

## Sustainable Home Gardening and Food Preservation: The “Why’s” and “How To’s”




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## Topics to Cover

- I. Overview of the Cooperative Extension System
- II. Why promote consumption and local production of fruits and vegetables
- III. Planting a home garden
- IV. Principles of food safety
- V. Processing your produce for year round consumption

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## The National Cooperative Extension Service



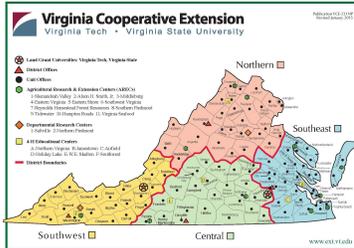

- Smith-Lever Act of 1914 created the Cooperative Extension System
- Cooperative Extension in every state
- Offices in over 3000 counties
- Program areas:
  - Agriculture and natural resources
  - Youth development (4H)
  - Family development and resource management
  - Leadership and volunteer development
  - Nutrition, diet and health

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## Virginia Cooperative Extension

- Operated cooperatively by VT and VSU
- 107 local offices
- 6 - 4H Centers
- 11 Agriculture Research and Extension Centers



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## Virginia Cooperative Extension Program Areas



- Agriculture & Natural Resources
- 4-H
- Community Viability and Leadership
- Family and Consumer Sciences
- Family Nutrition Program (EFNEP & SNAP-Ed)

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"Individuals and families looking to embark on the road to a healthier life face a myriad of social, economic, and environmental factors that reinforce their current behaviors."

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## Cooperative Extension National Framework for Health and Wellness

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## The New American Plate

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## Fruits and Vegetable Health Benefits: What's the evidence?

10 portions of a variety of fruits and vegetables a day:

- ✓ 24% reduced risk of coronary heart disease
- ✓ 33% reduced risk of stroke
- ✓ 28% reduction in cardiovascular disease
- ✓ 14% reduced risk of total cancer
- ✓ 31% reduced risk of premature death

**Eating just 2-3 portions a day makes a difference**

Note: Datta, 2017. Fruit and vegetable intake and the risk of cardiovascular disease, total cancer and all-cause mortality: systematic review and dose-response meta-analysis of prospective studies. *BMJ* 356:f2833.

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## Types of fruits and vegetables associated with disease risk

Lower CHD, CVD, stroke	Lower total cancer incidence	Lower all cause mortality
Apples	Cruciferous vegetables	Apples
Pears	Green-yellow vegetables	Pears
Citrus fruits		Berries
Cruciferous vegetables		Citrus fruits
Green leafy vegetables		Cruciferous vegetables
Tomatoes		Green leafy vegetables
Betacarotene-rich fruits & vegetables		Salads
Vitamin C-rich fruits & vegetables		

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## The Associations of Fruit and Vegetable Intakes with Burden of Diseases

Disease	Best identified dose response
All-cause mortalities (Aune et al. 2017)	0.92 (0.90, 0.93)
CVD mortality (Wang et al. 2014)	0.93 (0.89, 0.97)
Stroke (Aune et al. 2017)	0.93 (0.91, 0.95)
Renal cell cancer (Lee et al. 2009)	0.96 (0.93, 0.99)
CVD (Aune et al. 2017)	0.96 (0.94, 0.97)
Lung cancer (Vieira et al. 2016)	0.96 (0.94, 0.98)
CHD (Aune et al. 2017)	0.96 (0.95, 0.97)
Cancer (Aune et al. 2017)	0.98 (0.97, 0.98)
Hypertension (Wu et al. 2016)	0.99 (0.99, 0.99)

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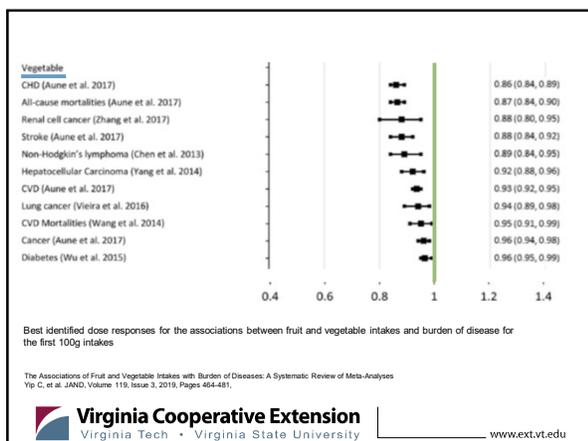
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## The Associations of Fruit and Vegetable Intakes with Burden of Diseases: A Systematic Review of Meta-Analyses

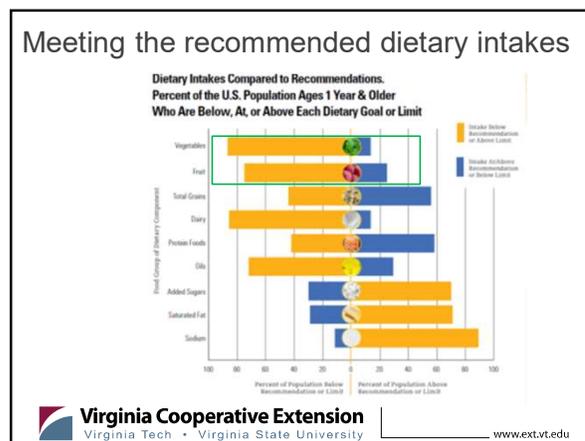
Disease	Best identified dose response
Esophageal cancer (WCRF-AICR 2007)	0.56 (0.42, 0.74)
Mouth, pharynx, and larynx cancer (WCRF-AICR 2007)	0.72 (0.59, 0.87)
Stroke (Aune et al. 2017)	0.86 (0.84, 0.88)
All-cause mortalities (Aune et al. 2017)	0.89 (0.88, 0.90)
CVD (Aune et al. 2017)	0.90 (0.88, 0.92)
Lung cancer (Vieira et al. 2016)	0.91 (0.85, 0.98)
CHD (Aune et al. 2017)	0.91 (0.89, 0.93)
Diabetes (Wu et al. 2015)	0.91 (0.89, 0.94)
Colorectal cancer (Schwingshackl et al. 2018)	0.97 (0.95, 0.99)
Hypertension (Schwingshackl et al. 2017b)	0.97 (0.96, 0.99)
Cancer (Aune et al. 2017)	0.98 (0.97, 0.99)
Tinned fruit	1.19 (1.06, 1.26)
All-cause mortalities (Aasheim et al. 2015)	1.23 (1.05, 1.43)
CVD mortalities (Aasheim et al. 2015)	1.23 (1.05, 1.43)

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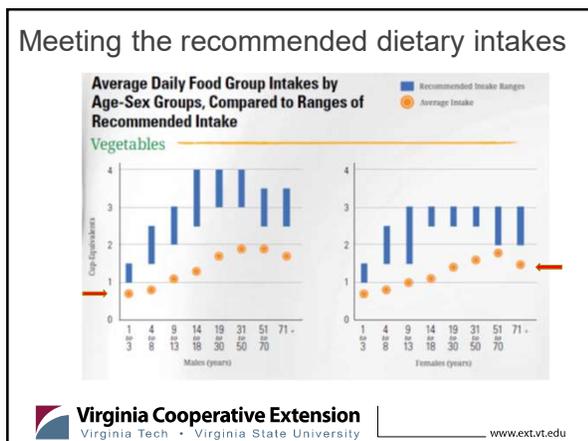
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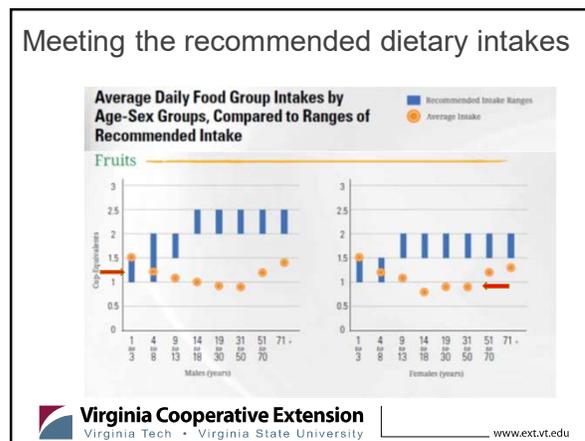
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### Nutritional Content of Fruits and Vegetables

**NUTRIENTS**

- Fiber
- Vitamin C
- Vitamin E
- Vitamin A
- Folate
- Potassium
- Magnesium
- Calcium
- Iron

**Bioactive Compounds**

"Compounds that are constituents in foods and dietary supplements, other than those needed to meet basic human nutritional needs, which are responsible for changes in health status" (NIH Office of Dietary Supplements)

Class	Compound
Carotenoids	a-carotene, b-carotene, b-cryptoxanthin, Lutein, Zeaxanthin, Lycopene
Phenolic compounds	Flavonols, anthocyanins, isoflavones, stilbene, tannins, etc.
Alkaloids	True alkaloids, peptide alkaloids, etc.
Nitrogen-containing	Amines, glycosides, glucosinolates, lectins, etc.
Organosulfur compounds	Isothiocyanates, indoles, allylic sulfur compounds

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### Harvest

**Fruit & vegetable separated from nutrition source**

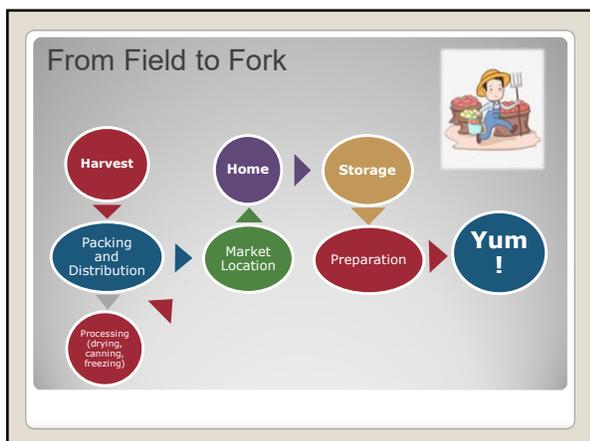
- Respiration – breaks down carbohydrate, protein, fat
- Produce vary in respiration rates
  - Vegetables can lose 15 to 55 percent of vitamin C within a week.
  - Spinach can lose 90 percent within the first 24 hours.

**Ripeness**

- The level of most minerals doesn't change much as fruit ripens.
- Antioxidants tend to increase as fruit ripens.

*Example: The vitamin C content of a red bell pepper is 50% higher than that of a green bell pepper, the vitamin A content is almost 10 times higher.*

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### Advantages to consuming home grown and locally grown produce

- ✓ Increased nutritional value of the foods
- ✓ Provides health benefits and helps to reduce environmental impact.
- ✓ Helps bring the community together.
- ✓ Connection with food production increases consumption
- ✓ Many people feel garden fresh produce food tastes better and lasts longer.

Check out your local grocery store and farmers' markets for locally grown produce, or start your own home garden.

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### Vegetable Gardening

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### What is a Vegetable?

- Might be defined as a herbaceous plant or portion of a plant that is eaten whole or in part.
- Vegetable crops can be thought of as high value crops that are intensively managed and differentiated from agronomic crops such as wheat, rice, soybeans, and cotton. These are more widely grown but managed less intensively.

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### Why Grow Vegetables?

- For a farmer:
  - Increase farm income
  - Farm diversification
- But for home gardeners it is:
  - Having their own food
  - Knowing the source
  - Enjoyable pastime
  - Something to share with neighbors and community

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### Planning a garden

- What do you want to grow?
- Will it all be for fresh consumption or will I freeze /can it?
- Who is going to benefit from the garden?
- How big a garden do I want?
- When will I have crops in the garden?
- **WHO IS GOING TO DO ALL THE WORK?**

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## Planning a garden

- Try to plan early, as much as possible
- Know which crops are direct seeded and which are transplanted
  - direct seeded
    - beans
    - carrots
    - sweet corn
    - Lettuce
    - pea
  - transplanted
    - tomato
    - pepper
    - melon
- Soil testing



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## Virginia's Growing Conditions

- Growing season days-165 to 230



DO YOU KNOW YOUR USDA PLANT HARDINESS ZONE?

**Tidewater Area**

- Average last killing frost in spring 4/10 – 4/21
- Average first killing frost in fall 11/08 – 11/28
- Average number of frost free days 230 days

**Piedmont Area**

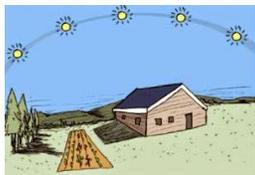
- Average last killing frost in spring 4/20 – 4/30
- Average first killing frost in fall 10/19 – 10/29
- Average number of frost free days 180 days

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## Sunlight

- How much sunlight do my plants need each day?
  - Generally 6-8 hours direct sunlight each day
  - Some crops will do better with less sunlight
  - On southern side of buildings
  - Try not to block plants with tall plants or trellises
  - Overall, more sunlight equals better harvests and healthier plants

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## Where to Plant?

- Draw it out
- Fairly level
- Well drained
- Little shade
- Maybe start small
  - 20' x 20' is a good size
- If the only area you have is not suitable, try raised beds/container gardening



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## Do I Need to Add Anything to the Soil?

- Start with a soil test
- Good organic matter
- Fertilizer
- Amendments
  - to adjust pH
    - acidic: sulfur, peat moss, pine bark
    - basic: wood ash, lime
  - fertilizer
  - adding organic matter
    - compost
    - green manure cover crops
- Containers would use soilless media




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## Tilling the Soil

- Rototiller
- Disc
- Double digging
- Plow (moldboard or chisel)
- Generally best done in the spring





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### Containers and Raised Beds

- Made of wood
- Hills or mounds of dirt
- Small volume of soil to warm in spring
- More efficient use of irrigation
- Compost




[Publication](#)  
[Containers](#)

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### Weed Control

- Herbicides
- Ground covers/weed barriers
- Tight spacing
- Cold, hard steel






[Weed Control Video](#)

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### Pests

- Mammalian
- Fungus
- Bacteria
- Insect






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### Tools

Shovels, rakes  
Sprayers  
Hand tools






[Tool Video](#) [AgrAbility Video](#)

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### Irrigation



- Rain
- Drip
- Sprinkler
- Needed for consistency and success
- Plants and fruit high water content
- About one inch per week
- Keeping soil moisture evaporation down

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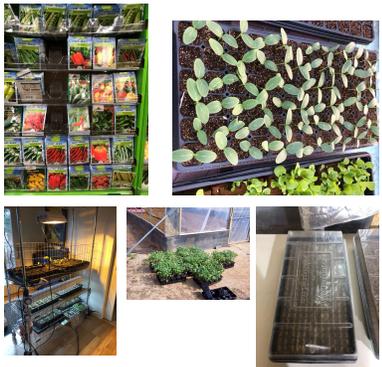
### Critical Watering Times

- Legumes –pod filling
- Cole crops – head development
- Sweet corn – ear development
- Tomatoes, melons – flowering to fruit development




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### Seeds and Growing Seedlings

- Check dates on pack
- Look at maturity times
- Beneficial for many crops
- Best in a greenhouse
- Requires proper planning
- Transplant shock
- Good initial watering



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## Closing the Garden

- Can be at different times of the year
- Make sure to protect infrastructure
- Gives you a head start on next season
- Takes some organization



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## What about Indoor Gardening?

- You can purchase 'off the shelf units'
- Build your own
- Can be inside with grow lights or outside
- Hydroponics
  - Growing plants without soil
- Aquaponics
  - Growing plants and fish together





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## Crops

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## Crops for different seasons

- Peas – mid-March
- Onions – mid-March
- Spinach – late-March through April then in the late summer through September
- Lettuce – spring and fall, winter with season extension
- Beets and Turnip – late-March/April
- Cabbage and Broccoli – late-March/April and August/September
- Green beans and Edamame – May
- Sweet Corn – May
- Eggplant and Tomatoes – late-April/May

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## Asparagus

- Perennial crop, long lived
- Plant crown 6" deep in trench in April then cover
- Plant in well drained plot
- pH 6-7
- Harvest in second season, but lightly
- Harvest just below soil surface
- Season extension
- Source [www.walkerplants.com](http://www.walkerplants.com)
- Crowns = \$1.00-1.50





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## Broccoli/Cauliflower

- Sunny, well drained field
- pH 6-6.5
- Cool season, into Jan. with protection
- Mostly heading type
- Transplants, easy to find
- Harvest before flowers open
- Leaves can be used as greens
- Loopers, aphids





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## Summer squash

- Sunny, well drained field
- Warm temperature
- Seeds or transplants
- Rows 3-4' OC and 2-3' within the row
- Few different types
- Usually <65 days from seed
- Harvest small fruit
- BER and failure to set fruit



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## Tomato

[Tomato Staking Video](#)   [Tomato Video](#)

- Warm season, intolerant to frost
- Edible part is the fruit, processing or fresh market
- In Virginia, commercially produced mainly on the eastern shore
- Different size, shape, and color based on cultivar
- Transplants
- Prune suckers to immediately below first cluster
- Determinant 4-5' row spacing 18 or 24" OC in row, Indeterminate 5-6' row spacing 24-36" OC in row
- Catfacing, BER, cracking
- Worms, Colorado Potato Beetle, Aphids, Thrips
- Botrytis, Late Blight, Fruit Rot




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## Salad Greens/Herbs/Spices

- Mostly we think of things like:
  - Lettuce
    - Bibb
    - Romaine
    - Leaf
  - Chard
  - Spinach
  - Mustard
  - Arugula
  - Sorrel
  - Kale
  - Endive
  - Basil
  - Peppermint
  - Ginger and Turmeric
  - Garlic








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## Summary

- General Steps for a successful Garden
  - Plan
  - Till ground or get compost/soil/media
  - Add amendments
  - Plant seeds or seedlings
  - Water as needed
  - Scout for pests and problems (daily)
  - Remove weeds (constantly)
- Tips for success
  - Pick good location
  - Soil test
  - Start small
  - Learn about the plants your growing
  - Have proper tools
  - Use high quality seeds
  - Give plant enough space
  - Journal (record information)

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## Resources

- <https://ext.vt.edu/lawn-garden/home-vegetables.html>
- <https://www.youtube.com/user/VirginiaFarmBureau>
- <https://hort.extension.wisc.edu/files/2014/10/Using-Cover-Crops-and-Green-Manures-in-the-Home-Vegetable-Garden-May-14-2014.pdf>
- [https://extension.umd.edu/sites/extension.umd.edu/files/\\_images/programs/hgic/Publications/HG42\\_Soil\\_Amendments\\_and\\_Fertilizers.pdf](https://extension.umd.edu/sites/extension.umd.edu/files/_images/programs/hgic/Publications/HG42_Soil_Amendments_and_Fertilizers.pdf)
- <https://catalog.extension.oregonstate.edu/sites/catalog/files/project/pdf/ec1561.pdf>
- [https://www.nrcs.usda.gov/Internet/FSE\\_DOCUMENTS/nrcs142p2\\_022940.pdf](https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_022940.pdf)
- <https://extension.tennessee.edu/publications/Documents/W346-E.pdf>
- <https://www.berryhilldrip.com/Starter-Kit-with-100-Feet-of-Drip-Tape.html>
- <https://www.rareseeds.com>
- <https://www.johnnyseeds.com/>

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## Contact

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Thank You.

Questions?



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## What you need to know about safety in growing and preserving fresh fruits and vegetables



Presented by  
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Developed with  
Renee Boyer, Ph.D. & Joell Eifert, M.S.

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## Foodborne Illness

- From the Centers for Disease Control and Prevention (CDC)
  - 48 million people annually
  - 128,000 hospitalizations
  - 3,000 deaths
- Biological, chemical, and physical contaminants



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## What Bacteria Need to Grow

- Food
- Acidity
- Temperature
- Time
- Oxygen
- Moisture



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## What Bacteria Need to Grow

- Food
- Acidity  
pH = Amount of acidity  
Low acid food = pH > 4.6
- Temperature
- Time
- Oxygen
- Moisture



pH	Substance
14.0	very alkaline
13.0	household lye
12.0	bleach
11.0	ammonia
10.0	
9.0	
8.0	egg whites
7.0	swimming pool water
6.0	pure rain
5.0	beer
4.0	pickle processing
3.0	lemon juice
2.0	
1.0	very acid
0.0	battery acid

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### What Bacteria Need to Grow

- Food
- Acidity
  - pH = Amount of acidity
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### What Bacteria Need to Grow

- Food
- Acidity
- Temperature
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### What Bacteria Need to Grow

- Food
- Acidity
- Temperature
- Time
- Oxygen
  - Aerobic: most spoilage organisms
  - Facultatively anaerobic: pathogens
  - Anaerobic: *Clostridium botulinum*
- Moisture

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### What Bacteria Need to Grow

	Microbial Group	Example	a <sub>w</sub>	Products Affected
Food	Normal bacteria	Salmonella species Clostridium botulinum	0.91	Fresh meat, milk
Acidity				
Temperature	Normal yeast	Torulopsis species	0.88	Fruit juice conc.
Time	Normal molds	Aspergillus flavus	0.80	Jams, jellies
Oxygen	Halophilic bacteria	Walleimia sebi	0.75	Honey
Moisture	Xerophilic molds	Aspergillus echinulatas	0.65	Flour
	Osmophilic yeast	Saccharomyces bisporus	0.60	Dried fruits

a<sub>w</sub> target = 0.85

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### Can't I just wash it?

- Washing is useful in removing physical debris
- Very difficult to remove chemical or biological contamination
- Prevention is key

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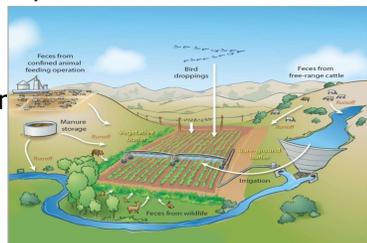
### Preparing the Garden

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## Site Selection

- Know the history
- What else is r



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## Soil and Compost

- Test your soil
- Safely create and use compost and/or other amendments



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## Water

- Determine your source and how you'll use it
  - Municipal, well, rain barrel
  - Overhead or drip irrigation



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## People

- Practice good handwashing
- Avoid eating, drinking, smoking, etc. in the growing area
- Provide some kind of training



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## Tools and Equipment

- Keep your tools and clean and sanitized
- Inspect equipment



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## Harvest, Storage, and Transport

- Determine by how/when you'll eat it!



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## Why Preserve Foods?

- Prevent Spoilage of Foods & Extend Shelf Life

- Types of Spoilage:

- Microbiological

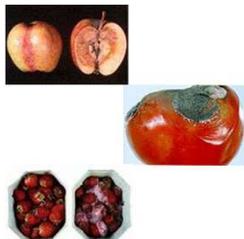
- Molds, yeast, bacteria

- Chemical

- Enzymatic changes

- Physical

- Bruising, water loss



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## Methods of Home Food Preservation:

- Heat Processing/Canning
  - Destroys microorganisms
  - Inactivates enzymes
  - Seals container
- Freezing
  - Slows down growth of m/o and slows enzymes
- Drying
- Fermentation

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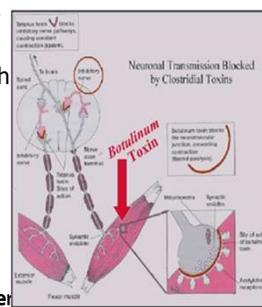
## Why Acidity is the most important factor when it comes to canning!

- Clostridium botulinum***
- Spore-former: spores ubiquitous in the environment
  - Can't make you sick
- ONLY: Under anaerobic conditions (commonly created during preservation), spores germinated into vegetative cells
- Vegetative cells produce toxin

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## Botulism:

- Ingestion of toxin in foods
- Neurotoxin
- Causes paralysis and death if medical attention isn't found quickly
- Very rare in U.S. now
- Primarily associated w/ improperly home canned



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## Acidity of Common Foods

- |                |               |
|----------------|---------------|
| ■ Apples       | ■ Meat, fish  |
| ■ Oranges      | ■ Carrots     |
| ■ Peaches      | ■ Green beans |
| ■ Strawberries | ■ Potatoes    |
| ■ Pears        | ■ Peas        |
| ■ Blueberries  | ■ Cabbage     |
| ■ Tomatoes     | ■ Corn        |
| ■ Apricots     | ■ Squash      |
| ■ Cherries     |               |

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## Canning Foods

- Low acid foods:
  - pH >4.6**
  - Processing Pressure canner!
- High acid foods:
  - pH <4.6**
  - Boiling water bath
- Acidified foods:
  - pH is decreased to <4.6 by **adding acid**
  - Pickling, salsas, tomatoes
  - Boiling water bath

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## Boiling Water Bath Canning:

- Large covered cooking pot with a rack
- Must be deep enough to cover 1 inch above jars
- Processes foods at boiling temp. (212°F)
- Acid / acidified foods
- Heat destroys m/o that spoil acid foods

**Water Bath Canner**

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## Pressure Canning:

- Heavy pot, lid can be sealed: fitted w/ vent and pressure dial or weighted gauge
- Processes foods at 240°F (10-11 pds pressure)
- ONLY safe way to process low acid foods

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## The Effects of Altitude:

- Water boils at lower temperatures as altitude increases.
- Lower temps are less effective, so:
  - Boiling water bath: processing time increased
  - Pressure canning: pressure increased
- Altitudes in VA vary greatly: Blacksburg: 2080ft

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## Freezing:

- Easiest, most convenient quickest methods
- Freezing is the safest method, but may not produce the best quality
- Does not sterilize foods
- Retards the growth of m/o and slows down chemical changes that affect the quality of the foods

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## HOME FOOD PRESERVATION

VIRTUAL PROGRAM

More people than ever are growing their own food at home. This self-paced virtual course will teach you how to safely preserve your fresh foods for year-round enjoyment using techniques such as canning, freezing, dehydration and fermentation.

You'll learn the science behind these techniques and receive step by step guidance on how to do them at home. After registering, you can complete the course at your own pace until December 31.

**For more info and to register, go to:**  
<https://bit.ly/2MrcY8G>

**Enroll**  
starting July 17,  
Registration deadline  
October 15, 2020

**Course fee**  
\$15

If you have any questions, please contact Dr. Renee

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