Water-Wise Vegetable Gardening

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Vegetables

- Healthful, low calorie, and critical component to the human diet
- Provide many essential vitamins, minerals and fiber
- However, vegetable crops are mostly composed of water (80-95% on average)

Growing Water-Wise Vegetables

Three Approaches:

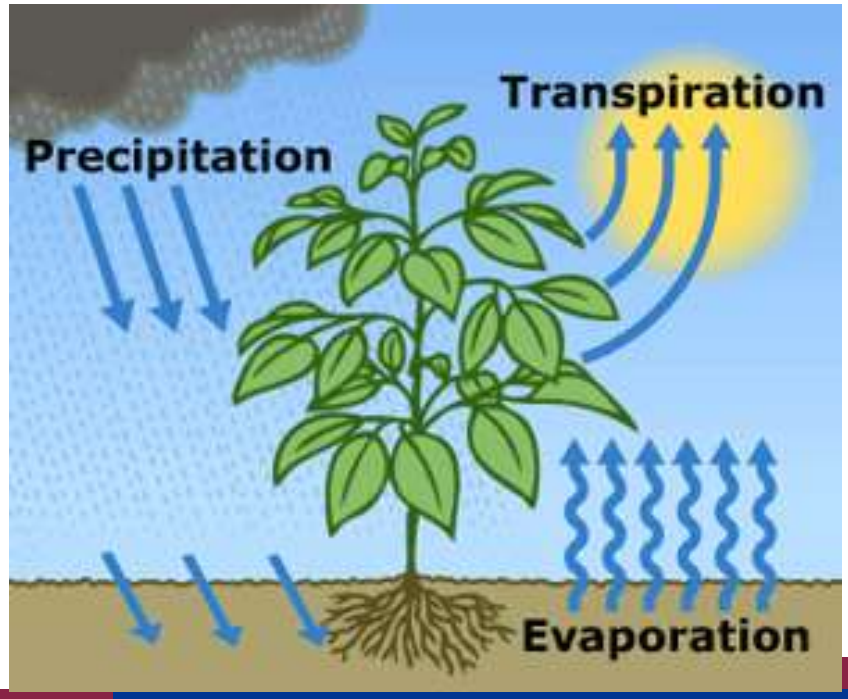
- 1) Modify the environmental conditions to minimize water loss to evaporation and leaching
- 2) Manage growth of vegetable plants for minimal supplemental water needs
- 3) Plant vegetables that need less water to produce a crop

Water-Wise Vegetable Gardening

MODIFY THE GARDEN ENVIRONMENT

Transpiration

- Loss of water by a growing plant
- Critical for cooling, nutrient uptake, and turgidity
- Increased rate with
  -high air temperature
  -low relative humidity
  -windy conditions
  -sunlight



http://ga.water.usgs.gov/edu/graphics//evapotranspiration.gif

Transpiration

- Drought resistant plants reduce transpiration through
  -Heavy cuticle
  -Small leaves
  -Less leaf area
  -Spines or hairs on leaves

- Most vegetable plants are not drought tolerant

How do we minimize transpiration rate in vegetable plants?

- ***Increased*** rate with
  -high air temperature
  -low relative humidity
  -windy conditions
  -sunlight
- ***Reduce rate*** with
  -wind protection
  -shading

Control Weeds

- Weeds compete with vegetable crops for water, as well as nutrients
- Weeds also frequently harbor diseases that will harm your vegetable plants

Control Weeds

- “Plants growing where you don’t want them to grow”
- Don’t allow weeds to go to seed!
- Control by:
  -Mechanical removal
  -Mulch
  -Herbicides
  -Targeted water application

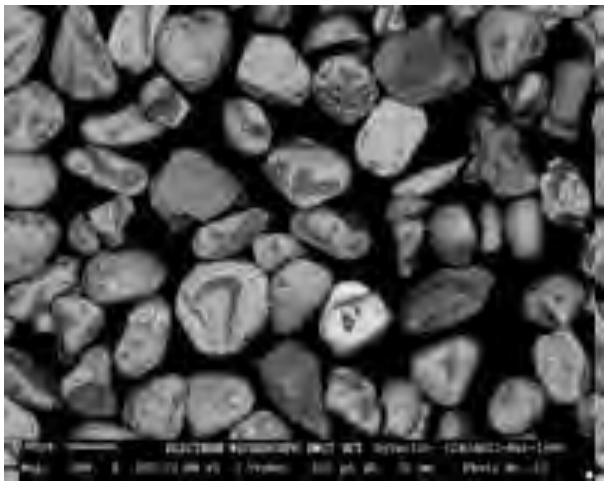
Know your soil

- Soil type affects frequency and duration of watering

Photo Courtesy of Netafim

Soil Texture

- Coarse textured soils (high % sand)
  - Good drainage and tilth
  - Hold very little water
  - Minerals readily leached



http://www3.imperial.ac.uk/pls/portallive/docs/1/7290187.JPG

  - Needs more frequent, 'lighter' watering

Soil Texture

- Fine textured soils (high in silt and/or clay)
  - Poor drainage, hard to manage
  - Hold soil water tightly
  - Bind more nutrients
  - In general, needs less frequent watering

http://www.semp.us/_images/biots/Biot226PhotoF.jpg

Prepare Soil to Maintain Moisture

- Best soil is deep, well drained & contains plenty of organic matter
- Organic matter holds soil moisture
  Example: Sponge vs. Gravel

- Most soil in NM is very low in organic matter
- Increase through regular addition of compost, manure, organic mulch

Mulch

- Material placed on soil surface around vegetable plants
- How to apply
  - Once plants are established, cover ground 2-4”
  - Don’t cover vegetable plants

Mulching

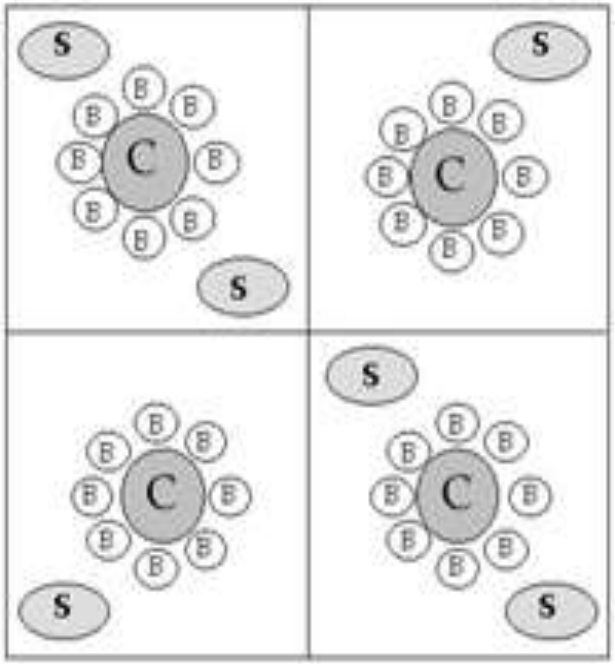
- Pros
  - Conserves soil moisture
  - Keeps weeds at bay
  - Keeps fruit off ground
- Cons
  - Could harbor pests
  - Labor and cost investment
  - Wind

Mulch

- **Organic types**
  - Straw, leaves, wood chips, newspaper, pecan shells, compost
- **Plastic mulch**
  - Excellent for preserving soil moisture and inhibiting weed growth
  - Doesn’t add to soil organic matter and creates disposal issue

Zuni Waffle Garden

- ‘Three sisters’ planting for dry conditions
- Waffles are approx. 12’ x 12’
- Each individual square is indented and surrounded by a high rim
- Allows maximum water efficiency in arid, southwest climate



Source: National Sustainable Agriculture Info. Service, www.attra.ncat.org

Water-Wise Vegetable Gardening

VEGETABLE PLANT MANAGEMENT

Water

- The vast majority of vegetable crops grown in New Mexico will require supplemental irrigation

- Controlled application can aid in vegetable management for drought tolerance

Water Requirements Through the Season

Know your plants, including critical windows for optimal watering

- Germination and transplant establishment periods are always critical
- Critical water stage for most vegetables is while consumable part is growing
- ‘Fruiting’ vegetables (tomato, chile peppers, melons) is at flowering and fruit set

Encourage Deep Root Growth

- The deeper the roots, the better a plant can hold up to drought stress
- Less frequent, deep watering encourages
- Water slowly to let moisture percolate

- Some vegetables naturally have shallow roots so wouldn't benefit: Onions, Lettuce

- Deep rooted vegetables include: **Asparagus, Squash, Tomatoes**

Deliver Water Directly to the Roots

- Sprinklers and flood irrigation are *least* efficient

- Drip irrigation and soaker hoses are *most* efficient
- Water early morning or at night to minimize evaporation

Water

- Many gardeners provide more irrigation than needed
- Too much water can also stress or kill plants
  - Water-saturated soil can ‘smother’ roots
  - Many soil borne diseases thrive in overly wet soil

- Watch for wilting, plant stress

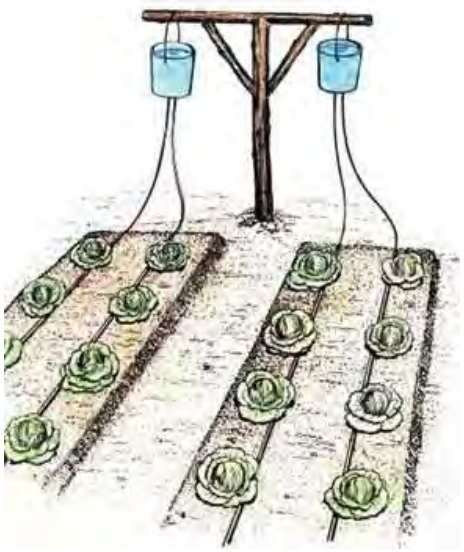
Irrigation

- Check soil moisture regularly
  - Irrigate when top two to four inches is dry to the touch
- Automate the system with controllers
- 1 inch of water in a 1’X 1’ space is a little over half a gallon

https://www.pinterest.com/explore/irrigation-systems/

Irrigation Systems

- Sprinkler
- Drip
  - Tape
  - Emitter
  - Low pressure
- Soaker Hose
- Flood



Check Your Flow Rate

- Measure the amount of water coming out of your spigot or valve
  - Time it takes to fill a five gallon bucket

Vegetable Water Application

- In general, approximately 1 inch of irrigation water is applied to vegetables weekly (about 1/3 inch every other day, depending on soil type and other factors)

Don’t Water ‘Dirt’!

- Avoid applying water to surrounding soil away from roots
  -At best - soaks into ground away from root zone
  -At worst - initiates weed growth

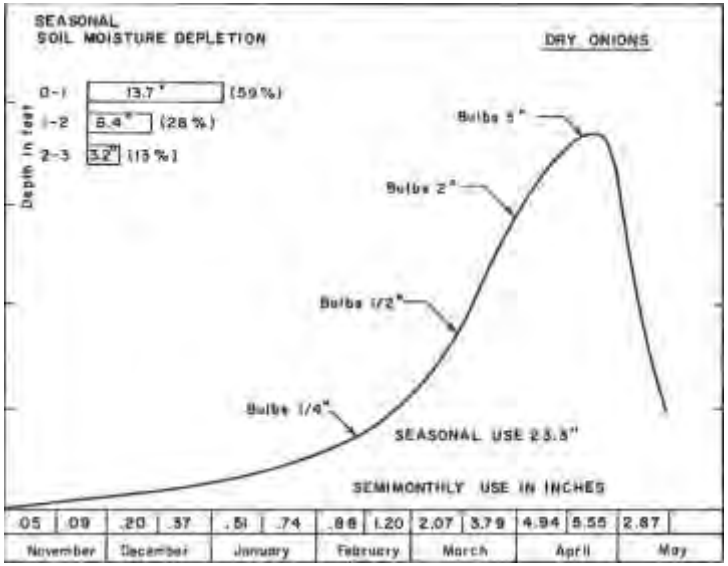
Water-Wise Vegetable Gardening

PLANT VEGETABLES THAT NEED LESS WATER

Cooperative Extension Service
NM STATE

Consumptive Use of Water

- Quick maturing vegetable crops typically have less total irrigation needs
  -Bush (determinate) vs. Vining (indeterminate)



https://cals.arizona.edu/crops/irrigation/consumuse/conusefinal.pdf

General Water Requirements

- Tomatoes, Eggplants, and Peppers
  - Need most water during flowering and fruiting
- Vine Crops (cucumbers, summer and winter squash, and melons)
  - Need most water during flowering and fruiting
- Carrots, Onions, Lettuce
  - Need consistent water throughout the season
- Sweet corn
  - Need the most amounts of water to produce quality crops

Low Water-Use Vegetable Crops

- Tepary Beans
- Black-eyed Peas (Cowpeas)
- Okra
- Asparagus
- Squash (some varieties)
- Tomatoes (some varieties)

Tepary Beans (*Phaseolus acutifolius*)

- Native to the American Southwest where they've been a staple crop for thousands of years
- From the Papago Indian phrase "t'pawi", meaning "it's a bean"
- Small beans in a wide variety of colors

Photo credit Native Seed/SEARCH

Cowpeas

- Black-eyed peas, as well as many other types
- Immature beans can be eaten like green snap beans
- Most produce long vines; allow 3-5’ between rows

http://en.wikipedia.org/wiki/Black-eyed_pea

Cowpeas (*Vigna unguiculata*)

- Originated in Africa
- Need little water to grow; grow poorly if watered too much
- Thrive in high heat

Baker Creek Heirloom Seeds

http://www.rareseeds.com/store/vegetables/cowpeas/

Okra (*Abelmoschus esculentus*)

- Member of the mallow family (Malvaceae), closely related to hibiscus and cotton
- Origins in northern Africa
- Grown for their immature pods
- Known for glutinous consistency (gumbo)

http://www.graphicpenguin.com

Okra Planting

- Okra plants prefer humidity and heat
- Well-drained, fertile soil is optimum
- Intolerant of prolonged wet soil
  -Plant in areas with good drainage
- Plant when soil is warm (> 60^{o}F)

Asparagus (*Asparagus officinalis*)

- Tolerant of heat, drought and salinity
- Perennial; productive for many years
- Dioecious
  - male and female plants
- Modern varieties all male for higher yield

http://en.wikipedia.org/wiki/Asparagus

Asparagus

- Wild asparagus near the Rio Grande

The Cucurbits: Pumpkins, Squash and Gourds

Cucurbita Species	Pumpkins	Summer Squash	Winter Squash	Ornamental squash
C. pepo	Pie, Miniatures	Crookneck, Zucchini	Acorn, Fordhook	Gourds
C. maxima	Jack O Lantern		Hubbard, Banana	Turban
C. moschata	Crookneck pumpkins		Butternut	
C. argyrosperma	Cushaw		Cushaw	

Squash: *Cucurbita argyrosperma*

- *C. argyrosperma*: Includes ‘Cushaw’, many of the best tasting pumpkins and squash
  -Requires a long, warm growing season
  -Many are grown for their edible seeds

- *C. argyrosperma* varieties: ‘Tennessee Sweet Potato’, ‘Hopi Cushaw’

Squash: *Cucurbita moschata*

- *C. moschata*: Includes the butternut and "cheese pumpkins"
  -Require 1-2 week curing
  -Some varieties will hold even longer than *C. maxima*

- *C. moschata* varieties: 'Waltham Butternut', 'Long Island Cheese'

‘Seminole Pumpkin’ (*C. moschata*)

- Cultivated by the Seminole Indians in Florida
- Large, spreading vines
- Fruit with long shelf-life

http://www.southernexposure.com

Squash: *Cucurbita maxima*

- *C. maxima*: Includes many of the winter squash varieties
  -Many require a month storage indoors to cure
  -Some will keep for several months and may develop improved flavor
  C. maxima varieties: Kabocha, Buttercup, Hubbard

Red Kuri Squash (*C. maxima*)

- Also called ‘Baby Red Hubbard’
- Thick-skinned, orange colored, winter squash
- Delicate, chestnut-like flavor
- Drought tolerant

Squash: *Cucurbita pepo*

- *C. pepo*: Includes most of the summer squash, and small to medium-sized ornamental pumpkins
  -Require 1-2 week curing
  -Most do not keep well after curing

- *C. pepo* varieties: Zucchini, Spaghetti, Acorn, Delicata

Summer Squash

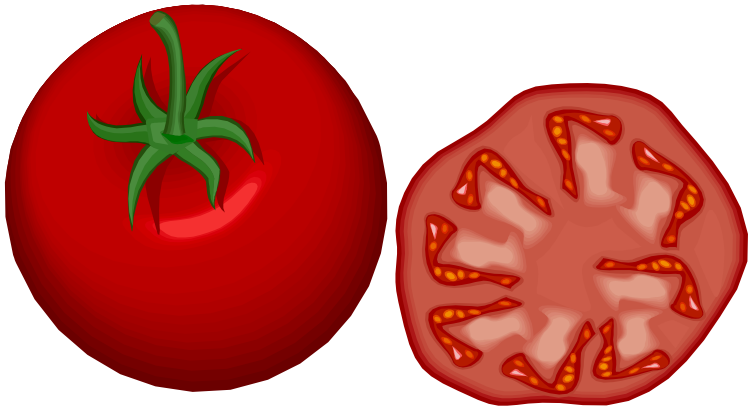
- Zucchini (*C. pepo*) cultivar ‘Dark Star’ -bred for deep, penetrating roots for drought tolerance

http://www.seedsofchange.com

Tomato Cultivars

- Drought-tolerant varieties:
  -Pineapple
  -Yellow Pear

- Look for early maturing types



Drought Tolerant Cultivar Selections: Tomatoes

- '**506 BUSH**'
  - Bright red fruit grows on strong vines that reach only about 18 inches tall.
  - Plants are drought tolerant and yield well. Determinate. 62 days.
- '**Celebrity Tomato**'
  - Hybrid, determinate, 70 days, red, globe (8-12 ounces)
  - 1984 All-America Selections Award Winner
- '**Punta Banda**'
  - Collected from the Punta Banda Peninsula in Baja California
  - Plants produce hundreds of red meaty, thick skinned fruits despite heat, water stress and poor soil
  - Renowned for its early maturity

http://www.seedsofchange.com

Nativeseeds.org

Drought Tolerant Cultivar Selection: Cucumbers

- '**Beit Alpha Cucumber**'
  - Its middle eastern heritage makes this a heat tolerant plant
  - Beit Alpha is generally gynoecious (producing mostly female flowers) which means it starts fruiting earlier and is very productive
  - Pick fruit when small, 6-8"

Water Harvesting

- Gray Water: Example: Place bucket in shower to catch water while it's heating
  -Viable option for container gardens

- Rainwater: Depending on size of collection area, even small rain events can provide helpful quantities of irrigation water

Water-Wise Vegetable Gardens Summary

- Incorporate organic matter into the soil
- For deep rooted crops, deliver water slowly & directly to encourage deep roots
- Cover bare ground with mulch
- Eliminate weeds
- Modify the growing environment through wind breaks and shading

Water-Wise Vegetable Gardens Summary

- Consider drought tolerant vegetables
- Select efficient irrigation system
- Take advantage of gray water and rainwater harvesting when appropriate
- Pay attention to plants' current needs-don't under- or over-water
- Each garden is unique; consider your situation & plan accordingly

Thank You

- Questions?