
Energy Programs

Rural Development Value-Added Producer Grant (VAPG) Program

www.rd.usda.gov

Rural Development VAPG Program

Purposes: The Value-Added Producer Grant (VAPG) Program is intended to provide grant funds to agricultural producers for planning activities and working capital expenses to assist them in receiving a greater share of the consumer's dollar for value-added agricultural products. The maximum grant in FY14 was $75,000 for planning activities and $200,000 for working capital for salaries, utilities, inventory, packaging, labels, and marketing expenses.

- Manure, a by-product of a dairy farm, is an eligible agricultural commodity for value-added purposes. It can be turned into methane and electricity that can be sold to the grid off-farm or used to process the producer's milk into a value added product(s).

VAPG is a nationally competitive program (no State allocations).
The demand for program funds annually exceeds the amount available.

Rural Development VAPG Program

VAPG Applicant Eligibility
- Independent Producer
- Farmer or Rancher Cooperative
- Agricultural Producer Group
- Majority-Controlled Producer-Based Business Venture

VAPG Product Eligibility
- Change in physical state (e.g. lamb chops, diced tomatoes)
- Differentiated production (e.g. organic) - must reference a venture-specific feasibility study and business plan
- Product segregation (e.g. identity-preserved corn)
- Farm-based renewable energy
- Locally-produced agricultural food product **AND**,
- Customer base must be expanded
- Greater portion of the revenue must be available to the producer

Rural Development VAPG Program

VAPG Purpose Eligibility:
- *Planning Grants* - to facilitate the development of a defined program of economic activities to determine the viability of a potential Value-Added venture including feasibility studies, marketing strategies, business plans and legal evaluations.
- *Working Capital Grants* - to provide funds to operate ventures and pay the normal expenses of the venture that are eligible uses of grant funds including: salaries, utilities, inventory, packaging, labels, and marketing expenses.

Matching funds eligibility:
- must equal or exceed the amount of the grant funds requested
- must be spent at a rate equal to or greater than grant funds
- must be provided by the applicant or a third-party in the form of cash or in-kind funds
- must be spent on eligible purposes and must be from eligible sources

Grant period can be up to 36 months. Limited to one application per cycle.
One planning and one working capital grant per project.

Rural Development Business and Industry (B&I) Guaranteed Loan Program

www.rd.usda.gov

USDA United States Department of Agriculture

Rural Business-Cooperative Service
Energy Programs

Rural Development
B&I Guaranteed Loan Program

Purposes

- Improve, develop, or finance business, industry, and employment and improve the economic and environmental climate in rural communities;
- Bolstering the existing private credit structure through the guarantee of quality loans which will provide lasting community benefits;
- Not intended for marginal or substandard or for relief of lenders having such loans.

RD Instruction 4279.108

USDA United States Department of Agriculture

Rural Business-Cooperative Service
Energy Programs

Rural Development
B&I Guaranteed Loan Program

Eligible Entities (borrowers)

- Cooperative organizations, Corporation, Partnership
- Legal entity organized & operated on a profit or nonprofit basis
- Indian tribe or a Federal or State reservation or other Federally recognized tribal group
- Public body
- An individual

- *RD Instruction 4279.108*

USDA United States Department of Agriculture

Rural Business-Cooperative Service
Energy Programs

Rural Development
B&I Guaranteed Loan Program

Ineligible Entities (Borrowers)

- Charitable institutions
- Churches, or church-controlled organizations
- Fraternal organizations
- Lending and investment institutions
- Insurance companies

- *RD Instruction 4279.114*

USDA United States Department of Agriculture

Rural Business-Cooperative Service
Energy Programs

Rural Development
B&I Guaranteed Loan Program

Eligible Purposes

- Real estate purchase and improvements
- Machinery and equipment
- Working capital
- Integrated agriculture production/processing facilities
- Debt refinancing
- Business acquisitions – under certain conditions

- *Complete list located in RD Instruction 4279.113*

USDA United States Department of Agriculture

Rural Business-Cooperative Service
Energy Programs

Rural Development
B&I Guaranteed Loan Program

Ineligible Purposes

- Lines of credit
- Lease payments
- Guaranteed loans made by other Federal agencies
- Distribution or payment to an owner, beneficiary, or close relative of the owner, when owner will remain an owner
- Federal tax-exempt obligations
- Loans with direct or indirect conflicts of interest
- Businesses engaged in illegal activity
- Golf courses & gaming activities

- *Complete list located in RD Instruction 4279.114*

USDA United States Department of Agriculture

Rural Business-Cooperative Service
Energy Programs

Rural Development
B&I Guaranteed Loan Program

Project Location

Rural Area – not within the boundaries of a city or town with more than 50,000 Inhabitants or the urbanized area of the city and town.

http://eligibility.sc.egov.usda.gov/eligibility/welcomeAction.do

USDA United States Department of Agriculture

Rural Business-Cooperative Service
Energy Programs

Thank you!

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USDA Natural Resource Conservation Service

Biographical Information:
David Hanson
NRCS

David is a native of the mid west. He graduated from the University of Wisconsin – Stevens Point in 1983 with a Bachelor's Degree in Resource Management. He moved to Utah for a year to work for the US Forest Service. He married a local lady also working for the Forest Service. Later, Dave and his wife moved to Texas A&M University and Dave received his Master's Degree in Range Science.

David was a commissioned officer in the Army National Guard for a few years and earned the rank of Captain while "playing" with the Field Artillery.

David has worked for the NRCS for 28 years in Ohio, Minnesota and currently in Utah. He and his family moved to the Provo area in early 2002. He is currently the District Conservationist or office manager. He and his staff are responsible for the NRCS programs in Utah, Wasatch, Tooele and Salt Lake Counties.

Session Description:
USDA Natural Resource Conservation Service information.

Urban and Small Farms Conference

February 19, 2015

USDA Farm Bill Programs

David Hanson
District Conservationist – Provo Field Office

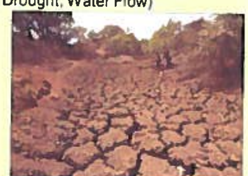
NRCS Background and Purpose

Sustainable & Productive Soils

Quality (Erosion, Nutrients, Contaminants)

Clean & Abundant Water

Quality (Nutrients, Pathogens, Petroleums, Salinity)
Quantity (Irrigation, Drought, Water Flow)

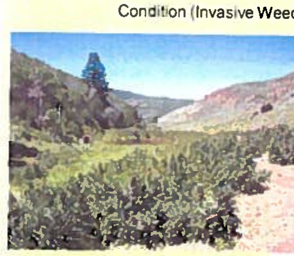


Air

Quality (Odor, Particulate Matter, Reduced Visibility)

Plants

Condition (Invasive Weeds, Wildfire, T&E Species)

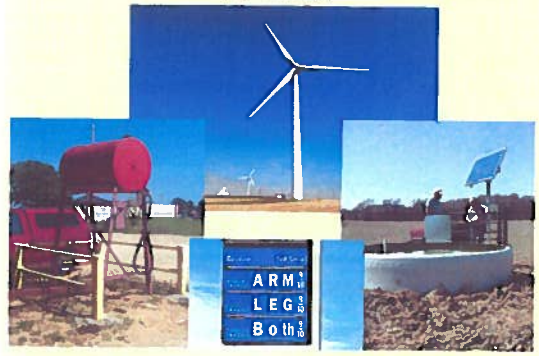


Animals

Wildlife (Habitat, Food, Cover, Shelter)
Domestic (Water, Forage Quality, Grazing, Manure Management)

Adequate Energy Supply

Fuel, Alternative, Power



Human

Economics, Sustainability, Cultural Resources, Traditions

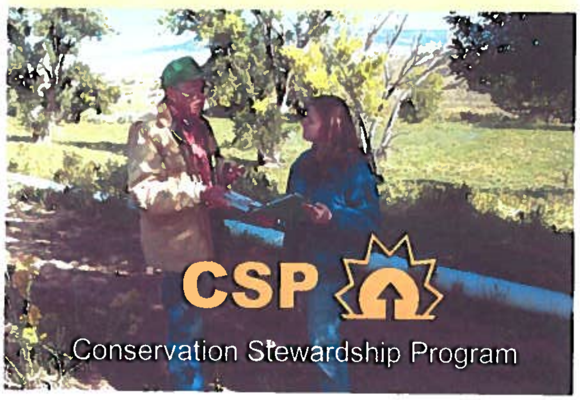
NRCS Programs

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)
- Agricultural Management Assistance Program (AMA)
- Conservation Stewardship Program (CSP)
- Agricultural Conservation Easement Program (ACEP)
- Conservation Innovation Grant (CIG)

EQIP Details

- Must be considered an agricultural producer
- Payment Schedule not cost share
- Batching periods: try to sign up before October
- Contracts typical length of 2 to 5 years
- Do not start any practice until you have signed a contract



Conservation Stewardship Program (CStP)

- Designed to assist those who have kept good records of the annual management of their operation.
- Designed for those who are good stewards of the land.
- Would like to continue to improve their operation with the installation of additional conservation practices or management changes.
- This is an annual payment not a cost-share payment.

Conservation Innovation Grant

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

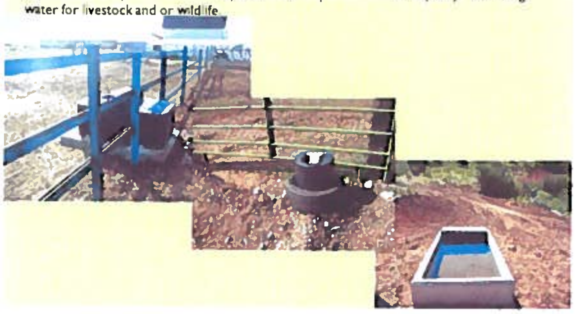
DEFINITION:
A seasonal polyethylene covered structure with no electrical, heating, and/or mechanical ventilation systems that is used to cover crops to extend the growing season in an environmentally safe manner.

High Tunnels

- Must be a commercial product, not home made.
- Requires a 4 year warranty.
- Present land use must be cropland.
- Must be 6 feet high minimum with 6 mil plastic.
- Maximum payment on 2178 Sq.Ft. per year.
- Plants must be planted in the ground not in pots.
- May automate and irrigate but no cost share provided.

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.



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

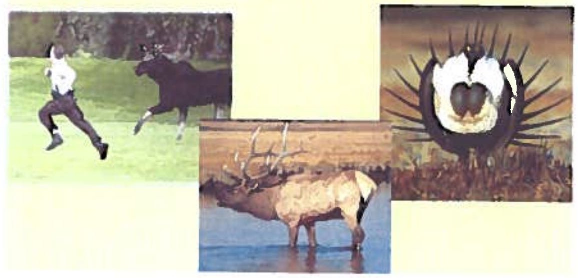
DEFINITION:
Utilizing environmentally sensitive prevention, avoidance, monitoring and suppression strategies, to manage weeds, insects, diseases, animals and other organisms (including invasive and noninvasive species), that directly or indirectly cause damage or annoyance.

Prescribed Grazing
Code 528

DEFINITION:
Managing the harvest of vegetation with grazing and/or browsing animals.

Upland Wildlife Habitat Management
Code 645

DEFINITION:
Provide and manage upland habitats and connectivity within the landscape for wildlife.



EQIP Funding Category: Organics

- Assist with conversion to organics
- Assist with state organic certification

EQIP Funding Category: Energy Audit

- Conduct an energy audit on your farm headquarters
- Conduct an energy audit on your other farming operations
- A consultant will perform the audit

ARDL Loan

Available through the state of Utah Department of Ag and Food

Low interest
Between 2.5% and 3%

To be used on qualifying ag purposes

* This is not an NRCS program but applications are available through our office.

The End

Natural Resources Conservation Service

David Hanson – District Conservationist

801-377-5580 ext. 113

302 E 1860 South
Provo, UT 84606

USDA Farm Service Agency Programs

Biographical Information:
Clif Rasmussen
Farm Loan Officer – Summit County FSA

I grew up in Southern Idaho working for several local farmers on beef, wheat, potato and alfalfa operations. I graduated from Utah State University with a degree in International Agri-Business in 2009. I have worked for the Farm Service Agency as a Loan Officer for 6 years in both Colorado and Utah. I currently cover Summit, Weber, Morgan, Davis, and Rich Counties.

Biographical Information:
Jennifer Hicks
USDA Farm Service Agency

While I did not grow up on a farm or have an agricultural related degree, I have come to love and respect the agricultural community. I have worked for the USDA Farm Service Agency in Utah for over 14 years. Over that time, I have held various positions that have allowed me to work and associate with producers in many counties. Currently I am the County Executive Director over Juab County.

Session Description:
Session will discuss the farm commodity, conservation and environmental, and emergency and disaster assistance programs available through the Farm Service Agency. Also discussing the financing options for agricultural producers offered by the Farm Service Agency.

Farm Service Agency

Mark Gibbons

Utah State Executive Director

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USDA

Utah State Committee Represent all Areas of the State in Supporting Utah Farmers and Ranchers

- Tim Munns – Chair, Box Elder County
- Ruth Ann George, Millard County
- Brent Money, Utah County

USDA

FSA County Office Committees (COC)

- FSA's county committee system keeps local producers involved
- COC members serve 3-year terms. Nominations accepted thru August
- COC's oversee delivery of federal programs locally

USDA

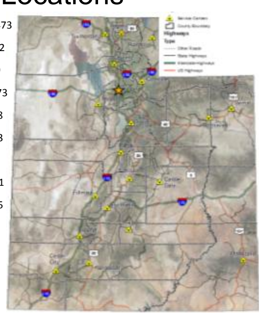
Utah Agriculture is Strong

- Farm net income continues to rise
- 2013 farm revenue in Utah exceeded $1.8 billion
- Top Utah Commodities in 2013
  - 1) Beef Cattle $360.57 million
  - 2) Dairy $342.67 million
  - 3) Hay $237.94 million
  - 4) Greenhouse $110.56 million

USDA

FSA Office Locations

Beaver County	(435) 438-5088	San Juan County	(435) 587-2473
Box Elder County	(435) 257-5402	Sanpete County	(435) 283-8002
Cache County	(435) 753-5480	Sevier County	(435) 896-5489
Duchesne County	(435) 722-2491	Summit County	(435) 336-5573
Emery County	(435) 381-2300	Tooele County	(435) 882-3018
Garfield County	(435) 676-8280	Uintah County	(435) 789-7133
Iron County	(435) 586-7274	Utah County	(801) 377-5296
Juab County	(435) 623-0342	Wayne County	(435) 836-2711
Millard County	(435) 743-5173	Weber County	(801) 629-0575
Rich County	(435) 793-2465		



USDA

Agriculture Act of 2014

Signed into law 2/7/2014

USDA

Agriculture Act of 2014

The goal of this farm bill is to allow the men and women who feed millions around the world to invest confidently in the future.

- Provides additional support to communities
- Builds on historic gains in rural America over the past 5 years
- Supports continued global leadership of our farmers and ranchers

Agriculture Act of 2014

- Eliminates Direct Payments (DCP)
- Improves farm safety net for new and beginning farmers and ranchers
- Recognizes potential of new and expanding markets for the agriculture industry
- Additional support for food hubs, farmers markets and on-farm businesses
- Streamlines conservation programs to better target limited resources to areas of highest need

Agriculture Act of 2014

- Makes youth loans available in urban areas
- Delinquent youth loan borrowers will no longer be excluded from receiving student loans
- Authorizes a relending program to assist Native American producers to purchase fractionated interests of land
- A limited resource rate is available to beginning and veteran farmers

Agriculture Act of 2014

- Expands types of entities eligible
- Provides favorable interest rates for joint financing arrangements
- Increases loan limits for microloans
- Eliminates term limits for guaranteed loans

Agriculture Act of 2014- Farm Programs

- Agricultural Risk Coverage (ARC)
- Conservation Reserve Program
- Dairy Margin Protection Program (MPP)
- Emergency Assistance for Livestock, Honeybees and Farm-Raised Fish Program
- Emergency Conservation Program
- Livestock Forage Disaster Program
- Livestock Indemnity Program
- Marketing Assistance Loan Program
- Noninsured Crop Disaster Assistance Program
- Price Loss Coverage (PLC)
- Tree Assistance Program

Agriculture Act of 2014- Farm Loan Programs

- Direct Operating and Ownership Loans
- Emergency Loans
- Farm Storage Facility Loans
- Guaranteed Operating and Ownership Loans
- Microloans
- Youth Loans

FSA Supports Utah Farmers and Ranchers

The USDA Farm Service Agency delivered over $119.4 million in federal program payments and loans to Utah farmers and ranchers in FY 2014. Of that, over 62.1 million was low interest loans to purchase or operate a farm or ranch.

USDA

Assistance

Please contact any FSA County Office or visit www.fsa.usda.gov/ut

USDA

Financing Small Farms

Biographical Information:
Sarah Buttars
Western AgCredit

Sarah has worked for Western AgCredit since 2007. Her current job is VP-Marketing and Communications Director. Her duties include producing FenceLines (a quarterly newsletter), representing Western AgCredit at ag-related meetings and conventions, organizing the customer appreciation barbecues, producing and ordering advertising materials, community outreach, and internal communications.

Sarah graduated from Utah State University with a degree in public relations and minors in business and political science. Prior to coming to Western AgCredit, Sarah worked for four years in marketing and communications for KEPCO+, a company that installs commercial stone exteriors.

Sarah grew up on a dairy farm in Lewiston, UT. In her spare time, she enjoys traveling, spending time with family and friends, reading, cooking and attending live performances and sporting events.

Session Description:

- Overview of Western AgCredit and the loan products offered.
- Details about our AgStart program specifically designed for local food farmers.
- Information on our new micro-grant program for farmers markets.

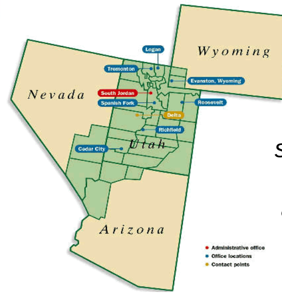
Financing Small Farms

Presented at: **Urban & Small Farms Conference**
Presented by: **Sarah Buttars**

February 19, 2015

www.westernagcredit.com

Western AgCredit's Mission



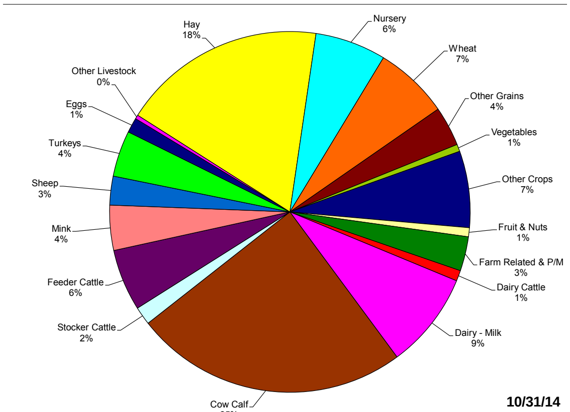
"To provide the most dependable source of credit and related service to agriculture and the rural community."

www.westernagcredit.com

Western AgCredit's Mission

- Cooperative Lending Institution
  - Approx.: 1,600 member borrowers
- Part of the Nationwide Farm Credit System Established in 1916
- Finance Production Agricultural Needs

www.westernagcredit.com



10/31/14

Short-Term Loans

(1-3 years)

- Operating needs
- Livestock
- Feed purchases
- Other agricultural purposes

www.westernagcredit.com

Intermediate-Term Loans

(3-10 Years)

- Farm machinery
- Production and processing equipment
- Building repairs/improvements
- Debt refinancing
- Herd expansion
- Other agricultural purposes

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Long-Term Programs
(Up to 30 Years)

- Real estate
- Construction of facilities
- Improvements
- Water and irrigation projects
- Other agricultural purposes

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WESTERN AgCredit

AgStart Loan Program

Funds For Local Food Farmers

- Started in 2013 to help us meet our mission
- Finance operations who market their agricultural products directly to consumers
- Operators have less than 10 years experience

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WESTERN AgCredit

AgStart Program Objective

Funds For Local Food Farmers

- Meet operation's lending needs
  - Line of Credits
  - Term Loans
    - Equipment
    - Livestock
  - Real Estate Purchase/Improvements
- Assist customers with development of sound business practices

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WESTERN AgCredit

AgStart Loan Program

Funds For Local Food Farmers

- $25,000 program cap
  - Goal: Transition customers into other loan programs
- Rate: Wall Street Journal Prime
  - Currently: 3.25%
- Payment Options
  - Monthly
  - Quarterly
  - Semi-Annually
  - Annually

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WESTERN AgCredit

AgStart Loan Application Requirements

Funds For Local Food Farmers

- Credit Report
- Entity Documents (if applicable)
- Most recent tax return(s)
- Current year W-2 or pay stub (if applicable)
- Income statement (if applicable)
- Personal letter(s) of reference

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WESTERN AgCredit

AgStart Collateral Requirements

Funds For Local Food Farmers

- 1st lien on Real Estate
- 1st Lien on Personal Property
  - Equipment
  - Farm Products

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WESTERN AgCredit

AgStart Application Areas of Measurement

- Credit History on Credit Report
- Industry Experience
- Secondary Support
- Business Plan
- Collateral

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Automatic Disqualifications

- Evidence of Repossession, Bankruptcy, or Foreclosure in past 10 years
- Applicant convicted of Felony Offence by state or federal court
- Loan/value is greater than 100%
- Any applicant is not a citizen of the United States

www.westernagcredit.com

Questions/Comments?

Contact: agstart@westernagcredit.com

Sarah Buttars-Marketing & Communications Director
801.571.9200
sjb@westernagcredit.com

www.westernagcredit.com

New marketing trends including boxes

Biographical Information:
Ruby Ward
Utah State University

Dr. Ruby Ward was raised on a farm 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 University 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. Ward was the committee chair for the Diversified 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 website (RuralTax.org) and Co-chair of the National Farm Income Tax Extension Committee. She has given many presentations on Tribal tax and financial issues. Ward works primarily in the area agriculture entrepreneurship.

Session Description:
Some people have referred to the local food movement as a fad and others as a permanent shift in consumer preferences. Whether it is a fad or not will depend somewhat on how effective we are at reaching a broader segment of the market including millennials. Farms may need to shift how they market their products and the alternatives they offer. This session will go over some of the trends in marketing such as food box sets. Food box sets provide all ingredients and recipes home delivered (Blue Apron, Hello Fresh, Brit Kits, etc.). They are designed for consumers looking to return to the activities of the past (home cooking, canning, baking, etc.), but don't want to spend the time shopping and coming up with the ideas themselves.

New Marketing Trends – Including Food Box Sets

Dr. Ruby Ward

Utah State University Extension

Local Food Movement

- Fad vs. Permanent Shift in behavior
- **Fad** - practice or interest followed for a time with exaggerated zeal
- **Permanent Shift in Consumer Preferences** – Same ratch up with slow to catch on, but based upon something that permanently changes what people buy

Fad

- Best strategy is to take advantage of it while it is hot.
- Making big investments might not pay off if the fad quits

Permanent Shift

- Will be around for a long time
- Can support major investments over time

Table 2
Number of direct-to-consumer farms and sales, 2002-12

Item	Census year: 2002	2007	2012
All farms reporting direct-to-consumer sales	116,733	136,817	144,530
Percent of all farms	5.5	6.2	6.9
Direct-to-consumer sales (million dollars)	812	1,211	1,310
Percent of all farm sales	0.4	0.4	0.3
Direct-to-consumer sales (millions of constant dollars: 2012 = 100)	1,002	1,322	1,310
Percent change from previous census	36.1	31.9	-0.9

source: USDA, National Agricultural Statistics Service, Census of Agriculture data, various years; Council of Economic Advisors, Economic Report of the President (2014), Table B-3: Quantity and price indexes for gross domestic product, and percent changes, 1965–2013.

How do we sell more “Local”?

- Sell more to the same people?
- Find new people to sell to
    - Penetrate deaper into the market.

Generation DI(Y)

- Young adults under the age of 35 dominate the 29 billion dollar crafting industry.
- "There's something about my tech-bound and social-media obsessed age …that's developed a nostalgia for quainter, quieter times, home cooking and even such gendered pastimes as knitting." Forbes Article "Birchbox and Brit Kits – Battle of DIY Box Sets." 11-15-12
- Canning is back in with millennials, but they lack knowledge and skills

Lost Culinary Skills

- In 1992 Pork Producers Council Survey –
  - 50 % didn't know how to thicken gravy
  - 75 % didn't know that broccoli should be cooked uncovered to maintain its color
  - only 55 % knew there are three teaspoons in a tablespoon. The test was contained in a mailed questionnaire sent out for the council by National Family Opinion Research Inc. in Toledo, Ohio.
  - "We are raising the first cooking-illiterate generation,"

Box Sets

- Materials, directions and ideas for a DIY are delivered to your door once a month or once a week.
- "For the multitasking generation, deciding on an idea, running around town to pick up supplies and sitting down to complete a project can seem like a pipe dream," Brit Morin. "By putting everything in one package, we've really been able to empower people to create in ways they otherwise might have only imagined."

Examples

- Science/discovery projects for kids 3-8 =
  - http://www.kiwicrate.com/our-crates
- This is one for a box of dog items each month
- https://barkbox.com/
- Brit Kits – Variety of DIY kits including crafts, food and drink
  - https://www.brit.co/shop/catalog/category/summary/diy_39/

Food Box Sets -

- **Blue Apron** – comes once a week 3 meals with recipe. You pick the delivery day. You pick 2, 4 or 6 servings. Box on your porch with recipe and everything but oil and salt, pepper
- Blueapron.com
- 1 million meals sold each month (doubled since May 2014)

Food box sets

- https://www.hellofresh.com/food-boxes/
- Plated.com

Winder Farms & the Challenges of Sourcing Local

Biographical Information:
Melanie Robinson
Winder Farms

Melanie Robinson is the VP of Marketing at Winder Farms, a grocery delivery service focused on delivering farm-fresh, locally sourced products to customers in Orange County, CA, Las Vegas, NV, and throughout Utah. Melanie oversees three key areas of the business: brand and product strategy, online customer acquisition, and customer service. Prior to joining Winder Farms, Melanie served in executive leadership positions at OrangeSoda in American Fork, Utah and CalFinder in San Francisco, California.

Melanie received her MBA from Stanford University and her BA in Economics from Eckerd College. When she's not at work, she is likely snowboarding, biking, or otherwise enjoying the outdoors that make Utah such a great place to live.

Session Description:
Winder Farms is a home delivery grocery service providing fresh groceries with a local focus to homes throughout Utah, Las Vegas, NV, and Orange County, CA. Melanie will discuss the unique challenges to providing local products through the home delivery model.

<u>Marketing into schools and using value added products</u>

Biographical Information:
David Cornaby
Janet Stocks
Cornabys

David Cornaby and Janet Stocks are both owners of Cornaby's LLC a specialty food business that produces jams, jellies, syrups, smoothie mixes, and more. David has a farming background and Janet has a background in food science. Together they have created many value-added ag products and explored various marketing outlets.

Session Description:
David will talk about their experience with farm to school programs. Janet will discuss the process of getting value added products into the marketplace. This will include Cottage Kitchen requirements, label requirements, etc.

Digital Target Marketing: How the New Utah's Own Website will connect you to local consumers

Biographical Information:
Tamra Watson
Utah’s Own/Utah Department of Ag and Food
350 North Redwood Road
Salt Lake City, UT 84114
tamrawatson@utah.gov
(801) 538-4913

Tamra Watson is farm-raised, Sanpete-County-Girl, who has a passion for agriculture and life. At age ten her dream was to become a veterinarian, which ended quickly when her family dog had puppies…(Gross!).

After participating actively in 4-H and FFA, Tamra stumbled upon an Agricultural Communications degree at Utah State University that matched her both passion for locally grown food and her natural talents and abilities. She went on to Oklahoma State University to obtain a master’s degree in the same field.

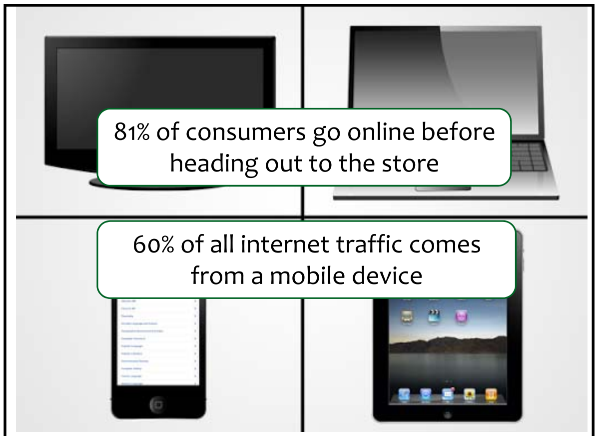
Today, she is one of three full-time marketing employees for the Utah Department of Agriculture and Food – working with the Utah’s Own program.

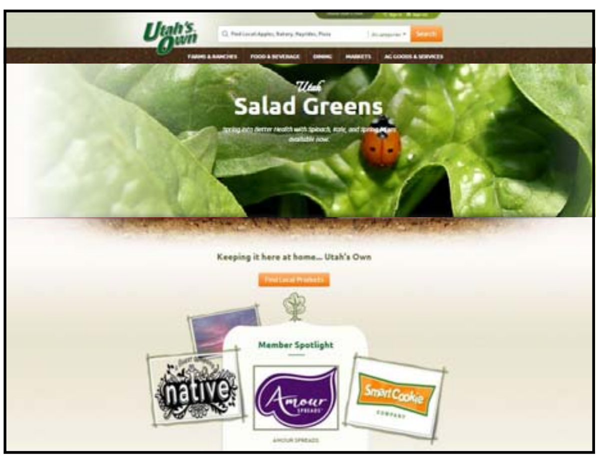
Session Description:
Farmers are faced with a two-edge sword in today’s marketplace: (1) An urban population, removed from daily interaction with agriculture but curious about food and farming practices (2) Limited time and resources to “tell-their-story” to a four-screen digital world, of which 81 percent of all consumers use to make purchase decisions.

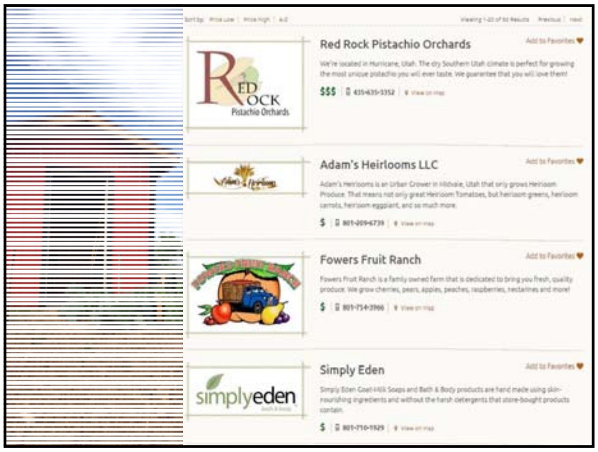
After identifying these trends, Utah’s Own contracted with a talented firm to develop a new site that is designed to provide consumers with content their searching for online: mainly local food, farms and restaurants. Come and discover how Utah’s Own will help you take advantage of this new marketing tool.

Digital Target Marketing:

How the New Utah's Own Website will connect you to local consumers






Red Rock Pistachio Orchards
Add to Favorites
We're located in Hurricane, Utah. The dry Southern Utah climate is perfect for growing the most unique pistachio you will ever taste. We guarantee that you will love them!
$$$ | 435-635-3352 | View on map
Adam's Heirlooms LLC
Add to Favorites
Adam's Heirlooms is an Urban Grower in Midvale, Utah that only grows Heirloom Produce. That means not only great Heirloom Tomatoes, but heirloom greens, heirloom carrots, heirloom eggplant, and so much more.
$ | 801-209-6739 | View on map
Fowers Fruit Ranch
Add to Favorites
Fowers Fruit Ranch is a family owned farm that is dedicated to bring you fresh, quality produce. We grow cherries, pears, apples, peaches, raspberries, nectarines and more!
$ | 801-754-3966 | View on map
Simply Eden
Add to Favorites
Simply Eden Goat Milk Soaps and Bath & Body products are hand made using skin-nourishing ingredients and without the harsh detergents that store-bought products contain.
$ | 801-710-1929 | View on map


Heirlooms & More, Worden Produce
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Phone: 801-205-3818
Email: darinworden@msn.com
Website: http://www.heirloomsandmore.com
Home Location: 547 East State Road 258, PO Box 359 , Elsinore, Utah 84724
$$$
Business Hours:
Monday thru Saturday - dawn to dusk
Seasonality: April through October
Gluten Free
All Natural
Heirlooms & More, Worden Produce is a Utah based grower of specialty heirloom vegetables. From our central Utah base of operations, we effeciently service the entire State of Utah.
Before the industrialization of agriculture (pre-1950s), a much wider variety of vegetables were grown. Today's modern agricultural practices use large, single hybrid variety plots to produce the majority of vegetables commercially available. These hybrid varieties are selected for their productivity, ability to withstand mechanical picking, cross-country shipping, and tolerance to drought, frost, or pesticide/herbicide use - not for their local freshness, quality, taste, and nutritional value.
Our selected heirloom varieties provide a source of locally and naturally grown vegetables whereby the full flavor, quality, and nutritional value of the non-hybrid/open pollinated species are available to you.
We specialize in client requested custom grow orders. Please contact us today if you are interested in a custom grow request
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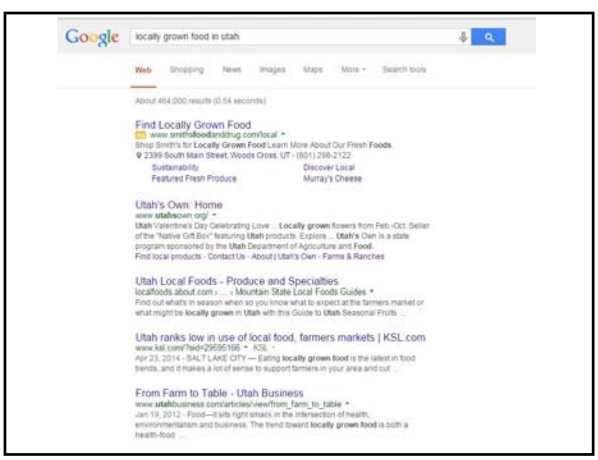
Worden Produce
www.heirloomsandmore.com


Rowley's Red Barn - Rowley's Southridge Farms
Add to Favorites
Phone: 801-754-5511
Email: barn@southridgefarms.com
Website: http://www.southridgefarms.com
Home Location: 901 South 300 West , Santaquin, Utah 84655
$
Business Hours:
April - October:
Monday - Saturday, 9 am - 9 pm
November - March:
Monday - Saturday, 9 am - 7 pm
Seasonality: Year Round
All Natural
Vegan
Vegeterian
Rowley's Red Barn and Rowley's Southridge Farm is the ultimate stop for farm-fresh foods and country fun, located just off the freeway in both the hills of Santaquin and the redrock of Washington, UT. The iconic red barn provides homemade ice creams and pastries, home-grown produce and world-class dried cherries—and all the character of a family-owned, working farm!
We've also offer a country spoon product line of jam's, jellies, salsa and syrups - if you're looking for a farm grown product you can trust and love.
If you don't have time to stop in at one of our great locations, enjoy the fresh taste of our farm grown and pressed, apple juice. You can find Red Barn Cider Mill juice at participating Associated Foods and Smith's stores near you. See the where-to-buy map below.
Check out our website for information on farm tours and events for every season.
Fruit Varieties from our Farm:
Cherries: Bing, Rainer, Montmorency, Morello, Sweetheart
Peaches: Red Haven, Elberta, Diamond Princess, Sun Crest, Lemon Elberta, July Flame, Angelus, J.H. Hale, O'Henry
Apples: Gala, Honey Crisp, Fuji, Jonagold, Ginger Gold, Braeburn, Granny Smith, Red Delicious, Enterprise, Pink Lady


Where We Are Located
Where To Buy
BRIGHAM
PEAC


Where We Are Located
Where To Buy
RED
ACRE
FARM • CSA


Google
locally grown food in utah
Web
Shopping
News
Images
Maps
More
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About 464,000 results (0.54 seconds)
Find Locally Grown Food
www.smithsfoodanddrug.com/local
Shop Smith's for Locally Grown Food Learn More About Our Fresh Foods.
2399 South Main Street, Woods Cross, UT - (801) 298-2122
Sustainability
Discover Local
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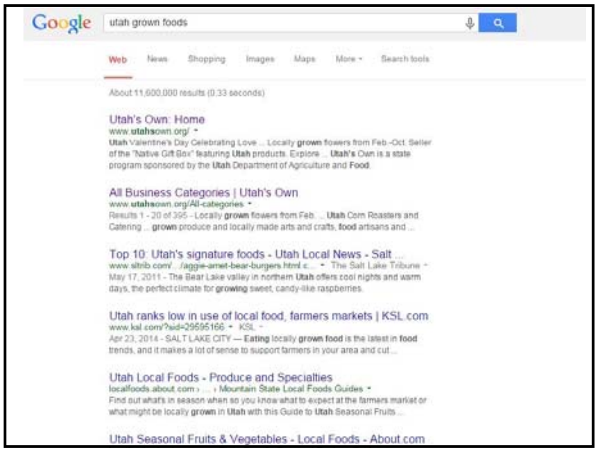
Murray's Cheese
Utah's Own: Home
www.utahsown.org/
Utah Valentine's Day Celebrating Love ... Locally grown flowers from Feb -Oct. Seller of the "Native Gift Box" featuring Utah products. Explore ... Utah's Own is a state program sponsored by the Utah Department of Agriculture and Food.
Find local products - Contact Us - About | Utah's Own - Farms & Ranches
Utah Local Foods - Produce and Specialties
localfoods.about.com › ... › Mountain State Local Foods Guides
Find out what's in season when so you know what to expect at the farmers market or what might be locally grown in Utah with this Guide to Utah Seasonal Fruits ...
Utah ranks low in use of local food, farmers markets | KSL.com
www.ksl.com/?sid=29595166 · KSL
Apr 23, 2014 - SALT LAKE CITY — Eating locally grown food is the latest in food trends, and it makes a lot of sense to support farmers in your area and cut ...
From Farm to Table - Utah Business
www.utahbusiness.com/articles/view/from_farm_to_table
Jan 19, 2012 - Food—it sits right smack in the intersection of health, environmentalism and business. The trend toward locally grown food is both a health-food ...


Google
utah grown foods
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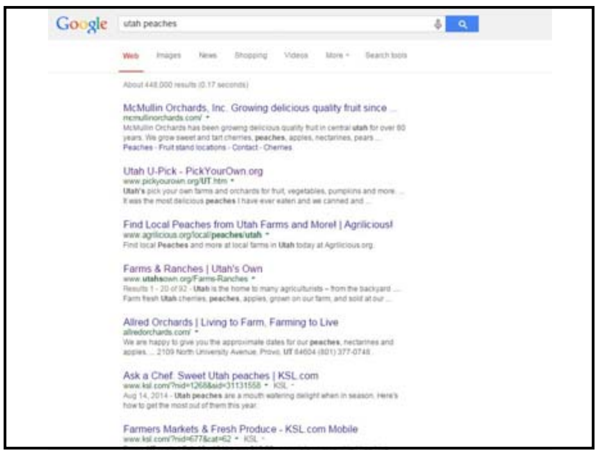
Utah's Own: Home
www.utahsown.org/
Utah Valentine's Day Celebrating Love ... Locally grown flowers from Feb.-Oct. Seller of the "Native Gift Box" featuring Utah products. Explore ... Utah's Own is a state program sponsored by the Utah Department of Agriculture and Food.
All Business Categories | Utah's Own
www.utahsown.org/All-categories
Results 1 - 20 of 395 - Locally grown flowers from Feb. ... Utah Corn Roasters and Catering ... grown produce and locally made arts and crafts, food artisans and ...
Top 10: Utah's signature foods - Utah Local News - Salt ...
www.sltrib.com/.../aggie-amet-bear-burgers.html.c... The Salt Lake Tribune
May 17, 2011 - The Bear Lake valley in northern Utah offers cool nights and warm days, the perfect climate for growing sweet, candy-like raspberries.
Utah ranks low in use of local food, farmers markets | KSL.com
www.ksl.com/?sid=29595166 KSL
Apr 23, 2014 - SALT LAKE CITY — Eating locally grown food is the latest in food trends, and it makes a lot of sense to support farmers in your area and cut ...
Utah Local Foods - Produce and Specialties
localfoods.about.com › ... › Mountain State Local Foods Guides
Find out what's in season when so you know what to expect at the farmers market or what might be locally grown in Utah with this Guide to Utah Seasonal Fruits ...
Utah Seasonal Fruits & Vegetables - Local Foods - About.com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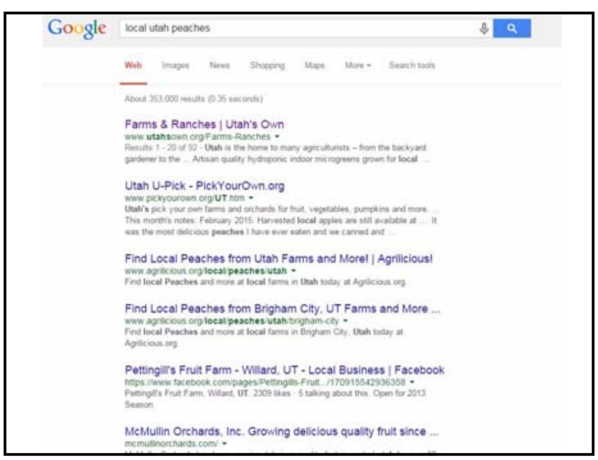
McMullin Orchards has been growing delicious quality fruit in central utah for over 80 years. We grow sweet and tart cherries, peaches, apples, nectarines, pears ...
Peaches - Fruit stand locations - Contact - Cherries
Utah U-Pick - PickYourOwn.org
www.pickyourown.org/UT.htm
Utah's pick your own farms and orchards for fruit, vegetables, pumpkins and more. ...
It was the most delicious peaches I have ever eaten and we canned and ...
Find Local Peaches from Utah Farms and More! | Agrilicious!
www.agrilicious.org/local/peaches/utah
Find local Peaches and more at local farms in Utah today at Agrilicious.org.
Farms & Ranches | Utah's Own
www.utahsown.org/Farms-Ranches
Results 1 - 20 of 92 - Utah is the home to many agriculturists – from the backyard ...
Farm fresh Utah cherries, peaches, apples, grown on our farm, and sold at our ...
Allred Orchards | Living to Farm, Farming to Live
allredorchards.com/
We are happy to give you the approximate dates for our peaches, nectarines and apples. ... 2109 North University Avenue, Provo, UT 84604 (801) 377-0748.
Ask a Chef: Sweet Utah peaches | KSL.com
www.ksl.com/?nid=1268&sid=31131558 KSL
Aug 14, 2014 - Utah peaches are a mouth watering delight when in season. Here's how to get the most out of them this year.
Farmers Markets & Fresh Produce - KSL.com Mobile
www.ksl.com/?nid=677&cat=62 KSL


Google
local utah peaches
Web Images News Shopping Maps More Search tools
About 353,000 results (0.35 seconds)
Farms & Ranches | Utah's Own
www.utahsown.org/Farms-Ranches
Results 1 - 20 of 92 - Utah is the home to many agriculturists – from the backyard gardener to the ... Artisan quality hydroponic indoor microgreens grown for local ...
Utah U-Pick - PickYourOwn.org
www.pickyourown.org/UT.htm
Utah's pick your own farms and orchards for fruit, vegetables, pumpkins and more. ...
This month's notes: February 2015: Harvested local apples are still available at ... It was the most delicious peaches I have ever eaten and we canned and ...
Find Local Peaches from Utah Farms and More! | Agrilicious!
www.agrilicious.org/local/peaches/utah
Find local Peaches and more at local farms in Utah today at Agrilicious.org.
Find Local Peaches from Brigham City, UT Farms and More ...
www.agrilicious.org/local/peaches/utah/brigham-city
Find local Peaches and more at local farms in Brigham City, Utah today at Agrilicious.org.
Pettingill's Fruit Farm - Willard, UT - Local Business | Facebook
https://www.facebook.com/pages/Pettingills-Fruit.../170915542936358
Pettingill's Fruit Farm, Willard, UT. 2309 likes · 5 talking about this. Open for 2013 Season.
McMullin Orchards, Inc. Growing delicious quality fruit since ...
mcmullinorchards.com/

Visitor Statistics – Oct. 2014 – Present; Top Farms

Page	Unique Page Views	Entrances
Petersen-Family-Farm	173	8
Jones-Creek-Beef	122	29
Harvest-Lane-Honey	121	27
Planet-Goat	120	10
Utah-Natural-Meat	114	7
Wight-s-Fresh-Turkey	111	47
Bees-Brothers	111	6
Fackrell-Farms-LLC	108	25
Weed-Family-Honey	104	13
Gold-Creek-Farms	92	4
Cedar-Valley-Honey	92	9
Chad-s-Raspberry-Kitchen	91	9
Slide-Ridge-LLC	89	7
Lazy-C-Beef	88	8
Heber-Valley-Artisan-Cheese	86	11

January 2015 Visitor Statistics

Page	Unique Pageviews	Entrances
Late-Bloomin-Heirlooms	45	35
Petersen-Family-Farm	36	0
Jones-Creek-Beef	35	12
Utah-Natural-Meat	35	2
Bees-Brothers	26	1
Abeez-Honey	25	6
Leaning-H-Livestock	24	1
BlueTree-Cattle-Co	23	1
Harvest-Lane-Honey	23	4
Tagge-s-Famous-Fruit-Veggie-Farms	23	5

Tamra Watson
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tamrawatson@utah.gov

Bailee Woolstenhulme
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baileewoolstenhulme@utah.gov

Katy Chandler
801-538-7139
kchandler@utah.gov

Let Us Help You Communicate Your Cause

Farm Link: connecting new farmers with land in SLCO

Biographical Information:
Julie Peck-Dabling
Salt Lake County Urban Farming Program

Julie Peck-Dabling loves her job! As the only County in Utah that dedicates staff to Open Space and Urban Farming, Julie finds herself on local trails one day and visiting with farmers the next. She has been running SLCO's urban farming program since it began in 2009. Julie is dedicated to strengthening this program over the next several years, especially partnering with restaurants, schools, growers, and farmers markets, to bring a love of fresh, local food to underserved populations in Salt Lake County.

Session Description:
Salt Lake County's Urban Farming program is in its 5th year and going strong. A brief review of existing programs, including Farm to School, Commercial Farming on county land, and community gardens in county parks, will be followed by a presentation on our newest program, Farm Link.

The average age of farmers in Utah is 59 years. We are quickly losing our abundance of local agricultural knowledge and wisdom acquired through decades of practical/efficient growing techniques. In response to this, Salt Lake County is creating a Farm Link program that will endeavor to link existing farmers and their land with individuals such as beginning farmers who are looking for land. Additionally, underutilized residential, commercial and industrial land of 2 to 4 acres will be made available to new growers.