Growing without Irrigation

Amy Garrett – OSU Extension

Steve Peters – OSA & Seed rEvolution Now

Jacques Neukom – Neukom Family Farm

Bill Reynolds – dry farmer & plant breeder

Oregon State University Small Farms

OSU Oregon State University Extension Service

Growing Resilience:
Water Management Workshop Series

http://smallfarms.oregonstate.edu/wmws

February 20, 2016

- Growing Without Irrigation
- Innovative Approaches to Catching and Storing Water

March 30, 2016

- **Navigating Water Law and Restrictions in Oregon**

June 2, 2016

- **Water, Soil and Carbon for Every Farm with Keyline Design:** *Learning from the world's driest inhabited continent and it's drought solutions* –Darren Doherty (Regrarians Ltd.)

June 3-12, 2016

- **Regrarians 10 day Integrated Farm Planning course** - Albany, Oregon
  Contact Andrew Millson for more information.

August 2016

- **Dry Farming Field Days** - Corvallis, Aurora, and Central Point
  - Dates to be announced

Introduction

- Cropping options on land without water?
- Climate change: reduced snowmelt, increased temperatures, and drought
- Vegetable growers using surface water for irrigation were cut off early during the 2015 growing season.
- Up to a 50% reduction in summer water availability in Oregon is predicted within 40 years (OCCRI)

What is dry farming?

- Crop production during a dry season like summers in the Willamette Valley and Northern California
- 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*

Carol Deppe

- *The Resilient Gardener*

David Granatstein

- *Dryland Farming in the Pacific Northwest*

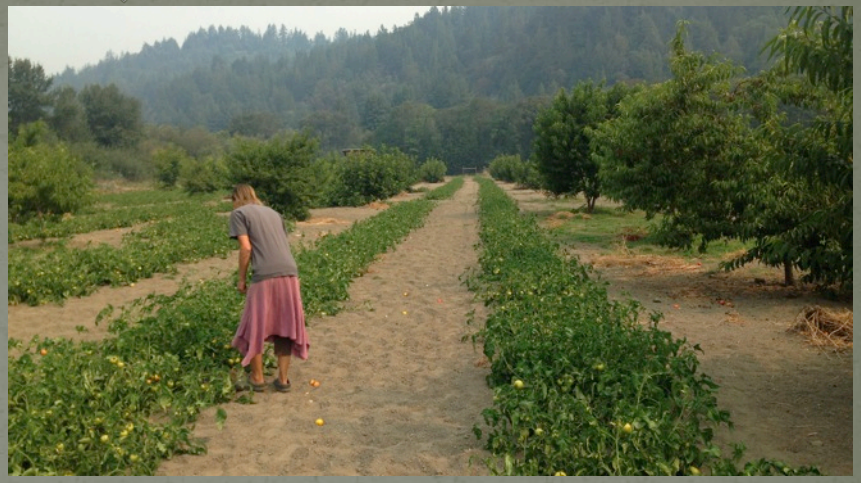
California Ag Water Stewardship Initiative

Widtsoe, John. 1920

- Dry Farming: A System of Agriculture for Countries Under Low Rainfall. 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
    - Participatory Dry Farming Research



USDA
United States Department of Agriculture
National Institute of Food and Agriculture

Jeannie Berg – Your Hometown Harvests

Small Farm News – Summer 2013 edition
Dry farming vegetables: One farmer's approach to building soil, conserving water and producing great tasting tomatoes

Veneta farmer with 40 years experience

Small Farm News – Summer 2014 edition
Common misconceptions and key points about dry farming: Case study of dry farmer with more than 40 years of experience

Dry Bean Farmer in Elmira

- Grows dry beans for Hummingbird Wholesale
- Uses dry farming/irrigation as a tool to stagger his harvest

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 16,000 gallons per acre-foot of applied water!
  - 4' of soil or more (Solomon)
  - Nutrient-rich
- Site selection
  - Plants as indicators
  - Web Soil Survey
  - Soil auger

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?

- Crop/variety selection
- Soil preparation
  - Timing
- Planting technique
  - Plant when and where there is moisture
  - Increased plant spacing
  - Pre-soaking seed
  - 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
- Surface protection
  - Dust mulch

Crop/Variety Selection

- Tomatoes
- Potatoes
- Watermelons
- Cantaloupes
- Winter squash
- Zucchini
- Dry Beans
- Corn
- Orchard crops
- Grapes

Soil Preparation -Timing

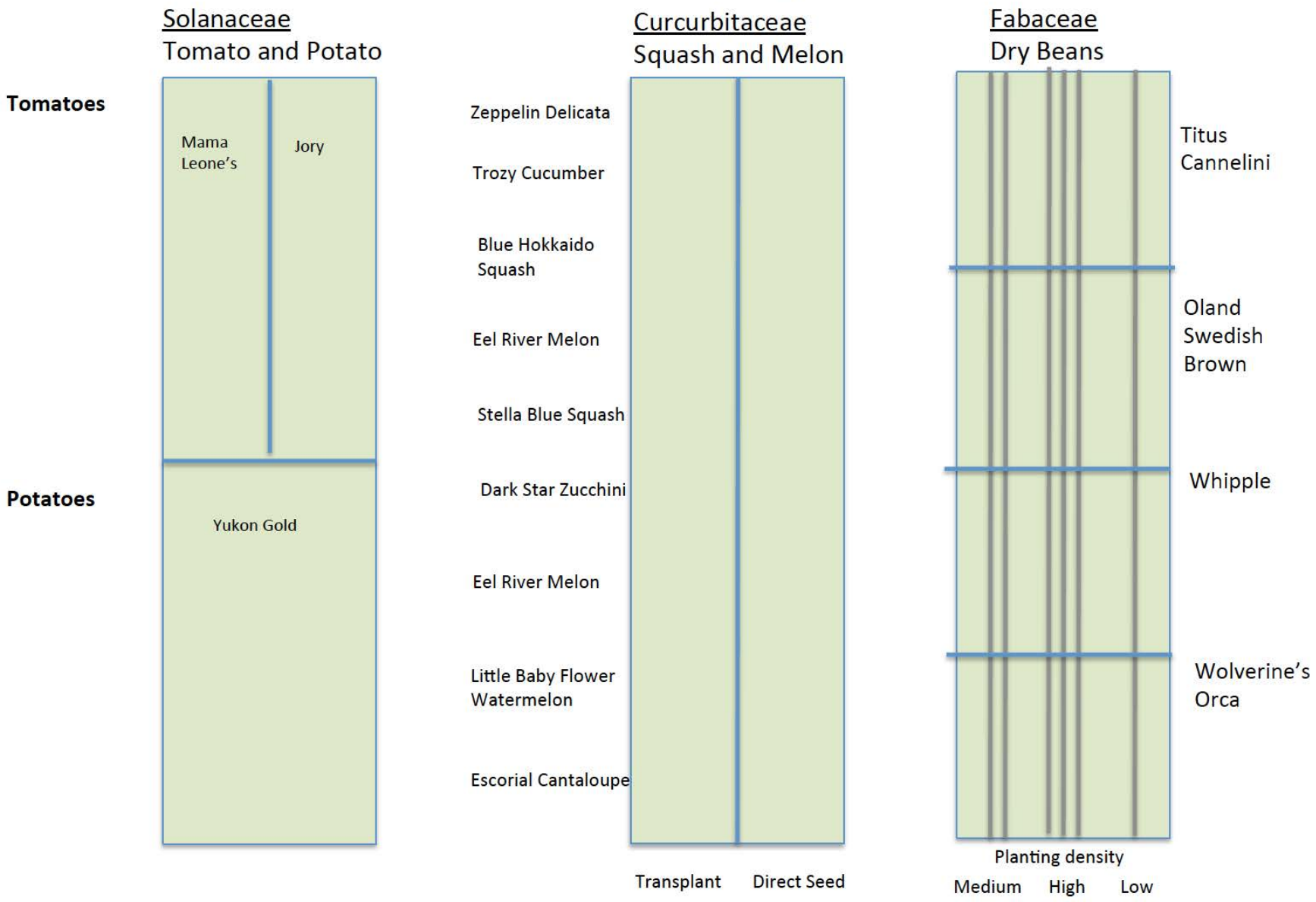
“The biggest mistake I see Oregon farmers making when they attempt to dry farm is that they don't start working their ground at the right time. If they start when it's too wet, they'll never get the tilth right after that. If they work it too dry, they'll never get the moisture back unless they're saved by late rains, which we didn't get last year. ” – Retired Dry Farmer

Dry Farming Demonstration
Oak Creek Center for Urban Horticulture

USDA

United States Department of Agriculture
National Institute of Food and Agriculture

Dry Farm Demonstration
Plot Map



Dry Beans

June 15, 2015

July 27, 2015

September 10, 2015

Squash and Melons

June 15, 2015

July 27, 2015

September 10, 2015

‘Dark Star’ Zucchini

Corvallis, OR

July 6, 2015

July 15, 2015

New Moon Organics - Shively, Ca

August 18, 2015

July 27, 2015

September 25, 2015

Tomatoes and Potatoes

June 15, 2015

July 27, 2015

September 10, 2015

Dry Farming Field Day

Dry Farming Field Day Survey

- Why is dry farming of interest to you?
  - 11% - I don't have water rights on my farm
  - 11% - My well ran dry this year
  - 86% - other reasons
    - Sustainability in a time of climate change
    - Conserving water, energy, and time
    - Weed management
    - Improved flavor
- **93% of them intend to apply what they learned at the field day on their land.**

2016 Dry Farming Project Plan

- 3 Demonstration Sites
  - Aurora
  - Corvallis
  - Central Point
- Growing Resilience: Water Management Workshop Series
- Participatory Dry Farming Research

New to dry farming?

- Select site with deep soil and good water-holding characteristics.
- Start small and expand on your successes!

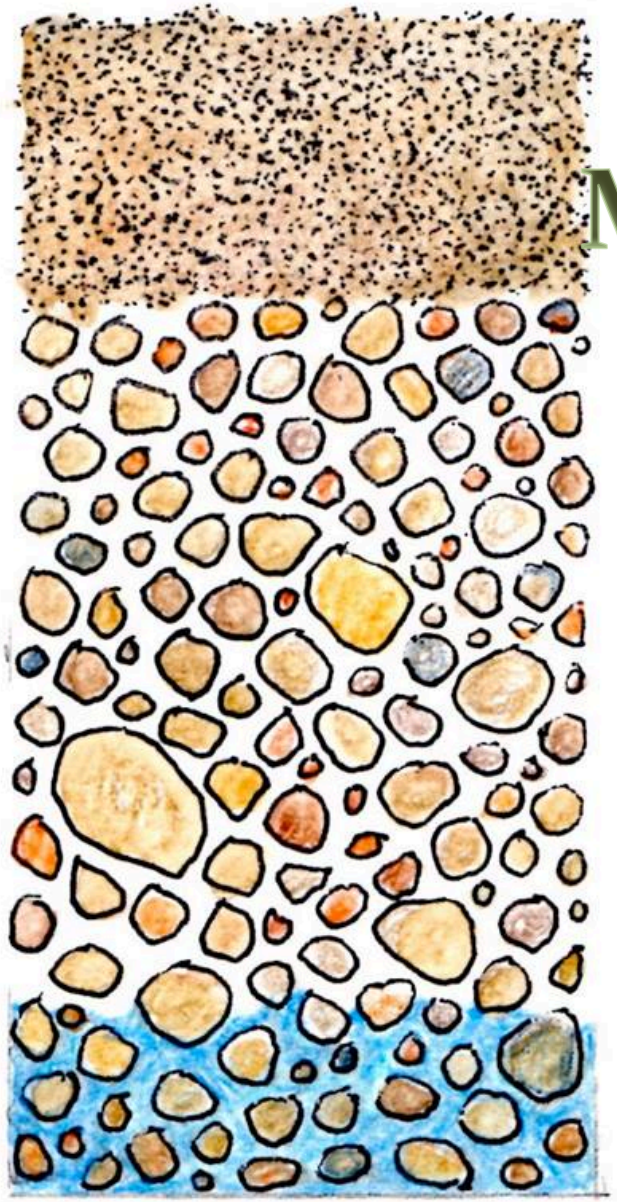
Basic Dry Farm Principle

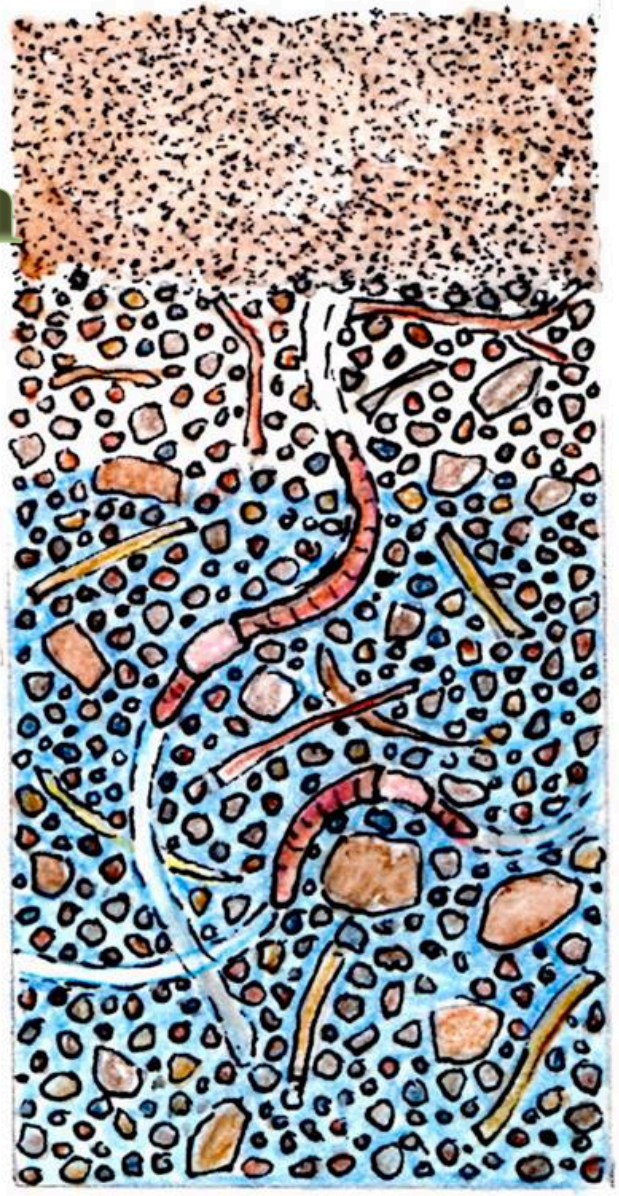
Capillary Action

Cohesive & Adhesive Forces

Pressure Gradient

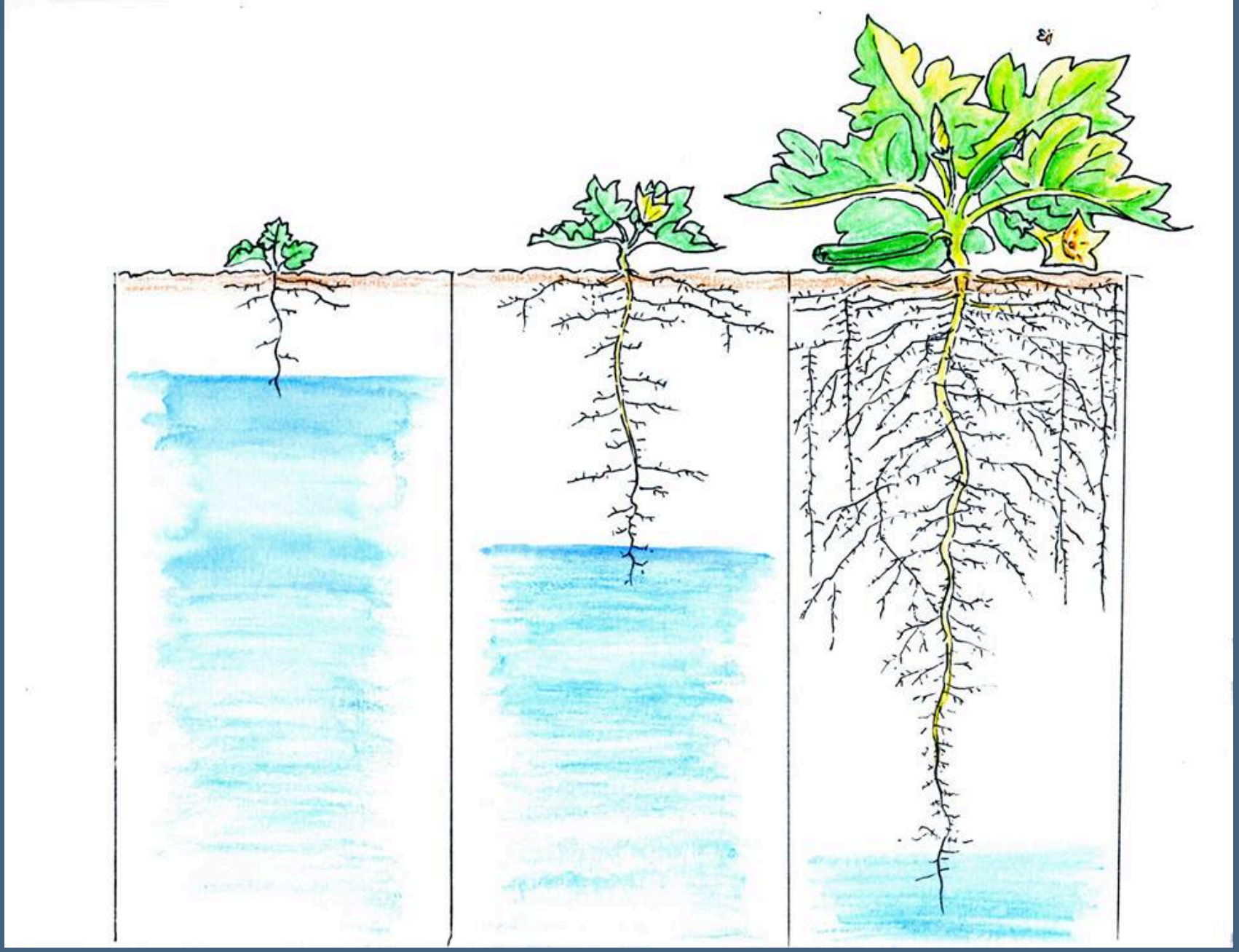
Dust Mulch





Sand
Poor Capillarity

Clay; Sandy/Silt Loams
Good Capillarity



Roots Extend To Edge Of Water-Saturated Zone

Know Your Soil

Soil Probe: One Piece Regular Soil Auger

- Total length – 53”
- 16” rubber-gripped cross handle
- 4” diameter auger
- Removes soil cores in 6” sections
- Minimum cost ~ $165.00 (AMS, Inc.)

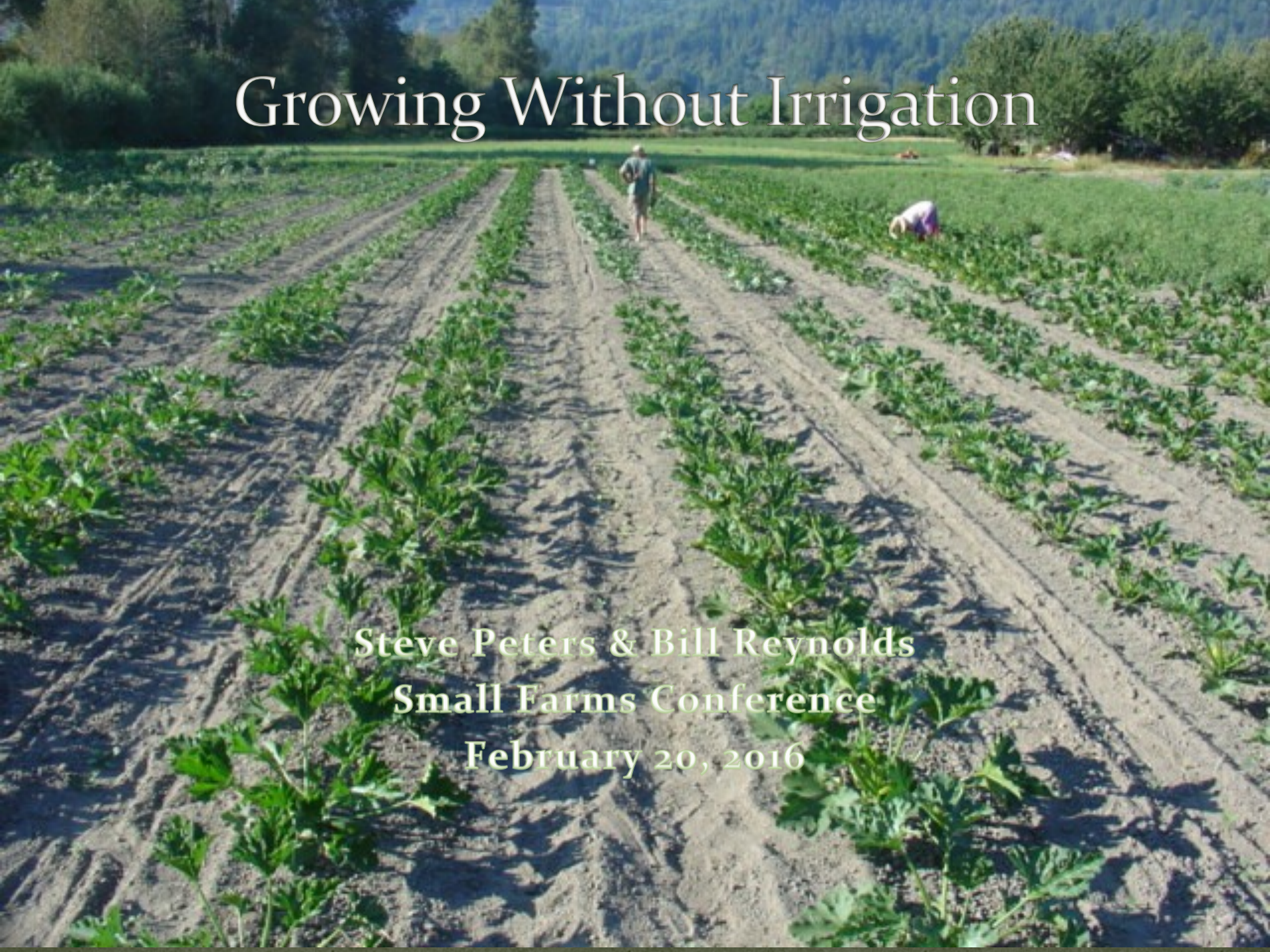
Neukom Family Farm

Willow Creek California

Jacques Neukom


460
JOHN DEERE


CUPPOLINI
butternut
butternut
buttercup



Growing Without Irrigation

Steve Peters & Bill Reynolds

Small Farms Conference

February 20, 2016


Improved, Open Pollinated,
Dry Farmed Zucchini Squash
Participants: Bill Reynolds, Eel River Produce; John Navazio, OSA;
Steve Peters, Seeds of Change

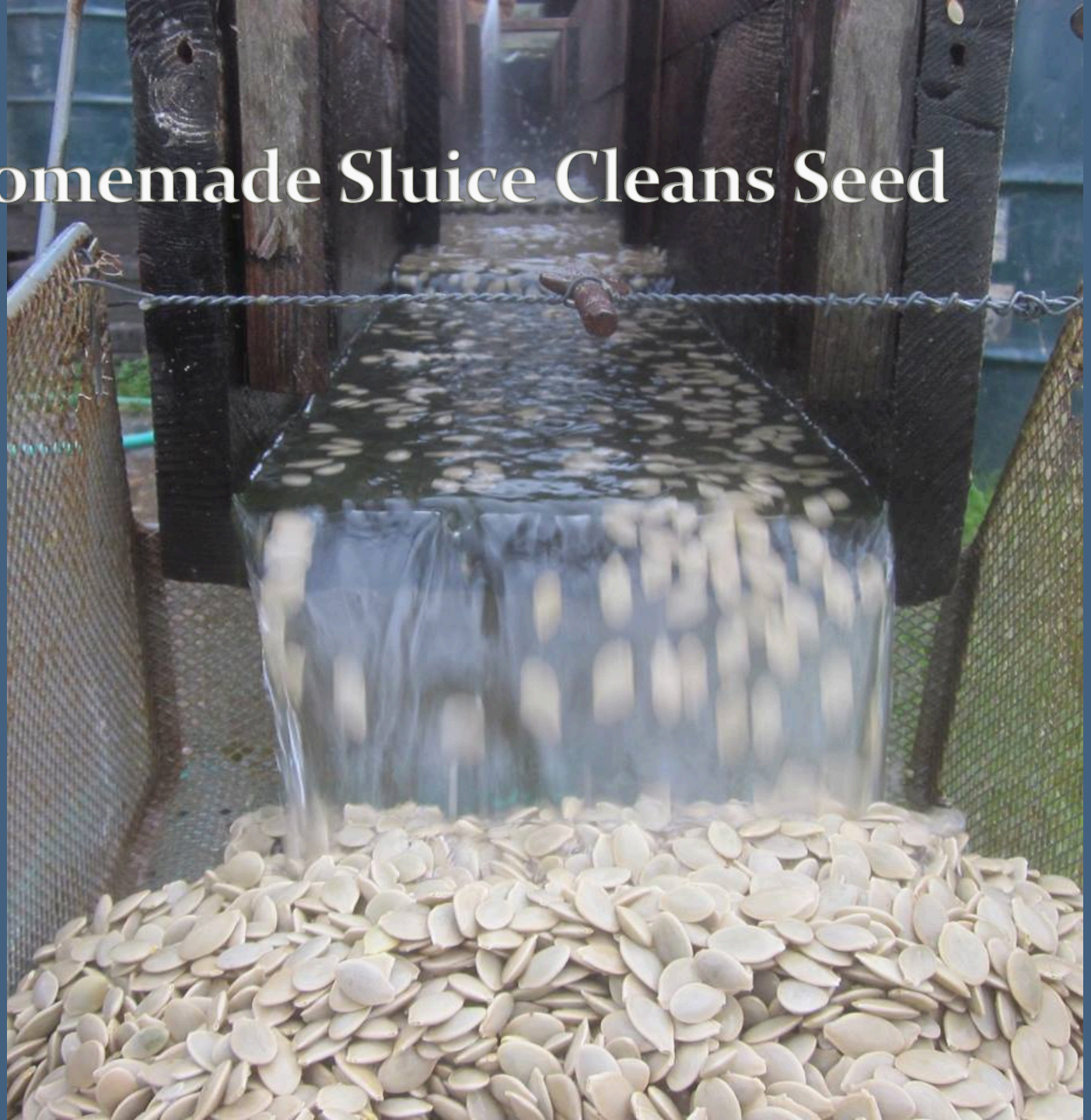

Dust Mulch

Wide Spacing


Heavy Fruit Set


Curing on the Wagon

Homemade Sluice Cleans Seed



Zucchini breeding goals

- Glossy, dark green fruits
- Light gold flesh (high lutein content)
- Cylindrical, faceted fruit
- Vigorous plants productive in dry-farm conditions
- Open canopy
- Bush habit
- Spinelessness
- Sustained Yield

Breeding History

Initial strain cross - 1998

Black Beauty (OP)

X

- High plant vigor
- Med/dark green fruit
- Long harvest window
- Heavy yielder
- Extremely thick vines
- Spiny leaf stems
- Many off-type fruit

Raven (F1)

- Very dark green, shiny, ridged fruit
- High lutein levels
- Open canopy
- Smooth leaf stems
- Low plant vigor
- Concentrated fruit set
- Short harvest window

Population Development

- Phenotypic mass selection for 4 yrs
- Several thousand plants grown
- Saved seed from superior 10-20 plants each generation
- Made 3 rounds of selections
  - Vigor
  - Plant type
  - Fruit type
- Final selection produced ‘Black Eel’ OP/Seeds of Change variety


Black Eel Zucchini

Self Pollination

- Selfing attempted on 50 superior plants (from 500)
- 26 successful selfs. Kept in separate bags
- Each bag = full-sib family

Progeny Testing

- All 26 full-sib family progeny planted in rows (25-35 plants/row)
- Eliminated all but 5 families
- Rogued individuals from remaining families
- All plants then inter-mated, but families saved separately
- Repeated process for 4 yrs


‘Dark Star’ Zucchini


Signature Star

Baja Zucchini Trial - 2006

- Large, organic operation
- Dark Star yielded fruit for 5-6 weeks longer than leading hybrids varieties
- Male flowers produced until the end
- Stocky, open plants
- Low spines
- Less cucumber mosaic virus & powdery mildew
- More variable than F1's, but higher yield

Commercial Hybrid (left)

Dark Star OP (right)

2007 -2011

- Maintained via mass selection
- Alternate stock seed and production seed years
- Increased acreage in Baja
- Dark Star only zucchini to survive Baja freeze in 2010-2011
- Only organic zucchini sold by Whole Foods stores nationwide Feb. 2011

Breeding Strategy
For Crops Suitable for Dry Farming

-Do not coddle plants. Expose them to drought conditions, heat, and wind, so strong individuals can be identified.

- Start with sufficiently large population.

-Begin mass selection process for minor improvements of existing variety.

- For creating a new variety, make initial strain crosses to establish breeding population.

- Continue mass selecting or employ progeny selection.

- Validate progress with comparison trials.

Dry Farming Project

For more info visit:
http://smallfarms.oregonstate.edu/dry-farming-demonstration

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