

# Soil Preparation and Fertilization

January 10, 2011

**Lunch & Learn With The Masters**

Joe Janak

County Extension Agent – Ag/NR

Victoria County

Improving Lives. Improving Texas.

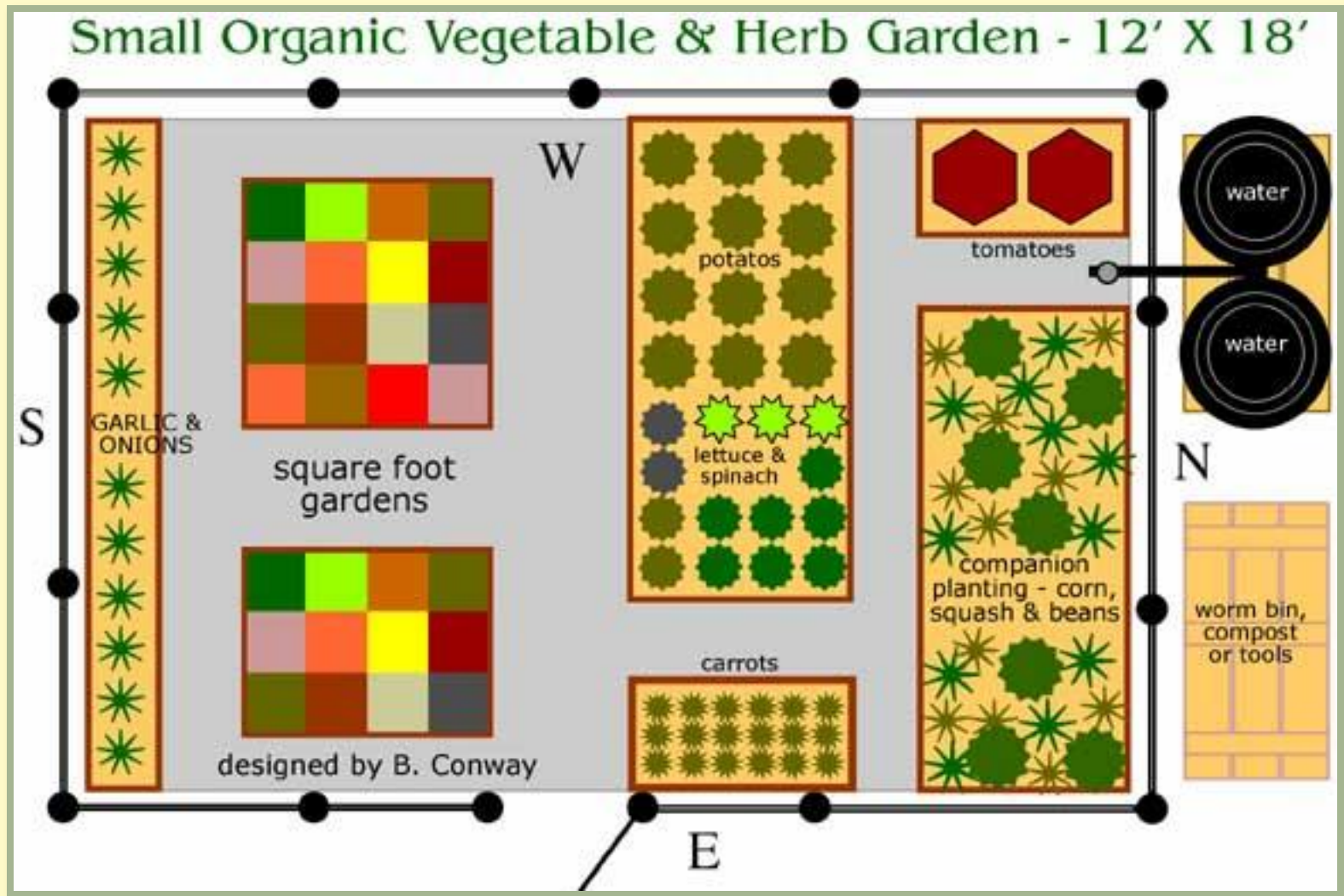


# Begin with a Plan

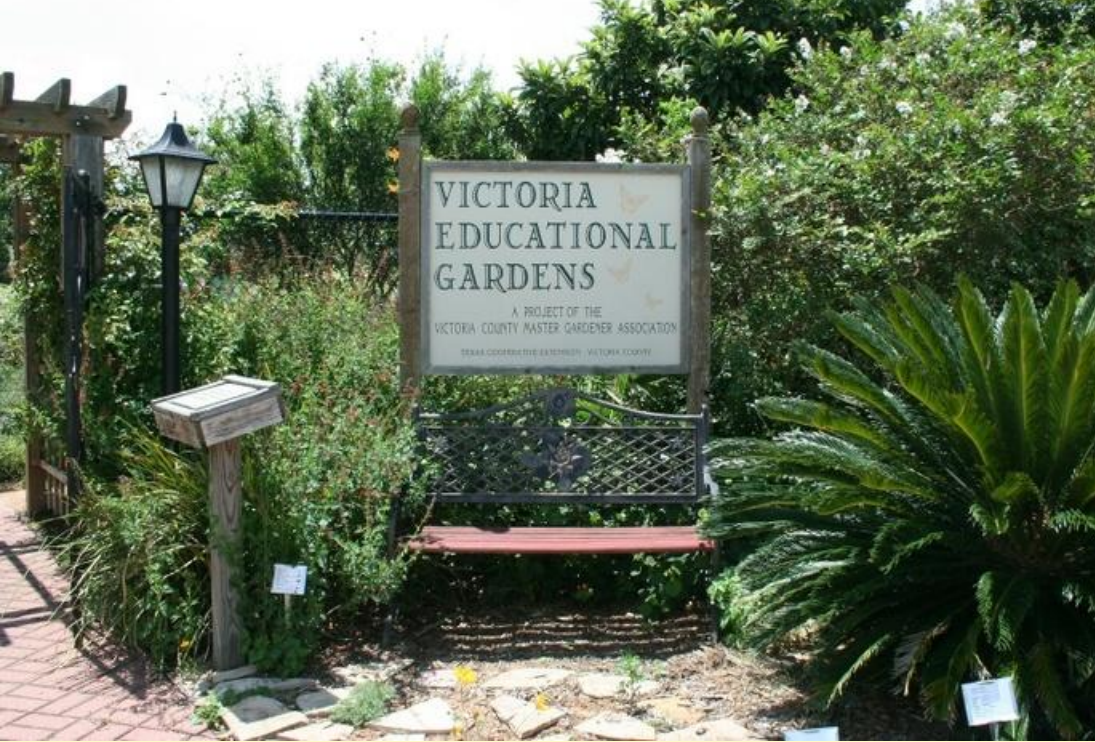


Begin with a Plan

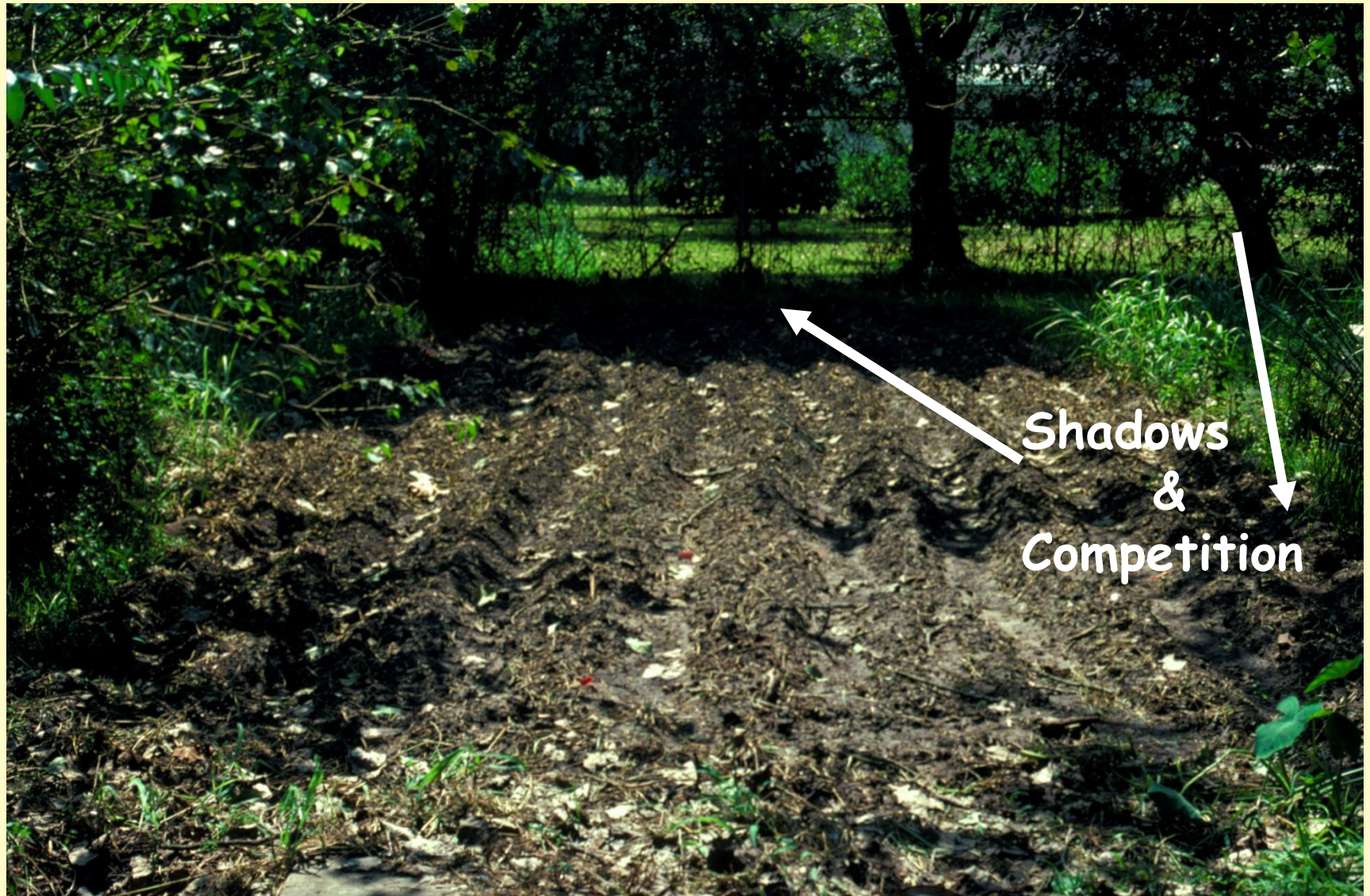
# Garden Design





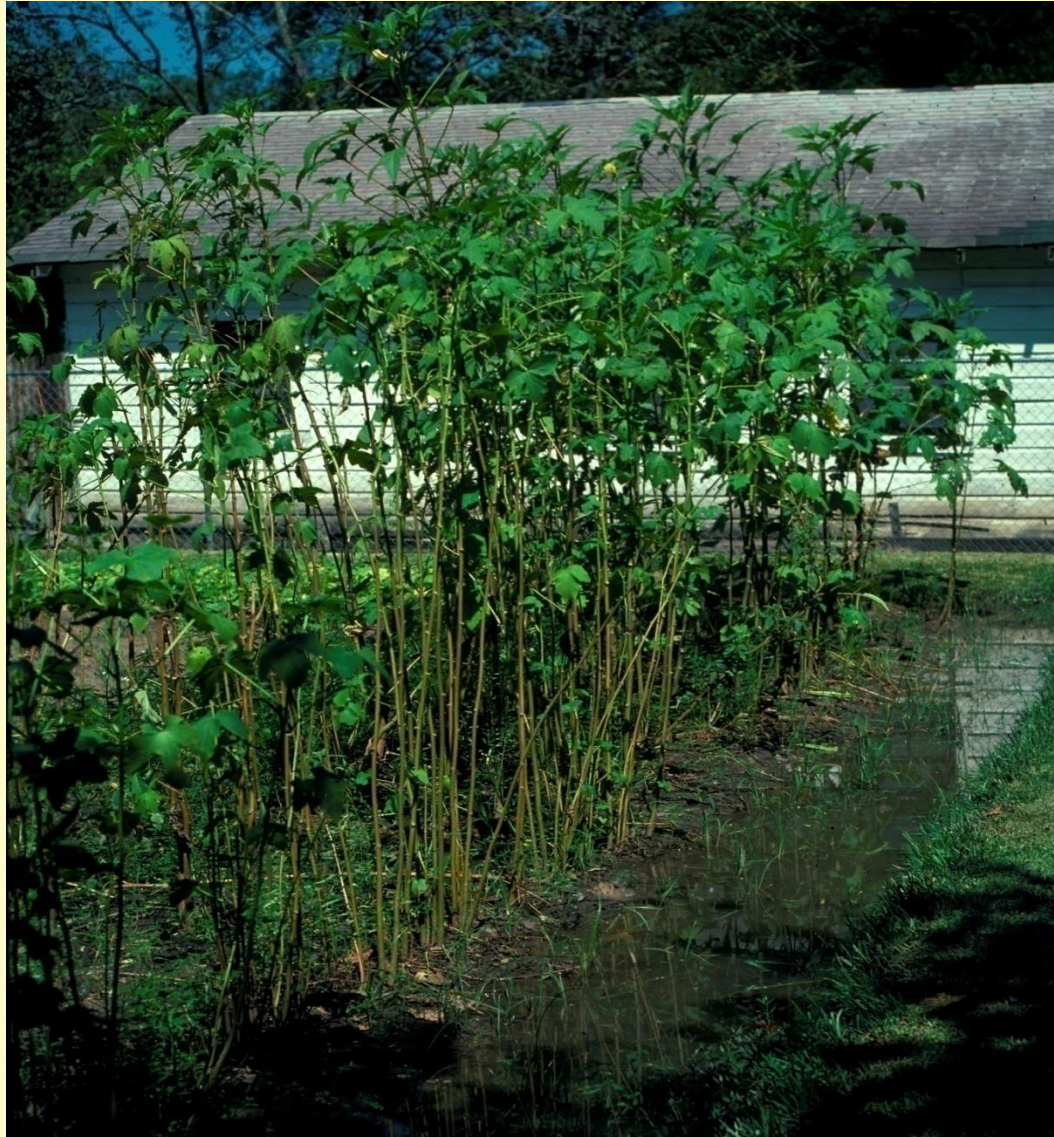


# Poor Garden Site



# **POOR SITE !!**

**(Water standing, poor drainage)**



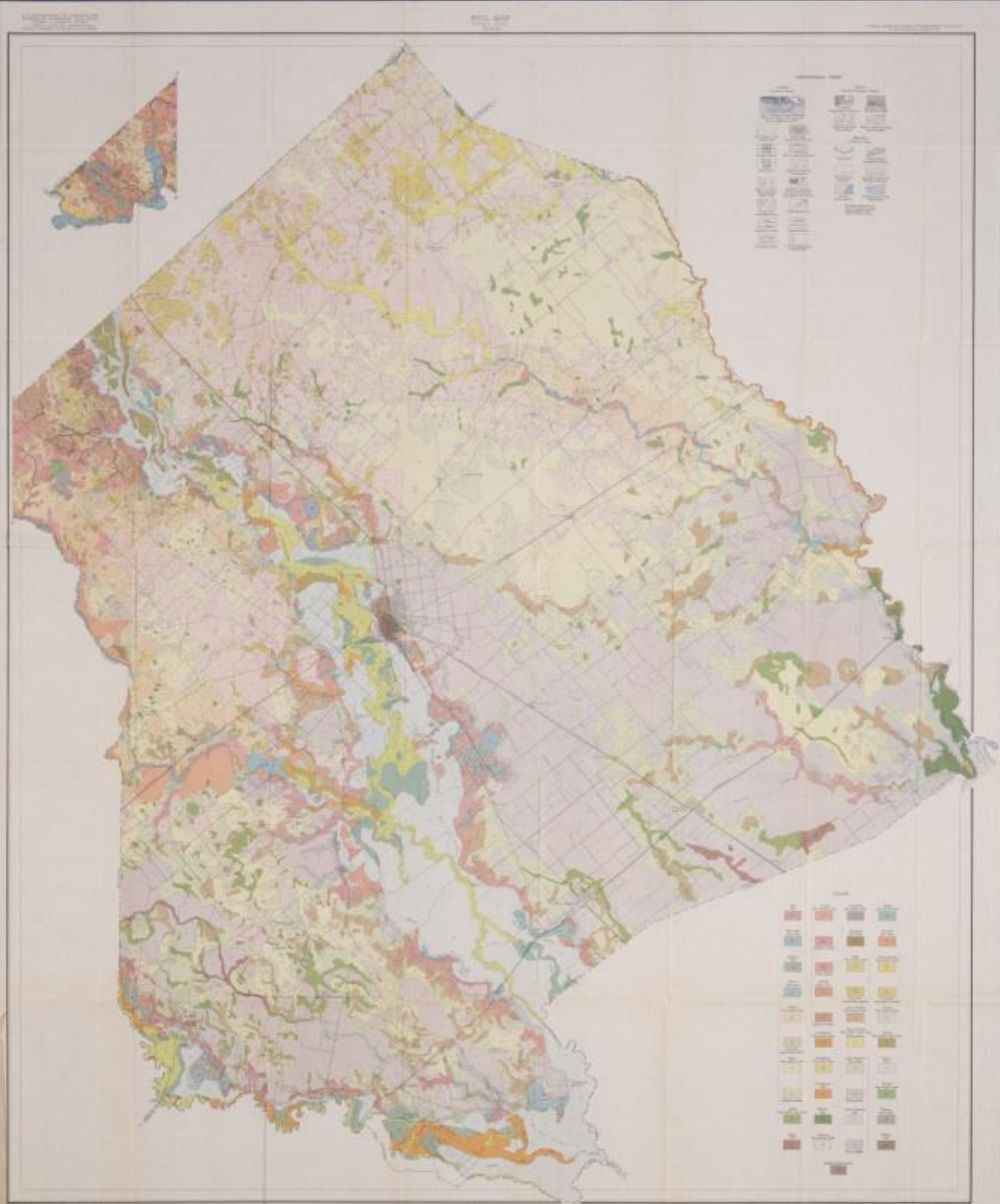
# Garden/Landscape Site Selection Factors

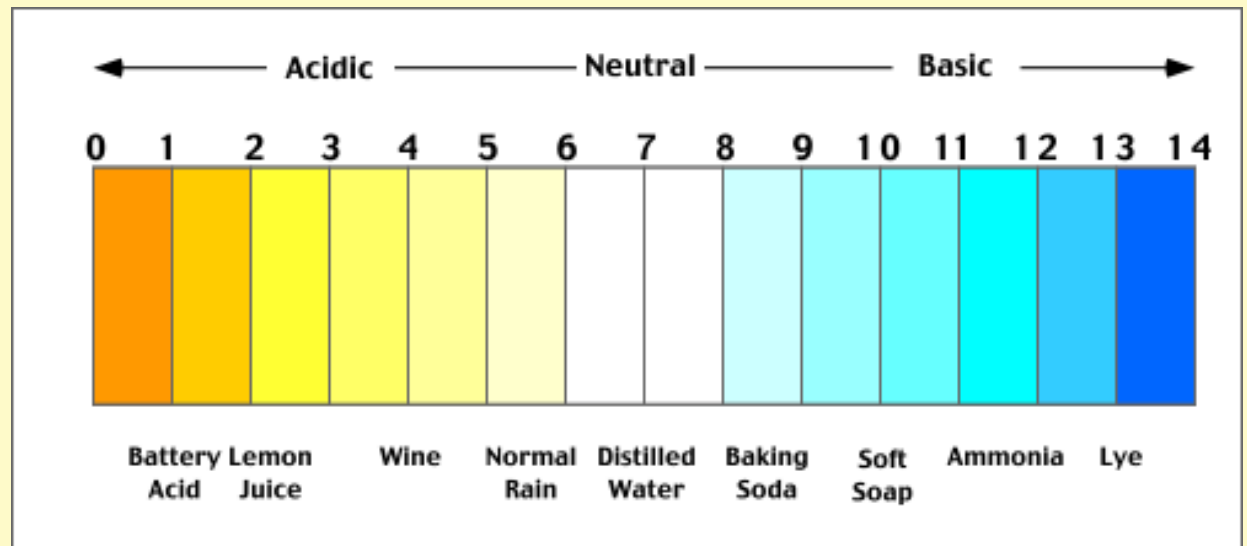
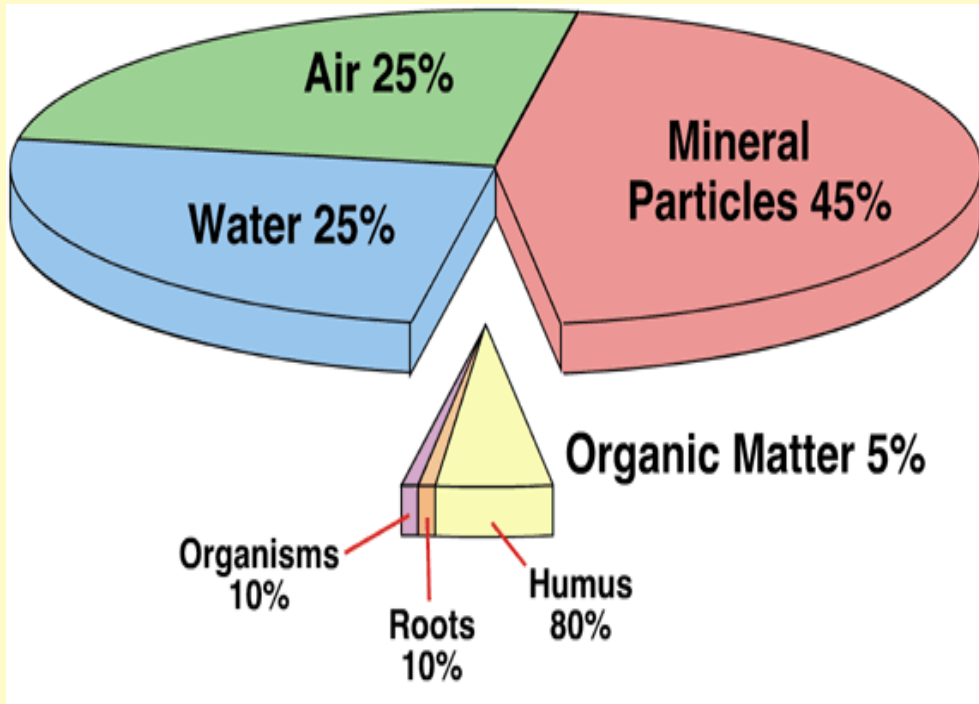
- Light - full sun; morning sun best
- Soil Type - sandy-loam best
- Drainage - well drained
- Water Source - low salinity
- Convenience - nearby

# **Garden/Landscape Site Preparation**

- A. Site Preparation/Amendment
- B. Test Soil
- C. Fertilization
- D. Irrigation (if needed)
- E. Bed Preparation

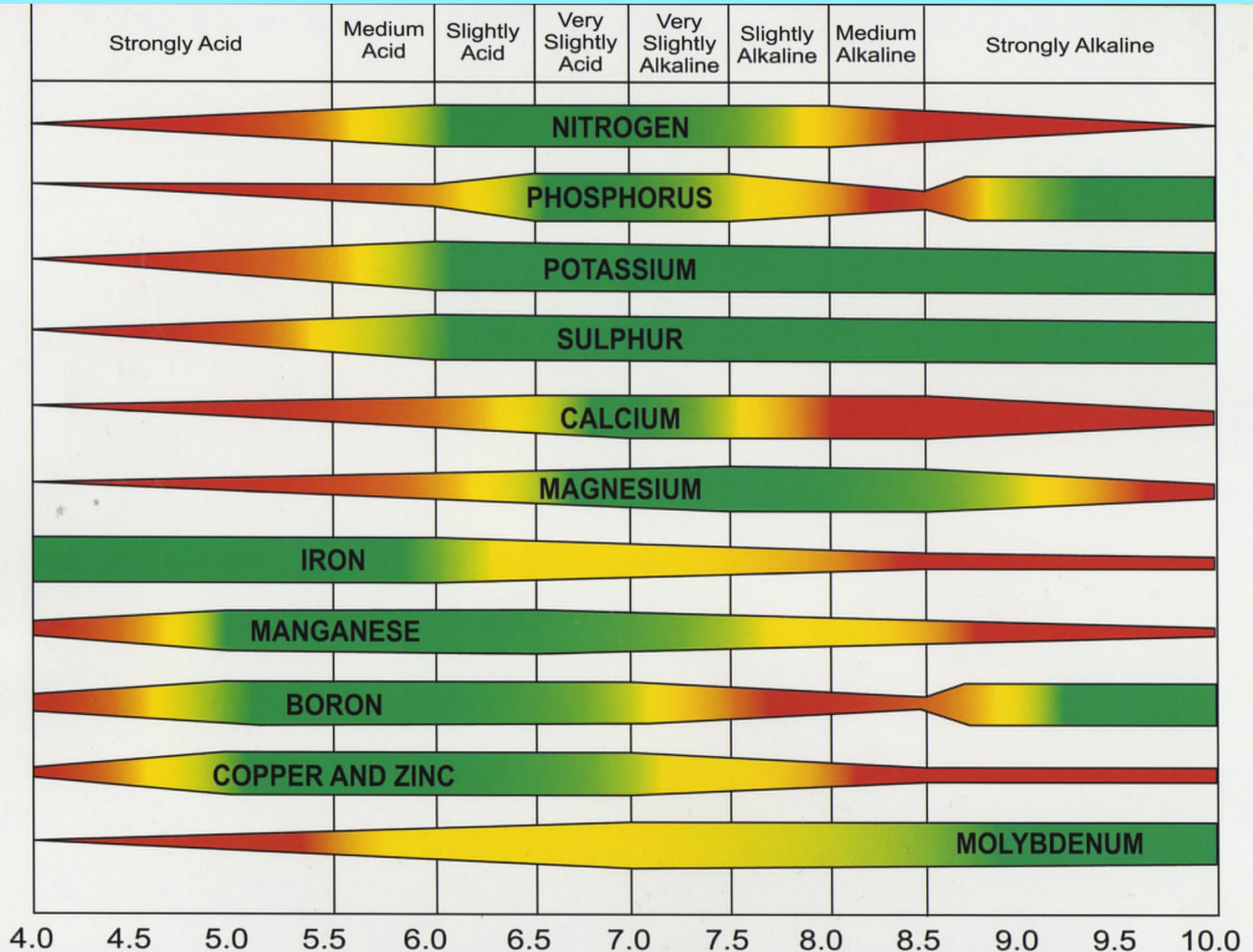
# Victoria County Soils Map





pH Range

# How soil pH affects plant nutrients



# Preferred pH Ranges of Various Plants

## Optimum pH Range for Vegetable Crops



**Crops:**

**Asparagus**

**Beets**

**Cabbage**

**Sweet Corn**

**Pumpkins**

**Tomatoes**

**Blueberries**

**Strawberries**

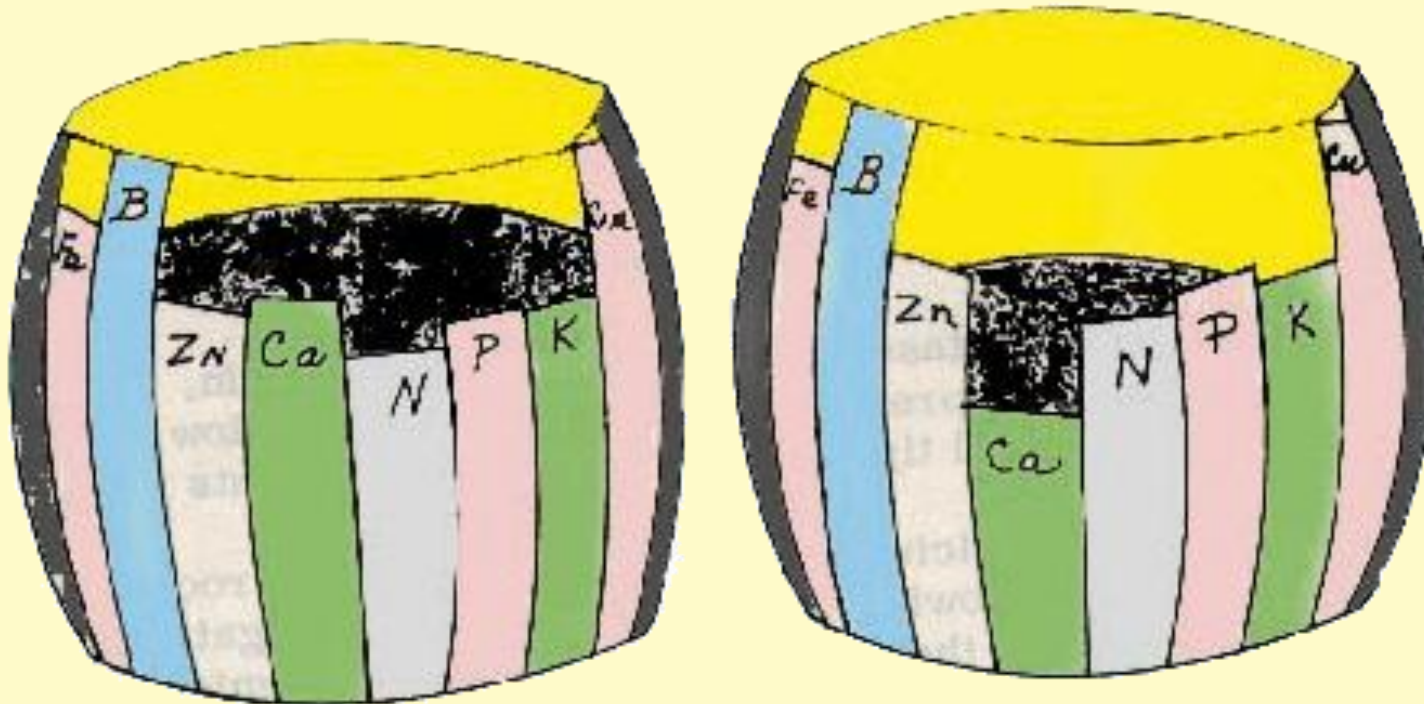


# Nutrients (fertilizers)

- 22+ essential nutrients for plant growth
- Found in air and water
  - Carbon, hydrogen, oxygen
- Major soil nutrients
  - Nitrogen, phosphorus and potassium
- Secondary soil nutrients
  - Calcium, magnesium and sulfur
- Micronutrients in soil
  - Iron, boron, zinc, chlorine, copper, manganese, molybdenum, cobalt, sodium, vanadium, nickel, silicon

# Nutrient Availability

The least available nutrient limits the plant's growth.



Justus Von Liebig and His Law – 1862

Every field contains a maximum of one or more and a minimum of one or more nutrients. **With this minimum**, be it lime, potash, nitrogen, ... or any other nutrient, the yields stand in direct relation. It is this factor that governs and controls ... yields. Should this minimum be lime ... yield ... will remain the same and be no greater even though the amount of potash, silica, phosphoric acid, etc. ... be increased a hundred fold.

# The Key to Nutrient Management

## Soil Testing

- A soil test is a chemical extraction that provides an index to estimate the nutrient supplying power of a soil.

Identifies the degree of deficiency or sufficiency of a nutrient.



# Taking Soil Samples

- Soil tests are only as accurate as the samples on which they are based.
- Samples must be representative of the area to be planted





Use a soil  
sampling probe  
or a  
sharpshooter  
shovel




Mail bag to Testing Lab



# Testing Lab results


Crop Grown: LANDSCAPE (LAWN , TREES , SHRUBS , OR GROUND COVER)

Analysis	Results	CL*	Units	VLow	Low	Mod	High	VHigh	Excess.		
pH	8.9	(6.2)	-	Strongly Alkaline							
Conductivity	138	(-)	 mho/cm	None						CL*	<b>Fertilizer Recommended</b>
Nitrate-N	7	(-)	ppm							<b>0.8</b> lbs N/1000sqft	
Phosphorus	10	(50)	ppm							<b>3.1</b> lbs P2O5/1000sqft	
Potassium	34	(175)	ppm							<b>3.2</b> lbs K2O/1000sqft	
Calcium	1,809	(180)	ppm							<b>0</b> lbs Ca/1000sqft	
Magnesium	298	(50)	ppm							<b>0</b> lbs Mg/1000sqft	
Sulfur	21	(13)	ppm							<b>0</b> lbs S/1000sqft	
Sodium	181	(-)	ppm								
Iron	4.82	(4.25)	ppm								
Zinc	0.81	(0.27)	ppm								
Manganese	1.66	(1.00)	ppm								
Copper	2.05	(0.16)	ppm								
Boron											
Limestone Requirement										<b>0.00</b> lbs/1000sqft	

\*CL=Critical level is the point which no additional nutrient and/or limestone are recommended.

# More example Testing Lab results

Crop Grown: GARDEN

Analysis	Results	CL*	Units	VLow	Low	Mod	High	VHigh	Excess.		
pH	7.8	(6.5)	-	Mod. Alkaline							
Conductivity	1,259	(-)	 mho/cm	Moderate						CL*	<b>Fertilizer Recommended</b>
Nitrate-N	13	(-)	ppm							1.0	<b>0.8</b> lbs N/1000sqft
Phosphorus	78	(50)	ppm							0.5	<b>0</b> lbs P2O5/1000sqft
Potassium	525	(175)	ppm							0.5	<b>0</b> lbs K2O/1000sqft
Calcium	6,556	(180)	ppm								<b>0</b> lbs Ca/1000sqft
Magnesium	181	(50)	ppm								<b>0</b> lbs Mg/1000sqft
Sulfur	361	(13)	ppm								<b>0</b> lbs S/1000sqft
Sodium	277	(-)	ppm								
Iron	11.57	(4.25)	ppm								
Zinc	3.33	(0.27)	ppm								
Manganese	7.58	(1.00)	ppm								
Copper	2.87	(0.16)	ppm								
Boron											
Limestone Requirement											<b>0.00</b> lbs/1000sqft

*New example*

\*CL=Critical level is the point which no additional nutrient and/or limestone are recommended.

# Calculating Fertilizer Rates

## Soil Test Fertilizer Recommendation

---

	Rate (lbs./1,000 ft <sup>2</sup> )	Ratio
Nitrogen (N)	1.0	2
Phosphate (P <sub>2</sub> O <sub>5</sub> )	0.5	1
Potassium (K <sub>2</sub> O)	0.5	1

---

# Calculating Fertilizer Rates

**Possible Fertilizer: 20-10-10**

N Rate: Desired rate (lb.)/1,000 ft<sup>2</sup> = lbs./1,000 ft<sup>2</sup>  
Nitrogen strength in %

N Rate: 1.0 lb./1,000 ft<sup>2</sup> = 5 lbs./1,000 ft<sup>2</sup>  
0.20

To figure P<sub>2</sub>O<sub>5</sub> rate: 5 x 0.1 = 0.5 lbs./1,000 ft<sup>2</sup>

To figure K<sub>2</sub>O rate : 5 x 0.1 = 0.5 lbs./1,000 ft<sup>2</sup>

# Nitrogen Fertilizer

## Movement in Soil:

$\text{NO}_3^-$  can leach

$\text{NH}_4^+$  won't leach

## Functions in Plant:

Part of Amino Acids, Proteins

Part of chlorophyll molecule

## Sources

- Inorganic, soluble source
- Inorganic slow release
- Organic (slow release)



# Nitrogen Fertilizer Sources

- Inorganic, soluble sources

Urea	45-0-0
Ammonium nitrate	34-0-0
Ammonium sulfate	21-0-0
Potassium nitrate	13-0-45

- Inorganic slow release

  - **Coated Products**

    - Sulfur coated urea
    - Polymer coated urea
    - Polymer/sulfur coated urea

  - **Reacted Products**

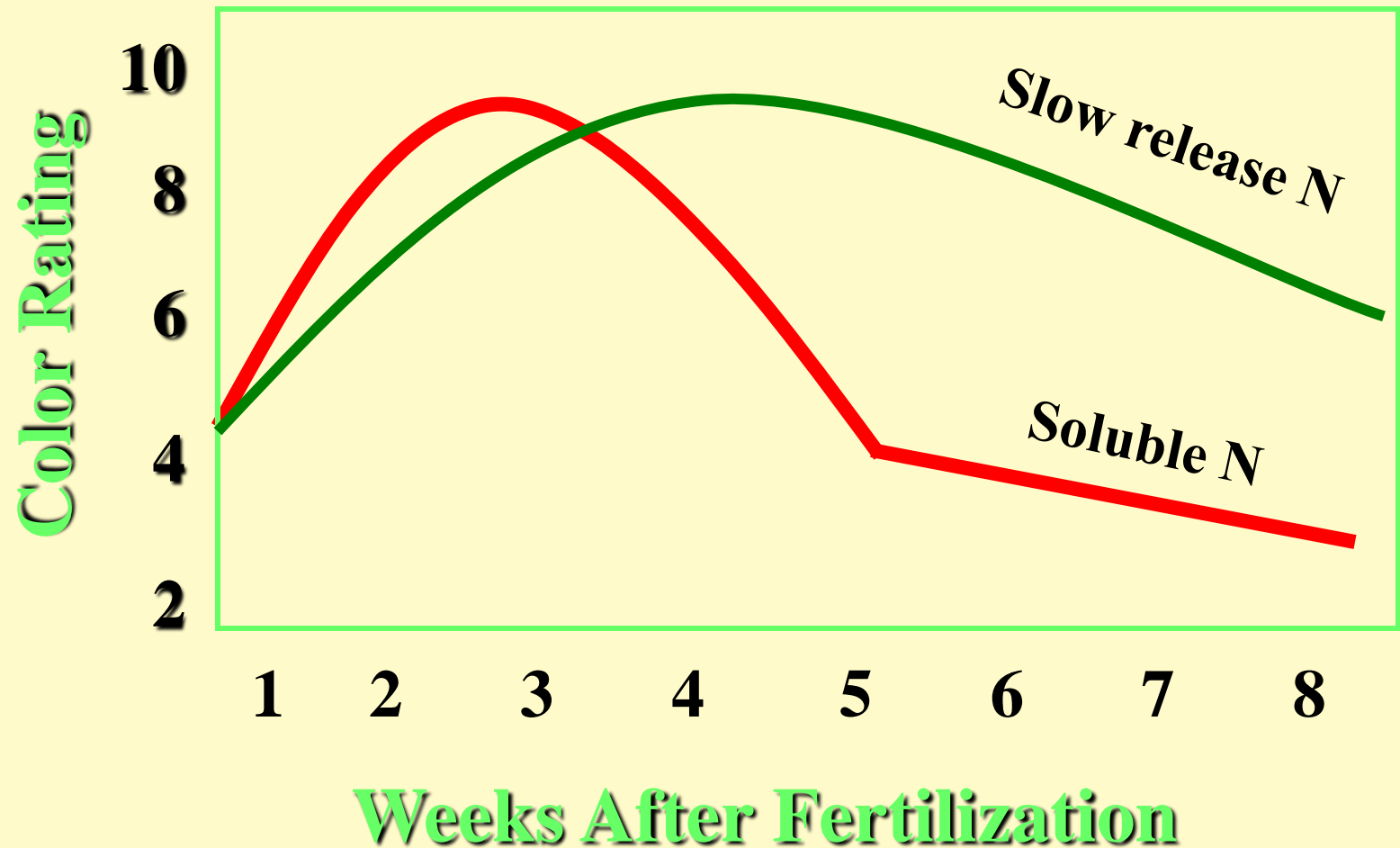
    - IBDU
    - Ureaformaldehyde
    - Methylene Urea
    - Ureaform

- Organic (slow release)

  - Municipal biosolids
  - Composts

  - Food processing by-products
  - Animal manures

# Plant Growth Response



# Phosphorus Fertilizer



## Movement in Soil:

Very immobile; Will not leach or volatilize; Builds up in soils.

## Functions in Plant:

Stimulates early growth & root formation; Hastens maturity and promotes fruit/seed production.

## Sources

---

### Inorganic

%  $P_2O_5$

Triple superphosphate (TSP)	46
Monoammonium phosphate (MAP)	48
Diammonium phosphate (DAP)	46

---

### Organic

Sludges	3 – 4
Animal manures	< 1 – 3
Bone meal	12 - 14

# Potassium Fertilizers



**Movement in Soil:** Does not leach/volatilize

**Functions in Plant:** Increases water use efficiency  
Increases disease resistance  
Improves cold hardiness

## Organic Sources

## Formula

## (% K<sub>2</sub>O)

Potassium chloride

KCl

0-0-60

Potassium sulfate

K<sub>2</sub>SO<sub>4</sub>

0-0-54

Potassium nitrate (salt peter)

KNO<sub>3</sub>

0-0-45

K Mag

KMgSO<sub>4</sub>

0-0-22

Wood Ashes

0-0-(6-35)

Greensand

0-0-7

# Essential Micronutrients

Zn Fe Cu Mn B Cl Mo

---



- Needed in very small amounts
- Most micronutrients come from decomposition of organic matter
- Increase in soil pH decreases micronutrient availability (Except Mo and Cl)

# Organic Nutrient Sources

- **Composts**
  - Mixed composition
  - Variable nutrient content
- **Municipal biosolids**
  - Milorganite; Vital-cycle (6-3-0)
- **Animal By-Products**
  - Manures (variable nutrient content)

# Nutrient Value of Manure

Source	N%	P%	K%	Suggested lbs./1000 ft <sup>2</sup>
Chicken	2.0-4.5	4.6-6.0	1.2-2.4	125
Beef	1.0-2.5	0.9-1.6	2.4-3.6	450
Sheep	1.1-2.0	0.6-1.0	1.7-2.5	450
Dairy	0.6-2.1	0.7-1.1	2.4-3.6	600
Rabbit	2.4	1.0	0.6	
Horse	0.7	0.3	0.6	

# Common Organic Fertilizers

Name	%N	%P <sub>2</sub> O <sub>5</sub>	%K <sub>2</sub> O
Dried Blood	13.0	1.5	0
Fish Meal	10.4	5.9	0
Bat Guano	13.0	5.0	2.0
Bone Meal	4.0	22.0	0
Cotton Seed Meal	6.5	3.0	1.5
Cotton Gin Trash	0.7	0.2	1.2
Seaweed (kelp)	1.0	0.5	9.0

# Fertilization

(best guess without soil test)



- When using inorganic or commercial fertilizers, 1 - 2 pounds of 8-8-8 fertilizer per 100 sq. ft. will be needed.
- The fertilizer can be broadcasted over the garden site and incorporated to a depth of 3 - 4 inches.
- It is always best to base fertilize use on soil analysis.

# Fertilizer Solutions

(Good for transplant starter solutions)

- Base solution: 2 cups of a complete fertilizer/gallon water
- Nutrient solution: 2 tablespoons of base solution/gallon water.
- Use this to water-in plants.



# Band Fertilizer if Possible



Best results occur when P is placed 2" below seed at planting

# Notice Banded Phosphorus Placement

*2x2 rule: 2" out, 2" below*



# Proper Bed Prep



- Start early; 1 -2 months before
- Remove all turf & weeds first. If you use a herbicide, read and follow label. Some materials require waiting before planting.
- Add a good soil amendment in a 1:3 ratio
- Till bed throughout, very fine.
- Rake bed even, slope to drain.
- Bed should be raised 2" to 6" when completed.
- Compaction & poor drainage are major causes for poor results.

# Bed Amendment

## Add Organic Matter



- 3 - 6 inches of manure or well decomposed compost turned in or worked into the site is ideal.
- The organic matter should be incorporated into the soil in the fall prior to the intended spring planting for best results.

# Bed Amendment Expanded Shale

(for clay soil)



- Till in 3 inches of expanded shale 6 to 8 inches deep (*1/4 – 3/8 inch size shale works best*).
- Next, till in 3 inches of compost. Make sure the compost is "finished" – no green material.
- Then, mix/till the expanded shale, compost and soil thoroughly.
- Crown the bed to shed water.
- Plant desired perennials.
- Cover with a 3-inch layer of mulch.
- Each spring restore mulch to 3" - 4" thickness

# Seed Bed Preparation



Till soil when it is dry or slightly moist.

Till soil several weeks or even months before planting.

This allows it to settle prior to planting.

# Make Raised Beds

Good Drainage is  
Essential



# Solarize the Soil

Use 6 ml clear plastic

Till 6" deep to loosen soil

Cover soil air-tight 1 - 3 months in sunny months

Should reach up to 150 degrees; pasteurizing soil

- Reduces harmful soil organisms
- Reduces nematodes, insects
- Reduces weeds and seeds
- Reduces soil-borne diseases.



Nematode galls on roots



# Avoid Soil Compaction



Mulch conserves water and controls weeds.

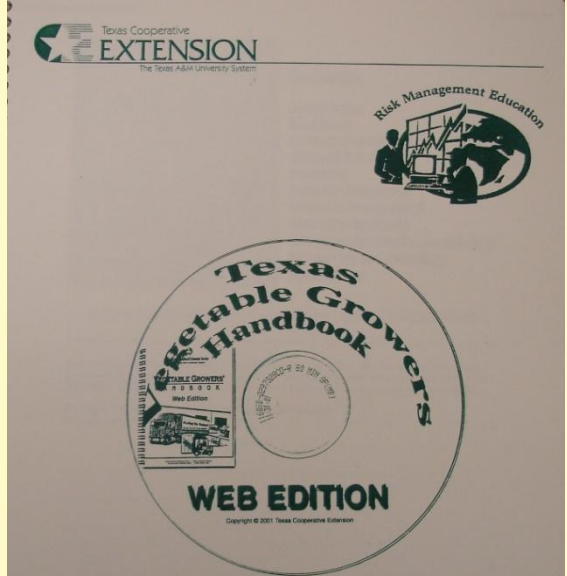
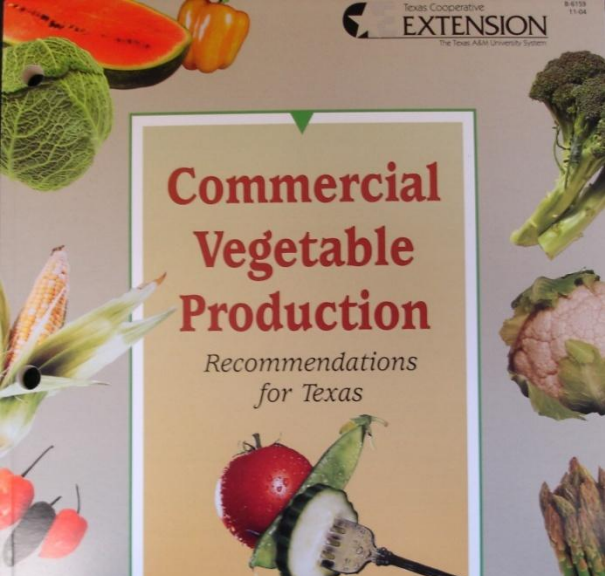


# Irrigation is Essential



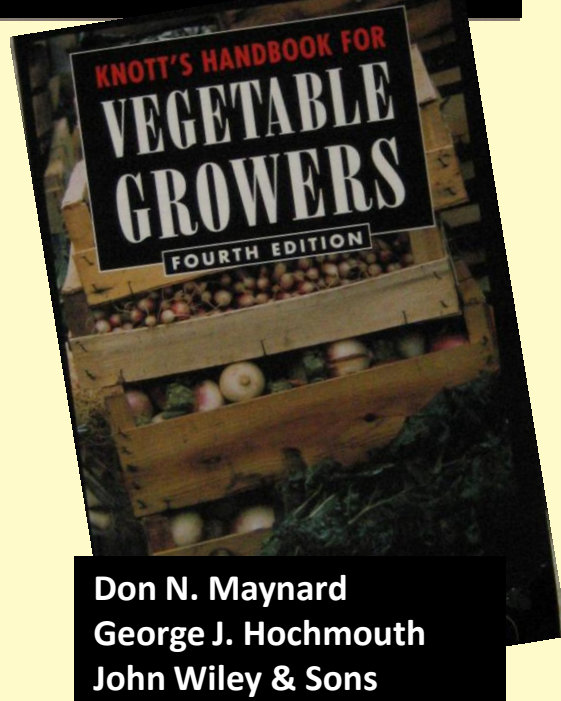
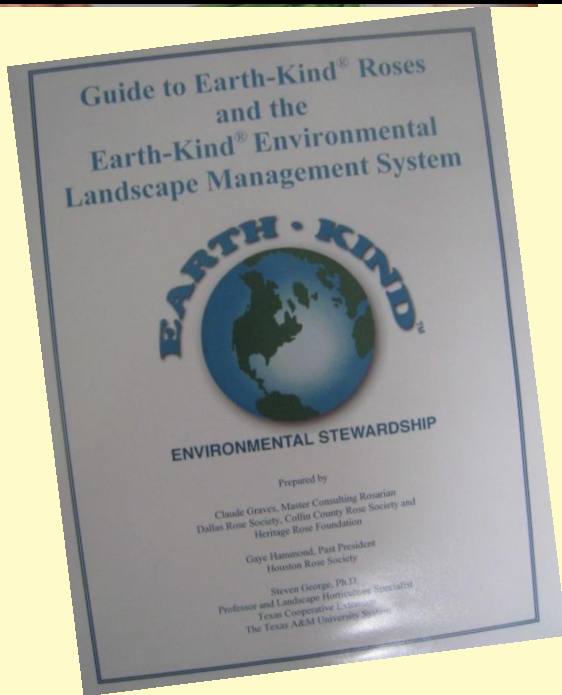
# Clean up and Compost



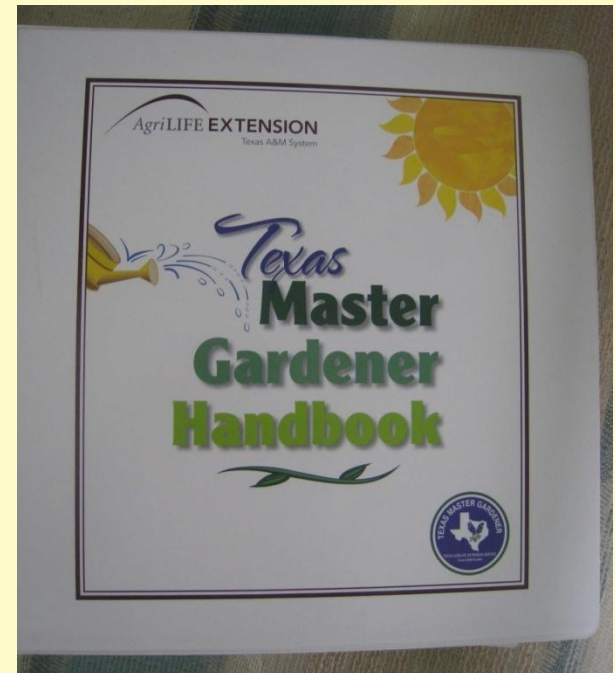


Keep on learning

# Texas AgriLife Extension Publications



Don N. Maynard  
George J. Hochmuth  
John Wiley & Sons



**In 2 weeks!**



# Pruning Shrubs & Trees

January 24, 2011

**Lunch & Learn With The Masters**

Charlie Neumeyer

Victoria County Master Gardener



Improving Lives. Improving Texas.

