Vegetable Gardening in the Low Desert: Growing Successful, Seasonal Harvests of Fresh Vegetables

By Pam Perry
Maricopa County Master Gardener

A garden's productivity is in direct proportion to the gardener's generosity!

Mission of the Maricopa County Master Gardener Program:

To teach people to select, place, and care for plants in an environmentally responsible manner based on research specific to the low desert.

Suggested Resources

- AZ 1005 Vegetable Planting Calendar
- University of Arizona Master Gardener Manual, on line
- University of California Master Gardener Manual

Desert Gardening for Beginners:

How to Grow Vegetables, Flowers and Herbs in an Arid Climate

Desert Landscaping for Beginners
Earth-Friendly Desert Gardening

- Desert Gardening by George Brookbank
  - Recommended with reservations.
  - This is out dated, but he tried many things and has good cultural information to share about many vegetables and small fruits we can grow in the low valley.

MaricopaMasterGardener.org

- Publications to download
- Monthly garden guide for planting, care, recognizing seasonal problems and insect challenges

Basics of vegetable gardening

- Soil
- Water
- Climate or seasons
- The making of the garden

Understanding Soils in the Valley

- What makes them different
- How the differences affect plant growth
- How we compensate for the challenges they offer

Irrigation

- Gardening in the west is easy: all you have to do is make the soil and make the water
Climate and Seasons

We can plant and harvest something in the garden every month of the year!

Selecting varieties and crops to optimize our harvest!

SOILS in the Valley

• Original source: decomposed ancient mountains: ROCK
  - Inorganic matter
    • Many different particle sizes
    • Contains essential mineral components necessary for plant growth
    • Good structural basis for garden soil

Physical Soil Characteristics

1. Composed of superfine particles or clay, often compacted
   This is a factor for water absorption and retention, influencing irrigation

Chemical Soil Components

• 17 elements or nutrients necessary for plant growth
• Macronutrients: the big three
  - Nitrogen N
  - Phosphorus P
  - Potassium K

2. Sand: promoting quick drainage and poor water retention

3. Without organic matter
**Micronutrients**

- 14 additional elements necessary for healthy plant growth
- Present in our soil

**Soil Tests Assess: Nutrients and Alkalinity**

Desert soils exhibit:
- low levels of nitrogen
- acceptable levels of phosphorus, potassium, and most micronutrients

- Alkalinity: Local soils register about 8 on the pH scale of 1-10
  - as pH rises beyond 6.5 many nutrients are not as accessible to plants
  - This is a condition of resisting chemical bonds on the molecular level

- Plants absorb water and nutrients on the molecular level
  - Molecules need opposing charges to allow bonding
  - Alkalinity changes the electrical charge of some nutrients inhibiting bonding

**Biological Components of Soil**

- Insects
- Bacteria
- Fungi
- Nematodes

**Missing links in desert soils**

- Organic material—plant debris
- Worms
- Beneficial insects
- Insects that participate in the decomposition process
**Ideal Soil: Sandy Loam**
A balance of many sized particles, organic material, and biological components
Porous enough to allow air and water to percolate through, but able to retain water to sustain growth
Macro and micronutrients essential for plant growth
Ph of 5-6: neutral soil aids in absorption of nutrients

**Steps and transitions from 'desert soil' to 'vegetable garden'**
- Physical manipulation of soil
  - Tilling, spading, digging
- Add “soil amendments”:
  - things we put into the soil
- Compensatory measures
  - Raised beds, irrigation, mulches

**Why Add Soil Amendments?**
- By varying the particle sizes of the mineral components, and
- Changing the physical structure of the soil
- We will increase porosity, improve drainage and water retention

**What are 'Soil Amendments'?**
Things We Put in the Soil.
- Compost
- Manures
- Fertilizers
- Living organisms
- Other materials

**What is Compost?**
- Decomposing organic materials:
  - Anything that was once living
  - When we talk about vegetable gardening we are talking about vegetative matter
Where does compost come from?

• Homemade -- make some at home
  - Kitchen scraps
  - Garden plants
  - Yard trimmings
  - Available manures from plant eating animals....

• Commercial composting
  - Large scale operation undertaken to reduce large amounts of organic material into a commercial compost
  • Located in yellow pages under 'landscape materials'
  • Available through nurseries and garden centers

Manures: Animal waste product

When talking about vegetable gardening we are talking about herbivores as our manure source.
Different animal manures have different properties and nutrient values.
The composting process begins in the digestive track of the animal.

• Sheep, goat, rabbit, llama manure:
  - not high in nitrogen
  - Without additional bedding matter this can be added directly to garden
  - If mixed with bedding material composting is preferred before use

• Horse
  - Often contains weed seed
  - Additional composting will reduce weed seed if temperatures of 160 degrees are reached
  - Can be added directly to the garden
  - Learn to recognize seedlings of feed components
- Dairy manure is good quality manure
- Steer manure had a reputation of being high in salts, but feeding practices have changed.
- Most available bagged at nurseries and garden centers.
- Determine freshness by fragrance. Compost or allow to age in the garden if in doubt about the potency.

- Green manure
  - A term applied to a cover crop which, while relatively immature, is turned into the soil and allowed to decompose
  - Used to hold soil, reduce erosion, nutrient leaching, break up compacted soils, improve organic components

- Chicken, other poultry
  - High in nitrogen. When applied to the soil the garden should rest a couple weeks for the potency to mellow.
  - Do not use this in the same volume as you would the other manures
  - Great to add to compost

**Fertilizers**
- Organic: Animal or vegetative based
  - Manures, blood meal, bone meal, worm castings, seaweed, compost are examples of organic fertilizers

- Inorganic fertilizers:
  - Chemical, often petroleum based
  - Mineral, a processed form of mineral i.e. sulfur
    - Powder, granular, liquid, or water soluble formulations
    - Guaranteed chemical analysis, are arithmetically described: 10-10-10, 21-0-0...

**What to Look For**
- Macronutrients: The three numbers on the package: 10-10-10 or 21-0-0
  - Nitrogen, N,
  - Phosphorus, P, and
  - Potassium, K
- Valley soils are notoriously low in nitrogen
**Recommended fertilizer ratios**

- Balanced 10-10-10, 15-15,15
- Ammonium phosphate 16-20-00
  - As primary soil amendment
- Ammonium sulfate 21-0-0
  - Sulfur component offsets the soil alkalinity

- Ammonium nitrate was once a recommended fertilizer and is still listed in out-of-date publications. It is no longer available to the general public since the Oklahoma city bombing.

**Micronutrients**

- Valley soils test well for most micronutrients
- If soil is lacking specific micronutrients they too can be applied and worked into soils, after soil tests confirm the need

**Why Fertilize?**

- To supplement nutrients in short supply or depleted by repeated crops
- To provide extra nutrients when plants require them
- To make nutrients more available in our alkaline soils
- To compensate for climatic conditions which inhibit nutrient absorption

**Nitrogen (N)**

- The nutrient which promotes green, leafy growth.
- Very volatile: gaseous, solid, aquatic,
- Use in moderate amounts as necessary to promote healthy growth.
- First number listed on a package label

**Phosphorous (P)**

- Readily available in our soils
- less available to plants during as soil temperatures drop.
- Promotes root growth, flowering and fruit set
- Repeated planting may result in deficiencies; supplement as needed
Potassium

Promotes stem development, fruit and seed production
Our soils have available amounts naturally
Repeated planting may result in some deficiencies, supplement as needed

Living Organisms

• Soil is full of living organisms. Many are too small to see
  • Worms, insects, bacteria, fungi, nematodes, algae
• New soil delivered from commercial source may not have many of these critters

• Living organisms improve nutrient availability
• Keep soil aerated
• Continue the decomposition process
• Can be engaged in symbiotic relationships with plants.

Adding living organisms

• Red wrigglers—fishing worms
• Inoculants for legume crops
• Nematodes
• Other living organisms thru homemade compost

Other Amendments and Chemicals

• Peat moss—an inert form of plant material in arrested decay process. No nutrients, hard to re-wet, often used in potting soils
• Soil sulfur—to mitigate alkalinity
• Gypsum
  • counteract excessive salt build up

• Lime
  • a common east coast component
  NEVER recommended for soils in the desert!
• Sand
  - Suggested to improve drainage
**Remember:** Adding sand to clay gives us adobe or concrete
**Alternative:** pumice— a volcanic rock that helps change physical soil structure

---

**Irrigation**

Design a system with flexibility to accommodate additional beds and seasonal needs
- Run a line to the compost pile.
  • Things in the desert petrify they do not putrefy.

---

**Additional Irrigation**

• Provide a spigot for a hose
  - Use to water transplants, special needs plants,
  - washing insect pests,
  - mixing liquid fertilizers,
  - washing veggies, etc.

---

**What Sort of System?**

• Best to apply water at the soil level
  - Inline drip
  - Soaker hoses
  - Emitters
  - Laser tube

---

**Find More Irrigation Information**

• Books
• Arizona Municipal Water Users Association
• City water departments
• Cooperative Extension
• Desert Botanical Garden
• Inspect several options in garden
Climate—It is different here!

- Fall: September/October/November
  - Soil temperatures cool
  - Evenings cool
  - Daylight hours are fewer
  - Not much rain naturally
  - Cool season weeds begin to sprout

- Winter: December/January/February
  - Days quite short and cool
  - Soil remains cool
  - May get cloudy days and rain
  - Frost and freezing temperatures very likely
  - Cool season weeds sprout

- Early spring! February/March
  - Day time temperatures are warmer
  - Soils begin to warm
  - Days increase noticeably in length
  - Some rain expected

- Spring: April/May
  - Soils are warm—time to plant early summer crops
  - Days are longer approaching solstice
  - Warm season weeds emerge

- Summer June/July/August
  - Long hot sunny days
  - Soil temperatures increase substantially
  - Hot drying winds in late afternoon are the norm
  - Cool season crops will have died
  - Summer monsoons may provide rain

The making of the garden

- Options
- Siting
- Soil prep
- Selecting your crops
- Plants vs. seed
- Routine care, harvests, IPM
Options for your gardens

- Container Gardens
- Raised beds
- Traditional layout
- Integrated planting: ‘edible’ landscaping
- Elements of all the above

Container gardening

- At least 1 foot deep, 18-24 inches across
- On wheels if possible
- Well drained
- Near water source
- Choose a soil mix specific for container gardening

Building Raised beds

- A raised bed may be only 3-4 inches high, defining a planting area within a traditional garden layout
- Or built to a height comfortable to bend, sit, stand, and work at
- Materials will be of your choice to fit hard scape, budget, flexibility

Characteristics of raised beds

- Raised beds may heat up more quickly than in-ground beds
- Raised beds may dry out more quickly than in-ground beds

• You should be able to reach the middle from both sides, or if available from only one side, reach across the whole bed
• Make edges wide enough to sit on
• Most treated lumber today is treated with inert materials

Container Gardening
Traditional gardens: ground level

- Traditional ‘victory’ garden rectangle with rows and paths
- Dig and amend soil and leave permanent paths
- Irrigate planting rows only

Edible landscaping

- Incorporating vegetable and fruits into the overall landscape plan to best use microclimates and expand available areas for vegetable gardening
- Plant annuals and biennials together to facilitate soil prep, and permanent plantings in groupings as well.

Determine your commitment

- Time, Energy, Space, Need
- We garden as much for pleasure as from need
- Our gardens supplement what we can obtain from market
- Years ago the market supplemented what people could grow

Selecting the garden site

- 6-8 hours of sun or very strongly reflected light on a north side for instance
- Convenient for irrigation purposes
- Convenient to visit and tend
- Accessible by wagon or wheelbarrow, tools
Little luxuries
- Potting, planting, and nursery area
- Compost pile site
- Storage for tools and equipment

Site and Soil Preparation
Clear site of debris
Remove any other living plants
Design your layout
Determine if you will want raised beds, a collection of containers, or an old-fashioned garden

- Dig soil to a depth of 12-18 inches the width of the bed until it is loose and crumbly. No big chunks! [physical manipulation]
- Remove rocks
- You may need to water the area and allow it to soften as part of this process.

- Beware of over watering
- Do not dig supersaturated soil. If you can squeeze water out of the soil, allow it to become drier before continuing to dig.

For raised beds
- Use a good quality screened fill or top soil to partially fill raised beds and add organic material equaling about 50% of the volume
- Proceed as you would for a traditional garden

- Use 'planters mix' from landscape supply companies listed in yellow pages
- This should have a sand or clay base with substantial organic material and even a little pumice mixed in.
- It should be screened to 1/2 to 3/4 inch size particles
- Length X width X height gives cubic measurement of amount needed
• Add 3-6 inches of organic material
  - Dig organic material in well, integrating it completely with native soil
• Apply chosen fertilizer at the rate recommended on the package
  - Length X width equals area
  - Dig this in to a depth of 12 inches.

• Rake the bed level
• Install irrigation
• Run irrigation so that the bed is irrigated 15-18 inches deep
• Adjust irrigation as necessary for even coverage

• Allow to the new garden to rest until the soil is as damp as a wrung out sponge and amendments mellow
• You are ready to plant!

It is time for the fun part! Do Some Research
• What shall I grow? Selecting your crops and choosing your varieties
  - Refer to AZ 1001
  - Refer to seed and plant catalogues
  - Take a trip to local nursery and garden center!

• Grow things you like to eat
• Grow things you would like to eat but are prohibitively expensive in the market
• Or are simply only good when eaten very fresh!
• Grow things just to try them
• Because they are pretty

But, grow them using AZ1005 as your guide
Look at AZ1005
Find Oct 9 along the column at top.
Follow down to a checked box, and follow that back left to identify the crop to be planted during this part of the month
Seed packet tips and cultural information

- Disregard 'when to plant info': use AZ1005
- Seed planting depth
- Seed spacing / Plant spacing
- Time to germination
- Days to maturity
- Descriptions, recipes, hints, lore

Label each row when planted with
- plant name
- planting date
- date of approx harvest is useful on crops new to you

The relation of season on crop maturation

**Fall season:** days get progressively shorter, soil progressively cooler.
By winter plants approach winter dormancy
Short season varieties should have sufficient maturity provide a continued crop

**Winter:** days are short, temperatures are cold
Frost sensitive plants will need frost protection, or they may die
Growth slows on many plants

**Spring:** days get longer, warmer, soils get warmer... growth resumes.
New plantings of heat tolerant varieties will thrive and bear as temperatures rise in late spring
Crops that are not heat tolerant may become stressed, and show signs of reduced vigor

**Summer:** days very long, hot and so are soils
Plant varieties that need high soil temps, and long days around the solstice to grow and bear
Shade protection will extend the production life of some crops
• Summer: days very long, hot and so are soils
• Plant varieties that need high soil temps, and long days around the solstice to grow and bear
• Shade protection will extend the production life of some crops

• For a fall crop you may use the same crop but a different variety than you would in the spring
• Choose varieties:
  - That mature before the season ends
  - That are resistant to disease and pests
  - Are adapted to the climate and soils

Use seed catalogs for research and selecting what to grow in your garden
  - Compare characteristics of several varieties easily
  - Recognize which will make better spring or fall crops
  - Be suited to the space available to your garden

Crop Rotation
• Do not repeat plants from the same families in the same place season after season.
• Container gardens: refresh soil and rotate crops in them as well
  - Disease and pathogens can build up in the soil if crops are not rotated
  - Some nutrients can become deficient

Vegetable Plant Families
• **Cruciferae** -- brassica or cabbage family
  - Cabbage, kale, broccoli, cauliflower, Brussels sprouts, oriental cabbages and Bok Choy, rutabaga, mustard, radish, and turnip
  - Most of these are cool season vegetables here in low valley -- fall or winter planted

• **Solanaceae** -- nightshade family
  - Tomato/potato/pepper/eggplant
  - Spring planted for summer harvest
  - Can be perennial but removal and relocation of new crops is recommended to prevent disease from fungal and bacterial build ups in the soil
• **Leguminosae**
  - Peas, beans, peanuts
  - Peas, garbanzo, and fava beans are fall / winter planted
  - Snap beans, southern or black eye-peas, asparagus beans and lima beans are spring to summer planted

• **Cucurbitaceae**
  - Cucumbers, Armenian cucumbers
  - Muskmelons, watermelons, squashes, pumpkins and gourds
  - Most of these are primarily spring planted for spring through summer harvest.
  - Refer to AZ 1005 for recommended dates

• **Liliaceae**
  - Asparagus
  - this is a perennial plant requiring 2 full years of growth before harvest.
  - Tolerates alkaline soils well, is a heavy feeder and needs moderate to high amounts of water.

• **Chenopodiacae**
  - Beets, chard, spinach, various amaranth species
  - Cooler season crops with the exception of the amaranth species
  - Leaves from all are edible, beets are a root crop as well

• **Gramineaee--grass**
  - Corn: two seasons of planting possible
  - Wind pollinated, needs close spacing to facilitate pollination
  - Is a heavy feeder: amend soil heavily, apply nitrogen when plants are knee high.

• **Compositae**
  - Sunflowers, endive and lettuces

• **Amaryllidaceae**
  - Leeks, onions, garlic
  - Fall planted
• Malvaceae
  - Okra: a summer planted standard in southern gardens
  - Hibiscus-

• Umbelliferae
  - Carrots, celery, parsnips, dill; plants with a flat top head composed of many tiny flowers
  - Fall through spring planted

Shall I purchase plants or Seeds?

• The benefits of using plants
  - 3-8 weeks quicker to harvest
  - No uncertainty about care for germination
  - Quicker to see ‘the garden’
  - Not having to make space to start seedlings at home

• Other considerations
  - Limited selection of varieties
  - Transplant set-back/shock possible
  - Too many of some varieties

Benefits of planting seeds

• Greater choice of varieties
• Easier to plan successive plantings
• Less expensive
• Seeds are real Magic!

• Other considerations
  - Irrigating sufficient to germinate and maintain young seedlings
  - Protecting young seedlings from predation
  - Having to decide among all-I-I-I those choices
  - Storing seed: cool dry place

Recommended to start from seed

• ‘Big seed’ or almost foolproof plants
  - Beans, peas, corn, squash, melons, gourds, radishes
• Plants that should not be transplanted
  - Root vegetables: beets, carrots, parsnips, rutabaga, kohlrabi
Plants not seeded into a garden

- Those that need 6-10 weeks longer season than we have
  - Tomato, eggplant, pepper, tomatillo
  - Garlic: grow from cloves of garlic instead of seed
  - Jerusalem artichokes from tubers
  - Asparagus from 2 year old ‘crows’

Handling young plants

- Always handle young plants and seedlings by leaves or roots
  - If these become damaged the plant has the capacity to grow more
  - Never damage the stem, there is only the one, when it is damaged, it always will be!

Space plants or seeds as directed on tags or seed packets
- Plant most plants with the soil level of the plug even with the soil in the garden

There is always an exception to the rule
- Tomatoes are the primary exception to this rule. They will grow roots along the stem
- Bury as much of the stem as possible while leaving several inches of plant above ground

Mulches and mulching

- A mulch is something that is used to cover the soil between plants or rows
- Organic or inorganic
- Permanent, temporary
- Can be rock, carpet, compost, hay, straw, chips, newspaper, commercial compost

Mulches in summer

Moderate soil surface temperatures
Help prevent evaporation
Help to prevent a crust from forming on the soil surface
Keep many weeds from germinating
Can protect melons and other crops from insects, pests and rot
Mulches in winter

*Can prevent soil from warming as spring progresses*

In winter, soils stay much damper, mulch provides cover for insects, good and not so good

*Prevent weeds from germinating*

---

How to choose which one, where

*Use commercial compost where you will want to dig it in after harvesting a crop*

*Use straw to protect melons from soil contact*

*Use a more permanent type for paths: chipper chip, rock, carpet…*

---

Pests

- Weeds
- Insects
- 2 or 4 legged critters

---

Weeds

- Compete for water and nutrients
- Can shade out less aggressive valued plants
- Host insect pests
- Remove when small before they flower and make seed!

---

Control by

Mulching: weed seed needs light to germinate
- Mechanical removal—pulling or hoeing
- Identify the plant
- Applications of herbicides. Not all pesticides work on all plants

---

Insects/IPM

- Few insects in garden are true pests
  - Always identify insects before considering treatment options
  - Follow good cultural practices: pests are attracted to stressed plants
  - Sacrifice infested plants as first step of treatment
• Use least toxic means of control first!
• Include plants that host beneficial insects
• Use mechanical means of control
  - Row covers, hand picking, removing egg cases
  - Remember you are planning to eat from this garden!

2 or 4 legged pests
• Build walls, erect fences
• Use hardware cloth as under layer for beds
• Use netting or light shade cloth for tenting threatened plants

Common questions master gardeners might be expected to answer
• I do not think I have room or time for a vegetable garden……is it a lot of work?
• How do I get rid of the bugs?
• How often should I water?
• When should I plant ‘_____’?

• Why is my plant looking yellow? Brown? Spotty? Looking wilted?
• Why are my tomatoes not setting fruit?
• When should I harvest my ‘_____’?
• Is there a secret for making compost

• What does gardening organically mean?
• What are the differences between hybrids, open pollinated, heirloom seeds?
• How do you know what varieties taste best?
• Where do you buy you seeds?

Thanks to Jo Cook, Charlie Stephens, Pam Slate, and Laurel Reader for the graphics and photos in this presentation.