Dry Farming in the maritime Pacific Northwest

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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
What is dry farming?

- Crop production during a dry season (like summers in the Willamette Valley in Oregon and Northern California) in region that receives 20 inches (50 cm) or more on annual rainfall
- Utilizes the residual moisture in the soil from the rainy season instead of depending on irrigation.
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 (USDA NW Climate Hub)*
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
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 mulch’ most common on small commercial farms
Sand
Poor Capillarity

Clay; Sandy/Silt Loams
Good Capillarity

By Moria Peters
Why ‘Dirt or Dust Mulching’?

- Organic farms are not applying herbicides – tractor cultivation for weed management
- Cost of applying organic mulch per acre
- Deep straw mulch could provide habitat for rodents and other pests
- Organic mulches - interfere with tractor cultivation

Dust Mulches

A soil management practice making the rounds on gardening Web sites is “dust mulching.” Purported to improve water conservation, dust mulches are created by intensively hoeing the soil surface, creating a finely-textured layer of soil. According to proponents, dust mulching breaks the soil capillarity, reducing the evaporative loss of soil moisture. Furthermore, we’re told that organic mulches aggregate water loss. In other words, no mulch is better for water conservation than organic material. With heightened government and public interest in reducing landscape water use, choosing effective mulches for water conservation is an increasingly important issue.

In improving soil moisture conservation (De and Giril, 1978; Sharma, 1991) and water use efficiency (Ali, 1985; Moitra and Ghosh, 1998; Raghavulu and Singh, 1982; Singh et al., 1998) when compared to bare soil conditions. But in the vast preponderance of studies, dust mulch was less effective in conserving water than organic mulches (Gargi and Gautam, 2003) derived from local crop residues, such as hay and straw (Ali and Prasad, 1972, 1974, 1975; Moitra et al., 1996; Raghavulu and Singh, 1982; Sarkar and Singh, 2007; Woldting, 1992), leaves (Mohan and Ali, 1969; Prasad and Singh, 1998; Sharma and Chakor, 1995), and ground corn cobs (Benoit and Kirkham, 1963).

Comparative effects of dust and organic mulches upon crop yields

To read this table, simply look under the “crop of interest”, then refer to the “ranking of mulches”. In the first example under “wheat”, organic mulching is better than dust mulching according to Ali. Codes for symbols are at end of table. References (sources) are located in third column for your convenience and a bibliography is available from Linda Chalker-Scott’s Web site.

<table>
<thead>
<tr>
<th>Crop</th>
<th>Ranking of mulches</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat (Triticum spp.)</td>
<td>OM &gt; DM</td>
<td>Ali, 1976</td>
</tr>
<tr>
<td></td>
<td>OM &gt; DM (wet year)</td>
<td>De and Giril, 1978</td>
</tr>
<tr>
<td></td>
<td>OM = DM (dry year)</td>
<td>De and Giril, 1978</td>
</tr>
<tr>
<td></td>
<td>OM &gt; DM &gt; PM &gt; C</td>
<td>Rao et al., 1997</td>
</tr>
<tr>
<td></td>
<td>OM &gt; DM &gt; C</td>
<td>Sihan, 1976</td>
</tr>
<tr>
<td></td>
<td>OM &gt; DM</td>
<td>Sihan et al., 1977</td>
</tr>
<tr>
<td></td>
<td>OM &gt; DM &gt; C</td>
<td>Sharma, 1991</td>
</tr>
<tr>
<td></td>
<td>OM &gt; DM</td>
<td>Sharma and Chakor, 1995</td>
</tr>
<tr>
<td></td>
<td>OM &gt; OM = DM</td>
<td>Sharma and Thakur, 1992</td>
</tr>
</tbody>
</table>

| Corn/maize (Zea mays) | OM+DM > OM > C | Shivran and Rana, 2003 |

| Barley (Hordeum vulgare) | OM > DM | Ali and Prasad, 1972 |
|                         | OM > DM | Ali and Prasad, 1974b |
|                         | OM > OM | Katjya and Uttam, 2003 |
|                         | OM > DM | Sarkar and Singh, 2007 |
|                         | OM = OM | Warsi et al., 1980 |

| Pearl millet (Pennisetum spp.) | OM > DM | Ali and Prasad, 1974a |
|                                | OM > DM | Daula et al., 1997 |
|                                | OM > OM | Gargi and Gautam, 2003 |
|                                | OM > DM | Singh et al., 1997 |

| Sorghum spp. | DM > OM > OM > DM > C | Prasad and Singh, 1998 |
|             | OM > DM = control     | Raghavulu and Singh, 1982 |

| Rapeseed (Brassica napus) | OM > DM | Moitra et al., 1996, 1998 |
|                         | OM > DM | Singh et al., 1989a and b |
Roots Extend To Edge Of Water-Saturated Zone

By Moria Peters
Crop/Variety Selection

- Tomatoes
- Potatoes
- Watermelons
- Cantaloupes
- Winter squash
- Zucchini
- Dry Beans
- Corn
- Orchard crops
- Grapes
August 10, 2016
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 sites hosting trials in 2017 throughout Western Oregon
- 270+ members in Facebook Group – open to anyone interested in dry farming
- 90+ members on email list – for internal organizing with trial hosts

Data Collection
- Soil testing (5’ cores)
- Yield
- Sensory Evaluation

Winter Growers’ Meeting (Dec 2017)
Gathering Together Farm
2016 Dry Farm Trial
Squash Marketable Yield
Oak Creek OSU Demo 2016

Variety
- Stella Blue
- Zeppelin Delicata

Treatment: Red for Dry Farm, Green for Biochar, Blue for Low Irrigation, Purple for Irrigated

AnOvation Group LLC
‘Dark Star’ Zucchini

Corvallis, OR

July 6, 2015

July 15, 2015

July 27, 2015

New Moon Organics - Shively, Ca

August 18, 2015

September 25, 2015
## Relative Soil Productivity Ratings by Classification

<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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<tbody>
<tr>
<td>Chapman</td>
<td>69</td>
<td>+9</td>
<td>0</td>
<td>24</td>
<td>76</td>
<td>100</td>
<td>Harcombe Farm</td>
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<tr>
<td>Chehalis</td>
<td>72</td>
<td>+5</td>
<td>0</td>
<td>+20</td>
<td>77</td>
<td>97</td>
<td>Gales Meadow Farm</td>
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<tr>
<td>Coburg</td>
<td>60</td>
<td>+5</td>
<td>+8</td>
<td>+20</td>
<td>73</td>
<td>93</td>
<td>Gathering Together Farm</td>
</tr>
<tr>
<td>Dayton</td>
<td>10</td>
<td>+22</td>
<td>+4</td>
<td>+27</td>
<td>36</td>
<td>63</td>
<td>Oak Creek</td>
</tr>
<tr>
<td>Helvetia</td>
<td>57</td>
<td>+5</td>
<td>+8</td>
<td>+20</td>
<td>70</td>
<td>90</td>
<td>Berry Lost</td>
</tr>
<tr>
<td>Latourell</td>
<td>70</td>
<td>+10</td>
<td>0</td>
<td>+20</td>
<td>80</td>
<td>100</td>
<td>North Willamette</td>
</tr>
<tr>
<td>McBee</td>
<td>55</td>
<td>+5</td>
<td>+9</td>
<td>+20</td>
<td>72</td>
<td>92</td>
<td>Gales Meadow Farm</td>
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<tr>
<td>Quatama</td>
<td>65</td>
<td>+5</td>
<td>+9</td>
<td>+20</td>
<td>79</td>
<td>99</td>
<td>North Willamette</td>
</tr>
<tr>
<td>Redbell</td>
<td>55</td>
<td>+5</td>
<td>+18</td>
<td>+20</td>
<td>73</td>
<td>93</td>
<td>Gathering Together Farm</td>
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<tr>
<td>Willamette</td>
<td>75</td>
<td>+5</td>
<td>0</td>
<td>+20</td>
<td>80</td>
<td>100</td>
<td>Oak Creek</td>
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<tr>
<td>Woodburn</td>
<td>65</td>
<td>+5</td>
<td>+8</td>
<td>16</td>
<td>78</td>
<td>94</td>
<td>Oak Creek, Gowan Farm</td>
</tr>
</tbody>
</table>


(Huddleston EC 1105)

Andy Gallagher – Red Hill Soils
2017 DFC Replicated Variety Trials

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

**Planting Density:** 6 plants per rep (16.7 sq ft/plant)

**Cultivars** (3 reps of each)
- Early Girl
- Early Girl F2
- Dirty Girl
- Perfect Rogue
- Big Beef
- Stupice
- Cour di Bue
Winter Squash

Planting Density: 3 plants per rep (33.3 sq ft/plant)

Cultivars (3 reps of each)
- Winter Sweet
- Hidatsa
- Stella Blue
- Little Gem
- Lower Salmon River
- Zeppelin Delicata
Data Collection for 2017

• **Soil Preparation:** Please list dates and descriptions for each soil prep activity up until planting (example highlighted in gray)

• **Crop Info:** Please list all of the following crop info for your dry farming trial. (example highlighted in gray)

<table>
<thead>
<tr>
<th>Variety</th>
<th>Planting Date</th>
<th>Direct-seed or Transplant</th>
<th>In-Row Spacing (ft)</th>
<th>Between-Row Spacing (ft)</th>
<th>Planting Density (sq ft/plant)</th>
<th>Total number of plants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early Girl</td>
<td>May 13</td>
<td>transplant</td>
<td>3</td>
<td>5</td>
<td>15</td>
<td>20</td>
</tr>
<tr>
<td>Eel River</td>
<td>June 1</td>
<td>transplant</td>
<td>4</td>
<td>5.5</td>
<td>22</td>
<td>30</td>
</tr>
<tr>
<td>Yellow Finn</td>
<td>April 30th</td>
<td>Direct-seed</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td>20</td>
</tr>
</tbody>
</table>

• **Yield for determinate crops** – harvested all at once such as squash and dry beans

• **Qualitative data for indeterminate crops** such as tomatoes and zucchini

• **Sensory evaluation** – color, texture, sweetness
Dry Farming Project
Next Steps.....

- Develop 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 2018)
  - Intro to Dry Farming
  - Site assessment and selection
  - Soil preparation and planting
- Continue to build network of growers
  - Collaborative learning
  - Participatory research
  - Expand our drought mitigation toolbox
Topics of Interest

- Dry Farmed Orchard Systems
- Participatory Plant Breeding (and selection) for Dry Farmed Systems
  - Dirty Girl (dehybridized dry farmed Early Girl)
  - Beefy Resilient Grex – Carol Deppe (cross between Black Mitla tepary and Gaucho common bean)
- Hugelkultur
- Different types of mulching
  - Deep straw
  - Wood chips
  - Weed fabric
- Others?
Challenges and Opportunities for the home gardener......

Challenges
- Increased plant spacing – less diversity in small garden
- Need deep soil (Solomon recommends 4’ or more) with good water-holding characteristics
- Raised beds not recommended for dry farming

Opportunities
- Experiment with Mulching
  - Back to Eden – film on VIMEO
- Outreach with School Gardens
  - Soil prep and planting in spring
  - Not much happening on summer break
  - Harvest in August/September
- Host dry farming trial/demo - Join the Dry Farming Collaborative!
Dry Farming Collaborative Field Days
Every Tuesday in August!

August 1st – Corvallis
OSU Vegetable Research Farm
OSU Lewis Brown Farm

August 8th – Eugene/Springfield
Last Year’s Rain (Eugene)
Moondog’s Farm
Taproot Growers

August 15th – Southern Oregon
Southern Oregon Research and Extension Center
Ridgeline Meadows Farm

August 22nd – Veneta/Elmira
Regulus Associates
Last Year’s Rain (Veneta)

August 29th – SW Corvallis & Philomath
Gathering Together Farm
Sunbow Produce
OSU Oak Creek Center for Urban Horticulture
Mary’s River Grange – dry farm themed potluck, melon & tomato tasting
46 North Farm – Astoria, Oregon
Recommendations for those new to dry farming....

- Select site with deep soil and good water-holding characteristics.
- Start small and expand on your successes!
- Join the Dry Farming Collaborative
  - Email List (for trial hosts) – to join contact Amy Garrett
  - Facebook Group – open to the growers, extension educators, plant breeders, and agricultural professionals
For more info visit:
http://smallfarms.oregonstate.edu/dry-farming-demonstration

Or join the Dry Farming Collaborative group on Facebook

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Co-creating the future of how we manage water on our farms and gardens in the maritime Pacific Northwest ......and beyond with your involvement!