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

VEGETABLE PLANT MANAGEMENT & INFRASTRUCTURE
Water

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

• Controlled application can aid in vegetable management for drought tolerance
Water

• Too much water can also stress or kill plants
  ➢ Water-saturated soil can ‘smother’ roots
  ➢ Many soil borne diseases thrive in overly wet soil
  ▪ Dig down to roots to check moisture
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
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
Disorders: Blossom End Rot

• Caused by Calcium (Ca) deficiency at growing point in fruit
• Drought stress during fruit set prevents transportation of Calcium
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
Don’t Water ‘Dirt’!

- Water applied to surrounding soil away from roots
  - at best - soaks into ground below root zone
  - at worst - initiates weed growth
Deliver Water Directly to the Roots

• Sprinklers and flood irrigation are *least* efficient

• Drip irrigation and soaker hoses are *most* efficient

• Water at night to minimize evaporation - most plant growth occurs at night
The Three Sisters

- Corn, Beans, and Squash benefit each other when planted closely together
- Corn provides support for beans
- Beans (legume) provide nitrogen to soil
- Squash leaves keep weeds suppressed
Zuni Waffle Garden

- Waffles are approx. 12’ x 12’
- Each individual square is indented and surrounded by a high rim
- Sunflowers are often planted along the edges
- Allows maximum water efficiency in arid, southwest climate
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

• “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
Control Weeds

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

• Soil type affects frequency and duration of watering
Soil Texture

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

- ‘Light’ soil
Soil Texture

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

- ‘Heavy’ soil
Courtesy of Netafim

Heavy Soil  Medium Soil  Light Soil
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

• To increase, add compost and manure
Compost

• Benefits of compost
  – Organic matter
  – Aeration
  – Soil moisture

• Make your own compost

• Compost must reach 130°F for approx. 7 days

http://www.aggregatepros.com/images/Compost_Heap_lg.jpg
Compost

• Ingredients
  – Leaves, manure, yard clippings, food scraps
• Turn often
• Keep moist, not wet
• Don’t add
  – Meat, dairy, slow decomposing items
Compost

• When to add
  – Pre planting
  – Post planting

• How to add
  – Till in
  – Mulch

http://www2.grist.org/images/advice/how/2008/08/19/shovel-o-compost_h528.jpg
Manure

- Improves nutrient content of the soil
- Compost manure to kill undesirable microbes, weed seed
- Be wary of salt content
Mulch

- Material placed on soil surface around vegetable plants
Mulching

• Pros
  – Keeps weeds at bay
  – Conserves soil moisture
  – Keeps fruit off ground

• Cons
  – Could harbor pests
  – Labor and cost investment
  – Wind

http://thailand.ipminfo.org/images/components/OrganicFarm_egg_plant_mulching_3.JPG
Mulch

• How to apply
  – Once plants are established, cover ground 2 – 4 inches
  – Don’t cover vegetable plants

• Types
  – Straw, leaves, wood chips, newspaper, plastic, pecan shells, compost
Mulch

- Las Cruces Utilities produces and provides free, composted mulch made from yard waste
- Old Foothills Landfill
  555 S. Sonoma Ranch Blvd.
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)
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
Consumptive Use of Water

- From: “Consumptive Use of Water by Major Crops in the Southwestern United States”

- United States Dept. of Agriculture – Agricultural Research Service Conservation Research Report Number 29

- https://cals.arizona.edu/crops/irrigation/consumuse/conusefinal.pdf
Cauliflower – Consumptive Water Use

[Graph and chart showing seasonal soil moisture depletion and seasonal use in inches for cauliflower.]
Cantaloupe – Consumptive Water Use

Figure 22.—Mean consumptive use for early season cantaloupe at Mesa, Ariz.

https://cals.arizona.edu/crops/irrigation/consumuse/conusefinal.pdf
Onions – Consumptive Water Use

![Graph showing seasonal soil moisture depletion for dry onions.](https://cals.arizona.edu/crops/irrigation/consumuse/conusefinal.pdf)
PLANT VEGETABLES THAT NEED LESS WATER

Water-Wise Vegetable Gardening
Low Water-Use Vegetable Crops

• Look for determinate, early maturing types or vegetables with a quick growth period
Low Water-Use Vegetable Crops

• Tepary Beans
• Black-eyed Peas (Cowpeas)
• Okra
• Asparagus
• Squash (some varieties)
Tepary Beans (*Phaseolus acutifolius*)

- From the Papago Indian phrase “t’pawi”, meaning “it’s a bean”
- Small beans in a wide variety of colors (black, white, brown, mottled)

http://commons.wikimedia.org/wiki/Category:Phaseolus_acutifolius
Tepary Beans

- Native to the American Southwest where they’ve been a staple crop for thousands of years

Source: 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

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

Baker Creek Heirloom Seeds
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°F)
Okra Harvest

- Harvest pods when less than 4” (2-3” optimum); larger pods are tough & bitter
- Harvest every other day (4-6 days after flowering)
- Wear gloves & long sleeves when harvesting
Okra Cultivars

• ‘Clemson Spineless’: 56 days to harvest. Dark green, slightly grooved pods with minimal spines

• ‘Red Burgundy’ plants with green leaves, burgundy stems branches and leaf ribs

www.burpee.com

www.superseeds.com
Okra Cultivars - Heirlooms

• ‘Silver Queen’ 80 days to harvest. Light, whitish-green pods

• ‘Star of David’ Thick, heavily ribbed pods

• ‘Eagle Pass’ Landrace from the Carrizo Springs and Eagle Pass, TX area
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
Asparagus Culture

• Start from crowns

• Don’t harvest 1\textsuperscript{st} year

• Stop harvesting
  – spears are less than diameter of a pencil

• Allow ferns to develop to feed the plants
Asparagus Varieties

- Open-pollinated varieties:
  - ‘Mary Washington’
  - ‘Martha Washington’

- Hybrid, all-male varieties:
  - ‘Jersey Giant’
  - ‘Jersey Knight’
  - ‘Purple Passion’


www.parkseed.com
## The Cucurbits: Pumpkins, Squash and Gourds

<table>
<thead>
<tr>
<th>Cucurbita Species</th>
<th>Pumpkins</th>
<th>Summer Squash</th>
<th>Winter Squash</th>
<th>Ornamental squash</th>
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<tbody>
<tr>
<td>C. pepo</td>
<td>Pie, Miniatures</td>
<td>Crookneck, Zucchini</td>
<td>Acorn, Fordhook</td>
<td>Gourds</td>
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<tr>
<td>C. maxima</td>
<td>Jack O Lantern</td>
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<td>Hubbard, Banana</td>
<td>Turban</td>
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<tr>
<td>C. moschata</td>
<td>Crookneck pumpkins</td>
<td></td>
<td>Butternut</td>
<td></td>
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<tr>
<td>C. argyrosperma</td>
<td>Cushaw</td>
<td></td>
<td>Cushaw</td>
<td></td>
</tr>
</tbody>
</table>
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’
Drought Tolerant Cultivar Selections: ‘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
  - 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
Drought Tolerant Cultivar Selections: 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
Drought Tolerant Cultivar Selections: Summer Squash

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

http://www.seedsofchange.com
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“
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
In Summary, Water-Wise Vegetable Gardens:

• Incorporate organic matter into the soil
• Deliver water slowly & directly to the roots
• Cover bare ground with mulch
• Eliminate weeds
• Modify the growing environment through wind breaks and shading
In Summary, Water-Wise Vegetable Gardens:

- Consider drought tolerant vegetables
- Select proper 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?