GROW IT

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Darke Soil & Water Conservation District

Agenda

- Soil nutrients & pH
- Soil sampling
- Fertilizer recommendations
- Fertilizer application
- Cover crops
- Crop rotations

GROW IT

A garden guide promoting environmental stewardship and economic soundness!

GROW SMARTER:

- Base nutrient applications on soil tests
  - Make split applications of nitrogen when the vegetable needs it.
- Rotate between different crops
  - Reduces pests and disease
  - Reduces the need for chemicals
- Plant cover crops to improve soil quality

SOIL SAMPLING TIPS:

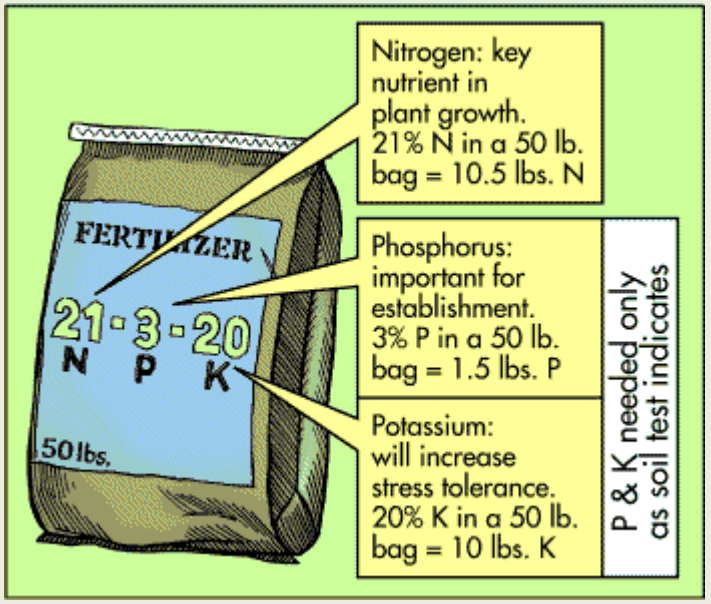
- Sample in fall or spring, every 3 years.
- Section out areas of concern and sample them separately.
- Collect a minimum of 10 cores, 15-20 cores are better.
- Pull samples at a 7" depth.
- Utilize zigzag method.
- Collect samples in a clean bucket.
- Dry samples.
- Mix cores thoroughly and send 1-2 cups to soil lab.

TOMORROW

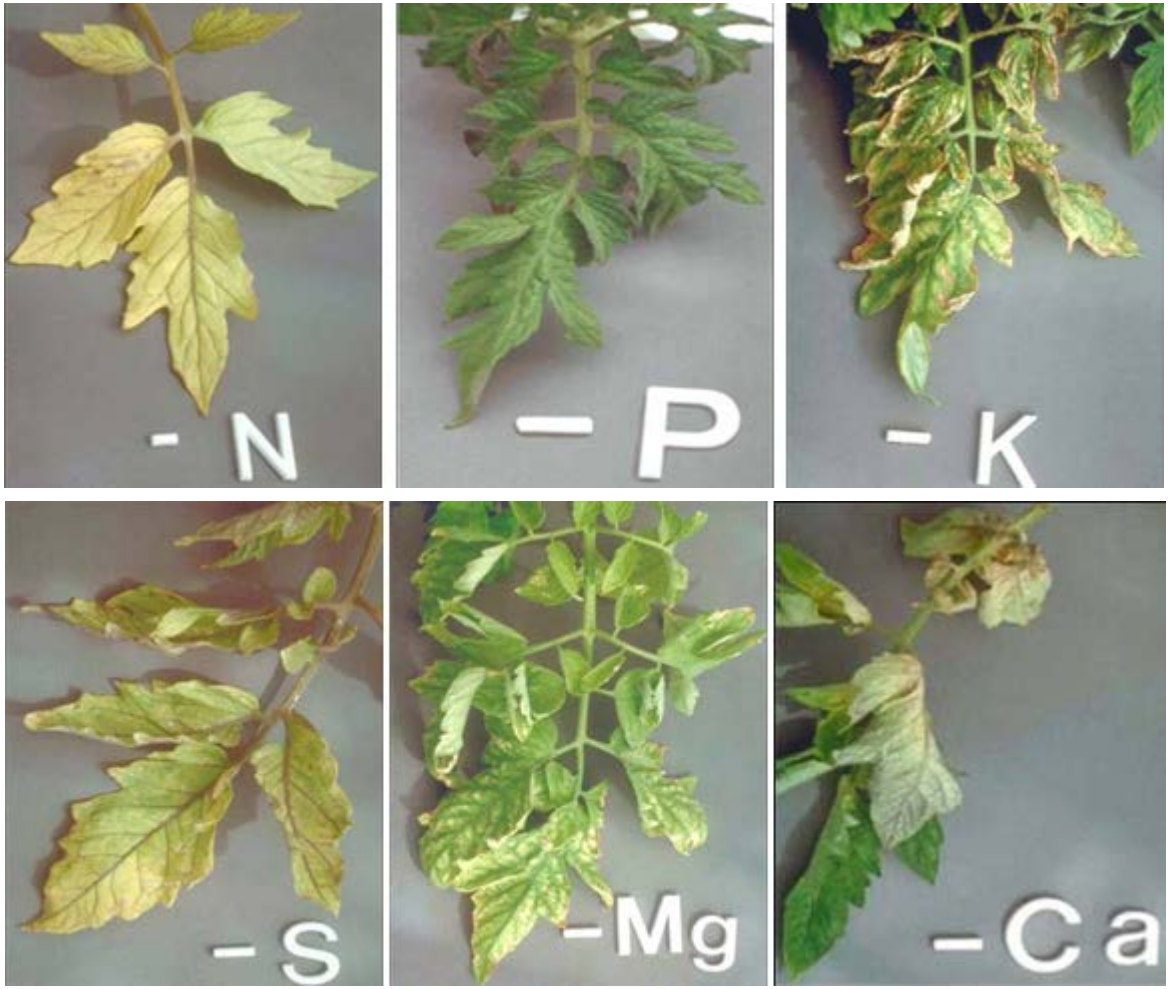
Contact the Darke SWCD at 937-548-1715 ext 3 for information.

Soil nutrients

- Macronutrients
  - Plants require larger amounts
  - Primary
    - Nitrogen (N) – plant tissue
    - Phosphorus (P) – roots
    - Potassium (K) – flowers & fruits
  - Secondary
    - Sulfur, magnesium, calcium
- Micronutrients
  - Plants require smaller amounts
  - Naturally found in Ohio soils



Nutrient deficiencies



http://www.farmspeak.com/nutrient-deficiency.html

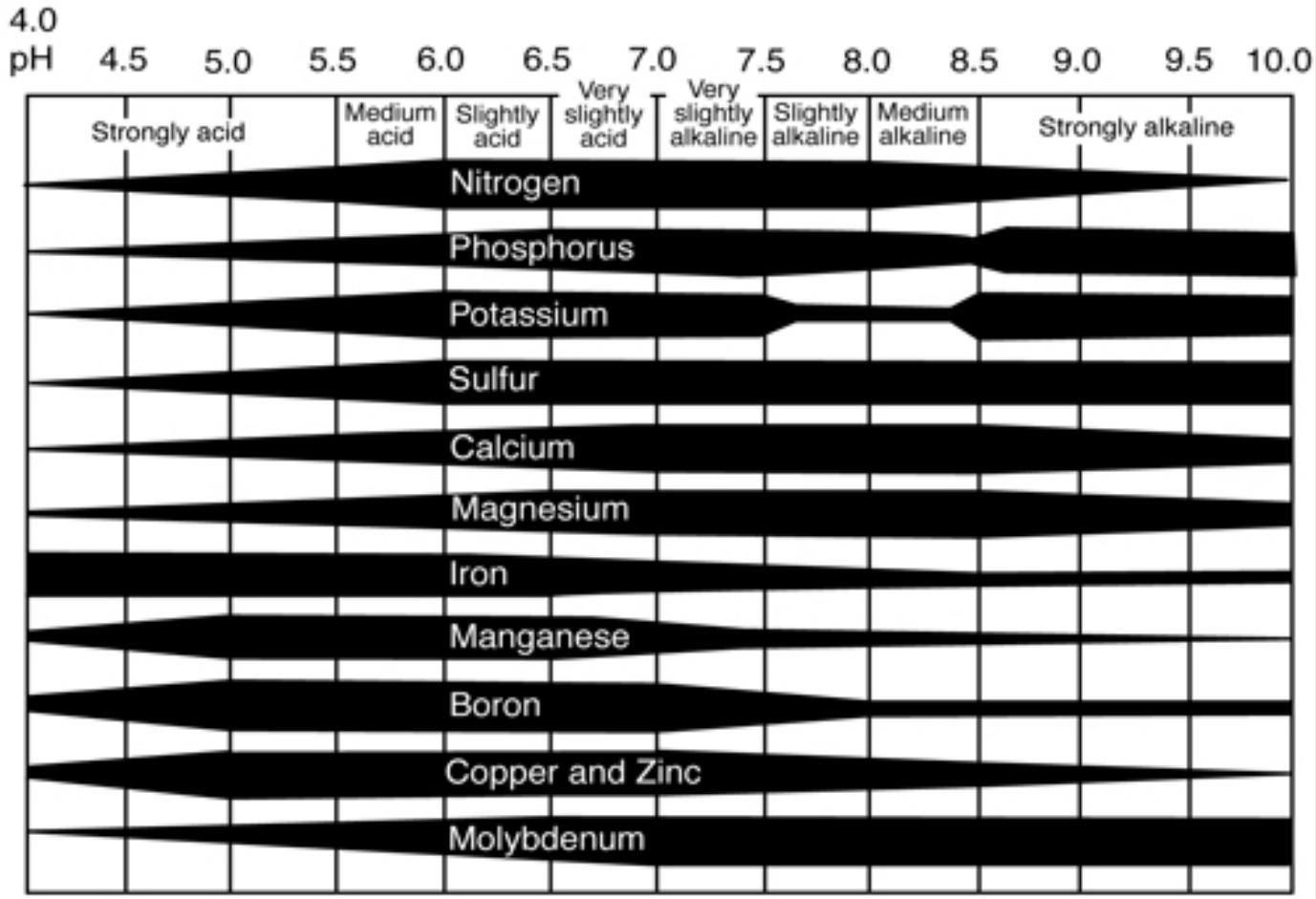
Soil pH

- Measure of acidity or alkalinity
- Desired pH: 6.3-6.8

- *Always soil test before attempting to adjust pH!*
  - To increase pH: lime
    - Fall apply
  - To decrease pH: sulfur
    - Spring apply

- pH affects soil fertility

Effect of pH on nutrient availability

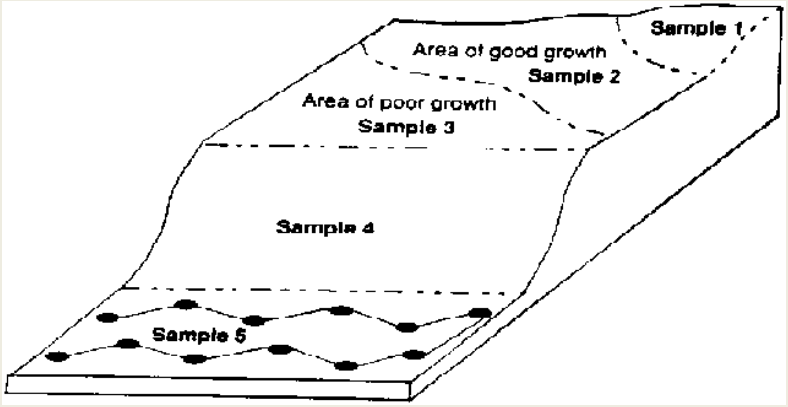


Adapted from nutrient information from Brady, N.C. 1974. *The nature and properties of soils,* 8th ed. MacMillan Pub. Co., Inc., NY.

Nutrient Recommendations for Vegetables based on Soil Test -2013 Midwest Vegetable Production Guide for Commercial Growers			
Test Item	**Desirable Range**		**Use of Measure**
pH	6.0-6.8 (Mineral Soils)		Water pH (Neutral pH =7.0)
	Reported as pounds per acre (lbs/acre)	Reported as parts per million (ppm)	
Phosphorus (P)	70-80	35-40	Used to make phosphorus recommendation More than 80 ppm (160 lbs/acre) no P needed
Potassium (K)			Used to make potassium recommendation. CEC is used in determining desirable range.
CEC= 4 meq/100g	170-270	85-135	
CEC=16 meq/100g	230-330	115-165	
Calcium (Ca)*			Ca deficiencies are rare in Ohio
Low	0-300	0-150	200lbs/acre broadcast
Medium	80-138	151-299	100lbs/acre broadcast
High	>139	>300	No application
Magnesium (Mg)			
Low	0-80	0-40	100lbs/acre broadcast 20 lbs acre in the row
Medium	80-138	40-69	50lbs/acre broadcast 10 lbs acre in the row
High	>139	>278	No application
* Information from University of Minnesota Fruit & Vegetable Crops			

Soil samples

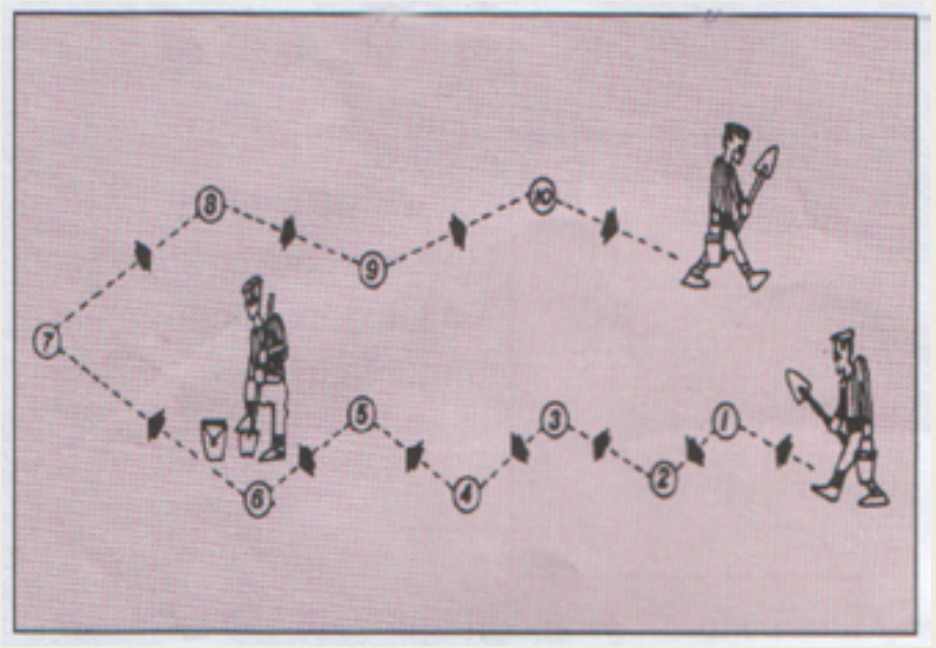
- Sample in fall or spring every 3-5 years
- Decide on number of samples
- Depth: 6-8”



Soil sampling with a trowel

How to sample

- Number: 10+ cores; 15-20 cores are better
- Collect in bucket
- Use zigzag pattern



Preparing sample

- Thoroughly mix all cores in bucket
- Pull out any grass, rocks, large plant material
- Spread sample on cardboard to air dry
- Mix again and collect amount recommended by lab (typically 1-2 cups)

Avoid contamination

- Make sure tools and bucket are clean and free of excess dirt, rust, and chemicals
- Keep out of reach from children and animals
- Do not smoke
- Do not dry on aluminum foil

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MICHIGAN STATE UNIVERSITY
SOIL AND PLANT NUTRIENT LABORATORY
EAST LANSING, MICHIGAN 48824-1325
(517) 355-0218

SOIL TEST REPORT FOR:	CONSULTANT
	DARKE COUNTY SWCD 1117 S. TOWNE-COURT GREENVILLE OH 45331

DATE	LAB #	COUNTY	GROWER'S EMAIL	ACRES	FIELD ID	SOIL
12/3/2008	94662	Darke			Layc1	Mineral

Next to Lake or Stream?	Year Area Planted	Fertilizer Tilled in Prior to Planting?	How Deep?
No	This Year	Yes	8 Inches

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH 6.9	Lime Index				
[2]Phosphorus (P)	47	ppm			
[3]Potassium (K)	235	ppm			
[3]Magnesium (Mg)	377	ppm			

ADDITIONAL RESULTS:

[3]Calcium (Ca) (ppm)	CEC (meq/100 g)	% of Exchangeable Bases K	Mg	Ca
1499	11.2	5.4	28.0	66.7

Optional Tests:

Micronutrients (ppm) B	Cu	Mn	Zn	Fe	Organic Matter %	Nitrate-N ppm

RECOMMENDATIONS FOR: *Garden, home*

nestone: NONE

NUTRIENT NEEDS:

Nitrogen (N)	Phosphate (P_2O_5):	Potassium (K_2O):	Target pH:
3-4 lb/1000 sq ft	3.2 lb/1000 sq ft	NONE	6.5

FERTILIZER OPTIONS:

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SOIL TEST REPORT

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9/22/2008	91300	Darke			Kug1g	Mineral

Next to Lake or Stream?	Year Area Planted	Fertilizer Tilled in Prior to Planting?	How Deep?
No	Prior To This Year	No	4 Inches

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
[1]Soil pH 7.4	Lime Index				
[2]Phosphorus (P)	520	ppm			
[3]Potassium (K)	257	ppm			
[3]Magnesium (Mg)	723	ppm			

ADDITIONAL RESULTS:					Optional Tests:						
[3]Calcium (Ca) (ppm)	CEC (meq/100 g)	% of Exchangeable Bases K	Mg	Ca	Micronutrients (ppm) B	Cu	Mn	Zn	Fe	Organic Matter %	Nitrate-N ppm
3326	23.3	2.8	25.8	71.3							

RECOMMENDATIONS FOR: *Garden, home*

Limestone: NONE

NUTRIENT NEEDS:			
Nitrogen (N)	Phosphate (P_2O_5):	Potassium (K_2O):	Target pH:
3-4 lb/1000 sq ft	NONE	NONE	6.5

FERTILIZER OPTIONS:

Fertilizer recommendations – P & K

- If you have a soil test, it removes some guesswork

Soil Test Level	Nutrient Value (lb/ac)		Fertilizer (lb/1000 sq ft)	
	P_2O_5	K_2O	P_2O_5	K_2O
High	60+	300+	0-1	0-1
Moderate	30-60	200-300	1-2	1-2
Low	<30	<200	3-5	3-5

Note: 1 lb/ac = 2 ppm

- Apply N at rate to achieve 1-2 lb of N/1000 sq ft

Adapted from Home Vegetable Gardening in Kentucky (ID-128)

Nitrogen fertilizer recommendations

- No soil test, apply:
  - A balanced fertilizer (10-10-10) for leafy greens
  - A ratio high in P & K (6-24-24) for vegetables grown for fruits, roots, seeds or bulbs
  - Apply at rate to achieve 1-2 lb. of N/ 1000 sq. ft.

vs.

or

Fertilizer Exercise

- Known: 20’ x 30’ garden
  6-24-24 fertilizer
  1 lb. N/1000 sq. ft.

- Unknown: Amount of 6-24-24 needed to fertilize the garden?

Fertilizer exercise

Garden area:

$$20\ ft * 30\ ft = 600 \text{ sq ft}$$

Pounds of N needed:

$$\frac{1\ lb\ N}{1000\ sq\ ft} * 600\ sq\ ft = 0.6 \text{ lb N}$$

Pounds of 6-24-24 needed:

$$\frac{0.6\ lb\ N}{0.06} = \underline{10 \text{ lbs}} \text{ of 6-24-24}$$

Application methods

- Methods
  - Broadcast: spread across large area
  - Band: 2-3 inches beside seed/plant
  - Sidedress: fertilizer placed beside growing plant

www.doityourself.com, www.caes.uga.edu

Fertilizer application

- Commercial fertilizer application
  - Broadcast in spring before tillage
  - Sidedress or band during growing season
- Manure application
  - Spring: work manure in 2-3 weeks before planting
  - Fall: surface apply & establish cover crops
  - Never apply fresh manure to growing food crops (pathogens)

Exercise

You have a garden that is 100 ft long and 25 ft wide.

How many 50 lb. bags of 12-12-12 fertilizer will you need to fertilize the garden at 2 lb. N/1,000 sq ft?

Fertilizer Exercise

- Known: 100’ x 25’ garden
  12-12-12 fertilizer
  2 lb. N/1000 sq ft
- Unknown: Amount of 12-12-12 needed to fertilize the garden?

Fertilizer exercise

Garden area:

$$100\ ft * 25\ ft = 2500 \text{ sq ft}$$

Pounds of N needed:

$$\frac{2\ lb\ N}{1000\ sq\ ft} * 2500\ sq\ ft = 50 \text{ lb N}$$

Pounds of 12-12-12 needed:

$$\frac{50\ lb\ N}{0.12} = \underline{417 \text{ lbs}} \text{ of } 12\text{-}12\text{-}12$$

Bags of 12-12-12 needed:

$$\frac{417\ lb\ of\ 12-12-12}{50\ lb/bag} = 8.3 \text{ or } \underline{9 - 50\# \text{ bags of } 12\text{-}12\text{-}12}$$

Cover crop benefits

- Soil quality
  - Decrease compaction, sealing
  - Increase organic matter
- Erosion control
- Fertility improvements
  - Legumes add nitrogen
  - Non-legumes decrease nutrient leaching
- Weed suppression

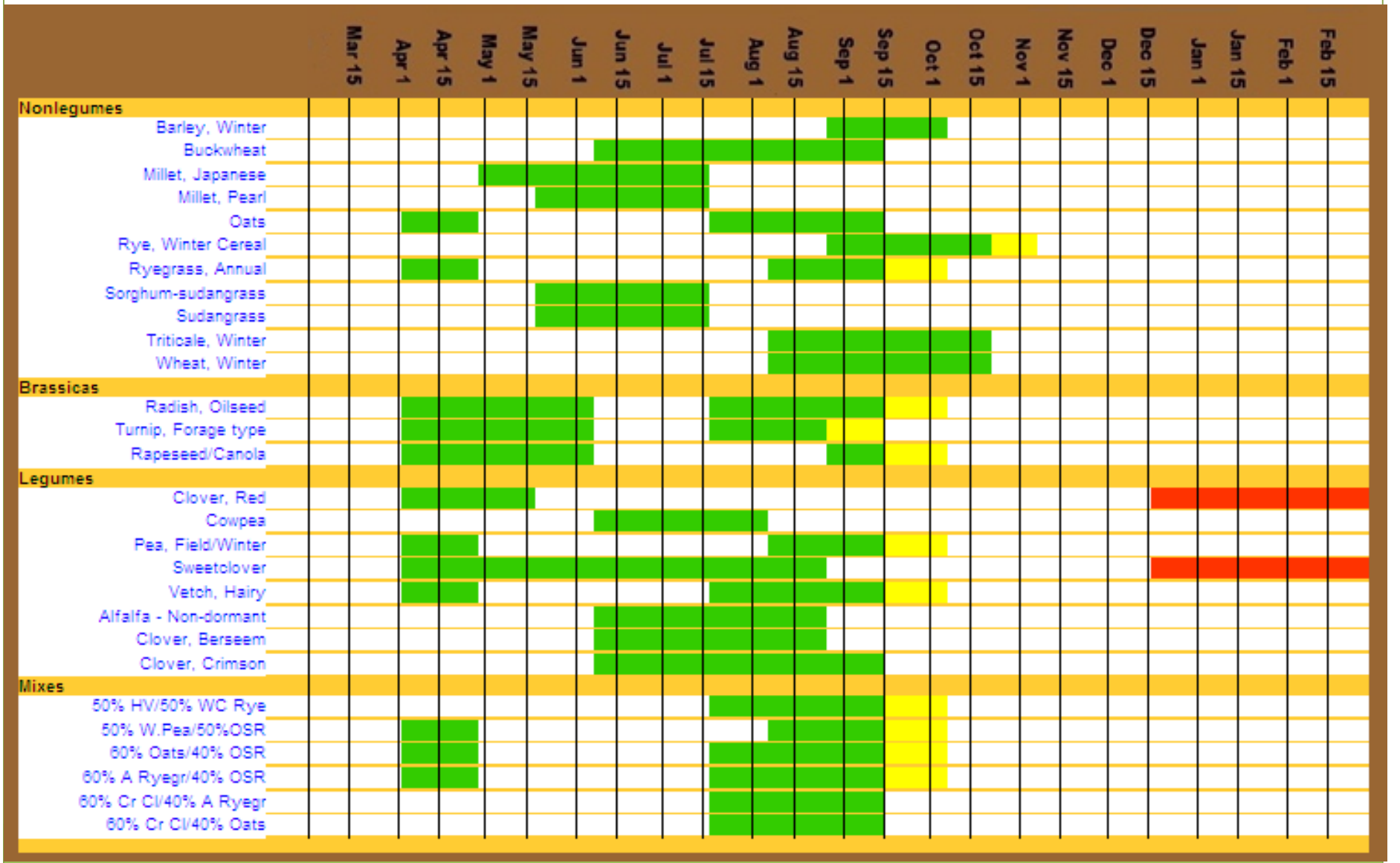
Oilseed radishes

Types of cover crops

- Cool Season Grasses
  - Oats, cereal rye, wheat, barley
- Warm Season Grasses
  - Sudan grass, pearl millet,
- Broadleaf
  - Radish, buckwheat, sunflower
- Legumes
  - Clovers, Field/winter peas, vetch, alfalfa, soybean

Oats & peas

Cover crop planting chart



Crop rotation

- Benefits
  - Reduce disease pressure
  - Reduce insect problems
- Examples
  - corn following peas
  - Fall broccoli following onions
- Avoid planting similar crops in same spot more than once every 3 years

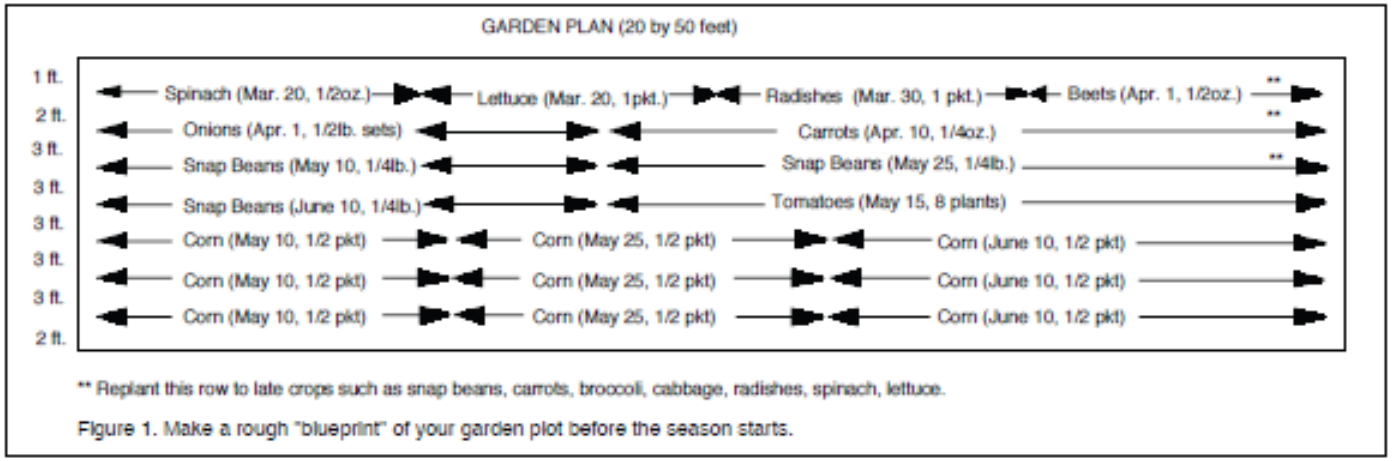


Figure 1. Make a rough "blueprint" of your garden plot before the season starts.

Rotate vegetables and cover crops

- 1st year: Corn
  - Cover crop: oats
- 2nd year: Peas
  - Cover crop: cereal rye
- 3rd year: Tomatoes
  - Cover crop: oats, radish, clover

Vegetable Garden Crop Rotation	
Family	**Vegetables in Family**
Apiaceae -(Carrot)	carrots, parsnips, celery, dill, cilantro, parsley, fennel
Asteraceae -(Sunflower, Aster)	sunflowers, lettuce, endive,
Brassicaceae -(Mustard)	Cabbage, cauliflower, broccoli, kohlrabi, kale, brussels sprouts, turnips, radish
Chenopodiaceae -(Goosefoot)	spinach, beets, chard, sugar beet
Cucurbitaceae -(Cucumber & Squash)	cucumber, melons, watermelon, summer squash, pumpkin, gourds, winter squash
Fabaceae -(Pea/Legume)	beans, peas, lentils, peanuts
Liliaceae -(Alliums)	asparagus, onion, leeks, chives, garlic
Poaceae -(Grass)	corn, rye, oats
Solanaceae -(Nightshade)	peppers, tomatoes, potatles, eggplant
Adapted from "The Organic Way-Plant Families" Virginia Tech	

References & resources

- Fertilizing Vegetable Garden Soils (HYG-1601-92). Ohio State University Extension Fact Sheet.
- Cover Crop Fundamentals (AGF-142-99). Ohio State University Extension Fact Sheet.
- Home Vegetable Gardening in Kentucky (ID-128). University of Kentucky.