Strategies for Growing without Irrigation in Western Oregon

Amy Garrett
Small Farms Program
OSU Extension Service
Introduction

- Cropping options on land without water?
- Climate change
  - reduced snowmelt
  - increased temperatures
  - drought
- Vegetable growers using surface water for irrigation were cut off early during the 2015 growing season - Some as early as June!
- Many new farmers have trouble finding land with unrestricted irrigation rights
- Water is expensive!
Adapting to a Changing Climate: Conserving Water with Dry Farming Management Practices

https://youtu.be/FRjDf7x9Tro
What is dry farming?

- Crop production during a dry season like summers in the Willamette Valley in Oregon and Northern California
- Utilizes the residual moisture in the soil from the rainy season instead of depending on irrigation.
Warm-summer Mediterranean Climate

[Map showing distribution of warm-summer Mediterranean Climate zones around the world]
Resources

Steve Solomon
- *Growing Vegetables West of the Cascades*
- *Water-Wise Vegetables*
- *Gardening Without Irrigation: or without much anyway*
- *Gardening when it counts*

Carol Deppe
- *The Resilient Gardener*

David Granatstein
- *Dryland Farming in the Pacific Northwest*

California Ag Water Stewardship Initiative

Widtsoe, John. 1920
The Dry Farming Project

- Work to date
  - Case studies
    - Western Oregon
    - Northern California
  - Demonstration
    - Field Day
    - Sensory Evaluation
    - Preliminary Yield Data
  - Grant funding
    - Expand Demonstration
    - *Growing Resilience: Water Management Workshop Series*
    - Participatory Climate Adaptation Research
    - *Dry Farming Collaborative*
How Does Dry Farming Work?

- Starts with the soil!
  - Water-holding capacity
    - Clay
  - Organic matter - For each 1% increase in soil organic matter, soil water storage can increase by 16,500 gallons per acre-foot of applied water!
  - 4’ of soil or more (Solomon)

- Site selection
  - Plants as indicators
  - Web Soil Survey
  - Soil auger

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**128B—Veneta loam, 0 to 7 percent slopes**

**Map Unit Setting**
- National map unit symbol: 234m
- Elevation: 300 to 800 feet
- Mean annual precipitation: 40 to 60 inches
- Mean annual air temperature: 52 to 54 degrees F
- Frost-free period: 165 to 210 days
- Farmland classification: All areas are prime farmland

**Typical profile**
- H1 - 0 to 14 inches: loam
- H2 - 14 to 39 inches: clay loam
- H3 - 39 to 60 inches: clay

**Properties and qualities**
- Slope: 0 to 7 percent
- Depth to restrictive feature: More than 80 inches
- Natural drainage class: Moderately well drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
- Depth to water table: About 36 to 72 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Available water storage in profile: High (about 10.3 inches)
How Does Dry Farming Work?

- Soil preparation
  - Timing
- Planting technique
  - Plant when and where there is moisture
  - Increased plant spacing
  - Pressing soil around seed or transplant
    - Good seed soil contact
    - Creates capillary action wicking moisture to the surface to help seed germinate and get established
  - Pre-soaking seed (Deppe)
- Surface protection
  - Mulching – ‘dirt or dust mulch’ most common on small commercial farms
Sand
Poor Capillarity

Clay; Sandy/Silt Loams
Good Capillarity

By Moria Peters
Crop/Variety Selection

- Tomatoes
- Potatoes
- Watermelons
- Cantaloupes
- Winter squash
- Zucchini
- Dry Beans
- Corn
- Orchard crops
- Grapes
June 3, 2016
July 6, 2016
August 10, 2016
‘Dark Star’ Zucchini

Corvallis, OR

New Moon Organics - Shively, Ca

August 18, 2015

July 6, 2015

July 15, 2015

July 27, 2015

September 25, 2015
Gathering Together Farm
2016 Dry Farm Trial
<table>
<thead>
<tr>
<th>Soil</th>
<th>Native Productivity</th>
<th>Amendments</th>
<th>Drainage</th>
<th>Irrigation</th>
<th>Max Dry</th>
<th>Max Irrigated</th>
<th>Farm</th>
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<tr>
<td>Chapman</td>
<td>69</td>
<td>+9</td>
<td>0</td>
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<td>76</td>
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<td>36</td>
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<td>Helvetia</td>
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<td>70</td>
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<td>+5</td>
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<td>Willamette</td>
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<td>+20</td>
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<td>100</td>
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<tr>
<td>Woodburn</td>
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<td>+8</td>
<td>+16</td>
<td>78</td>
<td>94</td>
<td>Oak Creek, Gowan Farm</td>
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(Huddleston EC 1105)
Andy Gallagher – Red Hill Soils
### Tomato Yield

**Selected Sites**

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>Native Prod.</th>
<th>Max Dry</th>
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<tbody>
<tr>
<td>Coburg Redbell</td>
<td>60 55</td>
<td>73 73</td>
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<tr>
<td>Latourell Quatama</td>
<td>70 65</td>
<td>80 79</td>
</tr>
<tr>
<td>Willamette Woodburn</td>
<td>75 65</td>
<td>80 78</td>
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</table>

**Graph**

- **Y-axis**: lb per ac
- **X-axis**: Variety
- **Legend**:
  - Treatment: Dry Farm, Biochar, Low Irrigation, Irrigated

**AnOvation Group LLC**
Dry Farming Collaborative

Group of growers, extension educators, plant breeders, and agricultural professionals partnering to increase knowledge and awareness of dry farming management practices with a hands-on participatory approach.
Dry Farming Collaborative

- 30 Trial Hosts
- Communication
  - Facebook Group (450+ members)
  - Email list (120+ members)
- Data Collection
  - Soil testing (5’ cores)
  - Soil moisture monitoring
  - Yield
  - Sensory Evaluation
- Events
  - Winter Meeting
  - Field Days
  - Tasting events
  - Conference presentations
2017 Dry Farming Collaborative
Replicated Variety Trials

- Farmer selected varieties
  - 5-8 varieties of each crop
  - Up to 20 replications of each crop across sites
- Mother – Daughter trial design
- Farmers designed replication size and protocol
- Intention to be inclusive of growers on different scales
2017 -2018 DFC Replicated Variety Trials

- **Tomatoes**: Early Girl, Dirty Girl, Stupice, Big Beef, Perfect Rogue, Cour di Bue
- **Winter Squash**: Stella Blue, Winter Sweet, Hidatsa, Zeppelin Delicata, Lower Salmon River, Little Gem
- **Zucchini**: Dark Star, Costata Romanesco, Goldini Zucchini, Rugosa Friulana, Genovese
- **Melon**: Eel River, Christmas Watermelon, Desert King Watermelon, Rich Sweetness, Sweet Freckles, Piel de Sappo
- **Beans**: Volga German, Whipple, Early Warwick, Beefy Resilient Grex
- **Corn**: Papas Red, Open Oak Party Mix Dent Corn, Magic Manna, Cascade Ruby Gold, Painted Mountain
# Mother – Daughter Trial Design

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<tr>
<th>Tomato</th>
<th>Melon</th>
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<th>Zucchini</th>
<th>Dry Beans</th>
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**1 rep = 100 sq ft**  
Or ~10 sq meters
5 farms collected yield data on 11 tomato varieties

Unbalanced design – difficult to fit to a statistical model
  • Not all farms grew all varieties

Statistical analysis
  • Random effects
    • Genotype x environment
  • Fixed effects
    • Plant Density (p=0.14)
      • Results suggest density effect of about 3 lb/plant, density range was from 870-2700 plants/ac
    • Available Water-Holding Capacity (p=0.06)
      • Results suggest an extra inch of water holding capacity in the soil is worth a couplet thousand lbs per acre of yield
Density Effect, Last Year's Rain, Big Beef Tomato

\[ \text{lm(lb.per.ac} \sim -1 + \text{NPlants.per.ac}; \text{p-value} = 0.00044 \]
2017 Oak Creek Tomato Yield per Plant (lbs)
Harvest 8/7 - 9/16
Dry Farming Project

Next Steps.....

• Developing Dry Farming page on OSU Small Farms website to be a resource hub for dry farming in our region

• Initiate dry farming extension publication series (release will begin in late 2018)
  • Intro to Dry Farming
  • Site assessment and selection
    • Soil moisture monitoring on 33 farms in 2018
  • Case studies
  • Variety Trial Report

• Continue to build network of growers
  • Collaborative learning
  • Participatory research
  • Expand our drought mitigation toolbox
Topics of Interest

- Participatory Plant Breeding for Dry Farmed Systems
  - Beefy Resilient Grex – Carol Deppe (cross between Black Mitla tepary and Gaucho common bean)
- Dry Farmed Orchard Systems
- Hugelkultur
- Different types of mulching
  - Deep straw
  - Wood chips
  - Weed fabric
- Others?
For more info visit:
http://smallfarms.oregonstate.edu/dry-farm/dry-farming-project

Join the Dry Farming Collaborative group on Facebook

Amy Garrett
Small Farms Program
OSU Extension Service
Amy.garrett@oregonstate.edu

Co-creating the future of how we manage water on our farms