Crop Trouble Shooting

Urban Farm Design, Installation, & Coaching
Outline

- Love & Carrots
- Trouble-shooting Major Crop Families
  - Goosefoots
  - Squash
  - Nightshades
  - Brassicas
- Sunlight Challenges
- Succession Planting
Love & Carrots

Trouble-shooting Major Crop Families
- Goosefoots
- Squash
- Nightshades
- Brassicas

Sunlight Challenges

Succession Planting
What We Do

Urban Farms, Gardens, Edible Landscapes

Design, Installation, Maintenance, Coaching

- Design & Installation
  - Over 600 gardens installed

- Full Service Garden Care
  - ~150 Gardens

- Garden Coaching
  - Community programming
  - Curriculum-based bi-weekly Lessons

- Other stuff!
  - Master plans, pergolas, garden fencing, irrigation
  - Consulting, planting plans, revamps...
Who We Are

Local, Woman Owned, Employee Owned

Experienced Staff, Good Living Wage, Benefits
Who We Are

Experienced Staff, Good Living Wage, Benefits
Who We Are
Our Farm

Transplants sourced in-house
Boosting new growers all over the city

Partnering with Communities

- Martha’s Table
- FoodPrints Schools
- Brainfood
- Many Area Schools
- Children’s Health Center
- Union Kitchen
- Low-income Housing Developments
- Apartment Complexes
- RiverSmart Homes
- Military Bases
- Little Wild Things Farm
- Montessori Schools

Percentage of revenue donated to non-profit and school garden projects every year.
Restaurant Collaborations

- Pineapple & Pearl
- Rose’s Luxury
- Columbia Room
- Calico
- Big Bear Café
- Red Hen
- Chaia Taco
- Boundary Stone
- Brookland’s Finest
- Timber Pizza
- Dolcezza
- Belle Haven Pizzeria
- Ice Cream Jubilee
- Bacio Pizza
- Del Ray Pizzeria
- Steele Plate
- Army Navy Club
- More…
Who We Are

Local, Woman Owned, Employee Owned

Award-winning

- 2017 Edible DC – Best Home Garden, and Best Chef-Farmer Collaboration finalists
- 2017 Best of DC – Best Green Business runner up
- 2017 Eat Local First – Best Green Business runner up
- 2016 MWCOG – Energy and Leadership Award
- 2016 Best of DC – Best Green Business runner up
- 2014 Business Insider – Top 50 “Coolest” New Businesses in America
- 2014 Business Insider – Top 24 “Coolest” New Businesses in DC
- 2013 DC Mayors Award for Sustainability
- 2013 Green America People and Planet Award

Founded 2011
Trouble-shooting Major Crop Families

- Goosefoots
- Squash
- Nightshades
- Brassicas

- Sunlight Challenges
- Succession Planting
Goosefoot Family

Chenopodiaceae

- **Beets**: Wild beets, leafy and without large roots, can still be found growing on the seacoasts of Western Europe and the Mediterranean.

- **Spinach**: Native to western Asia and domesticated after the fall of the Roman empire.

- **Chard**: A chard-like green has been eaten since prehistoric times. Early Greeks mentioned varieties of chard in their writings.

- **Others**: Amaranth, Quinoa, Lambsquarters
Goosefoot Family

Growing Tips:

- Fertilize every week with fish emulsion.

- Beets will become tough and stringy if grown in hot weather during droughts; enough water is essential to succulent roots.

- As beets size up, their shoulders will grow out of the soil. Hill a little bit of soil over the tops to keep the skin smooth.

- Beets not filling out? Check sunlight, check thinning, check soil test...
  - Low P and High N can lead to small bulbs.
Goosefoot Family

Managing Leafminers:

- If present in past seasons, row covers are not effective, as the fly overwinters in the soil as a pupae and emerges in the spring.

- Shortly after thinning, it is worth taking the time to check each leaf for eggs.

- Be patient, and do this twice when the sprouts are small and need all their leaves for photosynthesis.

- Once the beets are of an edible size, you can prune off some of the worst leaves, but do not remove them all!
Goosefoot Family

What happened?

- Beets not filling out?
  - Check sunlight: Less than 5-6 hrs can reduce bulbs, try small varieties
  - Check thinning: Improper spacing can reduce bulb size
  - Check soil test: Low P and High N can lead to small bulbs (be careful with P!)

- Spinach bolting
  - Cool weather crop: time to pull?
    - Start earlier with a row cover or cold frame
    - Plant bolt-resistant varieties
  - Too much water, too little water
    - Check drainage in pots
    - Check for tree root takeovers
Cucumbers:
- Originated in India and Western Asia.
- Cultivation began 3000 years ago.
- Romans grew them by 100 AD and spread them through Europe.
- Arrived in Haiti (Hispaniola) with Columbus in 1494.
- Spread to Florida and out to the Great Plains through Native American tribes.

Squash:
- New World OG: central Mexico, Peru and Eastern USA in 10,000 BCE.
- Native Americans cultivated squash heavily before European contact.
- Introduced to the Old World after Columbus' exploration in 1492.
Squash

Growing Tips

- Heavy Feeders
  - Mix in plenty of compost and mind your plant spacing!
  - Fertilize as necessary (soil test first)

- Don’t like dense soil – benefit from raised beds or deep cultivation

- Very delicate young root systems
  - Direct seed when possible
  - Pick off all early flowers
    - Transplanting often stresses plant, triggering early blossoms

- Sun hogs! 8+ hours for generous harvest
  - Cucumbers and Trombocino Squash can tolerate 5 hours of sun

- Bush type vs Climbing
Managing Cucumber Beetles:

- **Damage:**
  - Overwintered adults feed on sprouting seeds (cotyledons)
  - Larvae feed on roots
  - Spread bacterial wilt (*Erwinia tracheiphila*) coming up

- **Prevention:**
  - Use a row cover as possible
  - Transplant instead of direct seed (larger plants are more tolerant of damage),
  - Rotate crops
  - Trap crop of blue hubbard squash

- **Treatment:**
  - Sprays are generally ineffective
  - Sticky Traps
  - Kaolin clay on young plants
Squash

Bacterial Wilt:

- *Erwinia tracheiphila*: Overwinters in the digestive system of the cucumber beetle, and is active in its excrement.

- Spread by cucumber beetle: bacteria-laden excrement enters through feeding wounds, mouth parts become infected and they spread to other plants.

- Bacterium reproduces in the xylem of the plant, preventing the movement of water causing wilting.

- Can affect both cucurbits and tomatoes.
**Squash**

**Bacterial Wilt Identification:**

- Wilting of individual leaves first. Sometimes they will wilt during the day and recover at night.
- As the bacteria progresses entire branches wilt and die.
- Slice an infected branch and look for “bacterial slime”

**Control:**

- No organic treatment for infected plants: control cucumber beetles.
- Remove and destroy infected plant.
Squash Vine Borer

- Adult moth lays eggs on the stems and underside of leaves on squash and zucchini plants.

- Larvae tunnel into the stems of the plant. Small piles of sawdust-like material (“frass”) around the base of plants indicate vine borer presence.

Prevention:
- Early summer row covers
- Check for eggs in late spring/early summer and remove.
- Spray stems with kaolin clay.
- Crop rotation is key, since borers overwinter in the soil.

Treatment: Use a long pin or harvest knife to pierce larvae. Spray BT, mound soil over the wound in the stem.
What Happened?

- Big plants, not much fruit production
  - Not enough Sunlight
  - Enough Flowers? Try hand pollinating
  - Too much Nitrogen

- Blossom End Rot: Squash not developing
  - Low calcium is rarely the cause
  - Low pH (<5.5) prevents calcium absorption
    - Lime

- Plant stress: unusually cool or hot weather, drought, or wet soil
  - Root Damage
    - Add organic matter to clay soils, grow in raised beds, water evenly
    - Mulch Straw or grass clippings

- Nutrient over-saturation
  - Too much Nitrogen (N): accelerated plant growth, Calcium can’t keep up
  - Too much Potassium (K): inhibits calcium absorption
Nightshades

Solanaceae:

- Everyone’s summer favorites: tomatoes, peppers, potatoes and eggplants. Also Tobacco and goji berries.

- Found worldwide! Greatest diversity is found in South and Central America.

- Solanine is a poisonous alkaloid in all nightshades (other alkaloids include capsaicin and nicotine). They are natural pesticides.
  - Toxic to humans, pets and livestock
  - Jimsonweed, nightshade, and mandrake are all poisonous nightshades
Nightshades

Growing Tips

- Sun Loving: at least 7-8 hours of sunlight
  - Less Sun: Cherry tomatoes, hot peppers, non-bell sweet peppers, and Asian eggplants.
  - Consider Hybrids and disease-resistant varieties

- Trellis properly
  - “Tomato Cages” work for eggplant & peppers
  - Tomatoes need something taller, wider, sturdier

- Plant tomatoes nice and deep

- Mind your plant spacing

- Don’t over-water

- Practice preventative disease control (more to come)!
Nightshades

Common Pests:

- Spider Mites
- Squirrels
- Tomato hornworm
- Aphids
- Flea Beetles

Common Nightshade Diseases

- Bacterial and Viral Wilt
- Early, Late Blight
- Blossom End Rot
- Too many others!
Nightshades

Managing Spider Mites

- Identification
  - Beans, tomatoes, many Herbs and Cucurbits.
  - Suck chlorophyll from the underside of leaves, creating fine white spots ("stipples").
  - Spin fine webbing that can be seen on underside of leaves.

- Indicators of stress:
  - Low Light/shady conditions, too wet, too hot/dry

- Treatment:
  - Neem oil and pyrethrin when mites are first observed - spray in morning when leaves are rehydrated to prevent further damage.
  - Mites like it dry and dusty, so hose off undersides of leaves to cool and clean them and dislodge mites.
  - Remove badly infested leaves.
Nightshades

Early Blight

Late Blight

Fusarium & Verticillium Wilt (look in stems)
Blight Control

- Copper Fungicide is proven to slow blights

- Biological Control: “Serenade”
  - *Bacillus subtilis* occurs naturally in soil and the human gut.
  - Used in World War II by Germans to cure dysentery
  - Competes with disease-causing fungi for nutrients and space.
  - Releases an antifungal chemical that has shown to control powdery mildew, leaf spot, and many root pathogens.

- Serenade Use:
  - Spray plants to run-off, covering both top and bottom surface of foliage.
  - Ideally spray at 7 day intervals.
  - Spray as a preventative or at the first sign of foliage development.
  - You can harvest and eat fruits and vegetables the same day they are treated and *Bacillus subtilis* does not pose a risk to bees or beneficial insects.
Blight Control

Baking Soda / Sodium Bicarbonate / SBC

Is Baking soda really effective as a fungicide?

Yes and no.

- Fungistatic, not a fungicide
- Preventative in combination with....
  - Right Plant, Right place
  - Pruning and airflow
  - Crop Rotation
  - Remove diseased parts of plant

Fungistatic Baking Soda Recipe

- 1 Gallon Water
- 1 tablespoon baking soda
- 1 tablespoon oil*
- 1 or 2 drops dishwashing liquid

Avoid the heat of the day.

*Light Horticultural oil, or vegetable oil in a pinch
Nightshades

Blight Control

Blight flourishes in lower light conditions.
Night Shades
Night Shades

Squirrels
Nightshades
Nightshades

What Happened?

- Big plants, not much fruit production
  - Sunlight: lanky, tall plants: “etiolated”
  - Pollination problems, too much N

- Blossom End Rot
  - pH, N, K, drainage/irrigation

- Green fruit not ripening/spotted
  - Bacterial infections: Bacterial speck, canker, spot
  - Fungus: Alternaria canker, Late Blight, Buckeye Rot
  - Viral: Mosaic Virus
Nightshades

What Happened?

- Ripe fruit rotting
  - Fungus: Anthracnose, Black Mold, Sour Rot, Alternaria Canker, Late Blight
  - Blossom End Rot
    - pH, N, K, drainage/irrigation
  - Yellow Specks: Harlequin Beetle Damage
Nightshades

Good Nightshade Growing Practices:

1. Don’t Re-infect
   - Crop Rotation
   - Throw out old container soil
   - Sanitize tools

2. Plants dry and off the ground
   - Good trellising
   - Prune for good Airflow
   - Mulch w/straw

3. Roots moist, but not too wet
   - Don’t overwater
   - Ensure proper drainage
   - Mulch w/straw
Cole Crops

Brassicaceae

- AKA “crucifers” or “cole crops”
- Your favorite spring veggies: arugula, broccoli, collards, kale, and radishes, more...
- All brassicas share a common wild ancestor: resembled loose-leafed kale
- Native to the north Atlantic coast of Europe
- Adapted to the cold, salty spray of coastal habitats - Don’t like the heat! Perform best in the spring and fall
- Waxy, thick green leaves, which is still characteristic to the plant family.
Cole Crops

Growing Tips

- For large, adult plants, start with transplants
  - Start seeds indoors as early as January(!)
  - Consider non-heirlooms (hybrid and other disease-resistant varieties).
- Transplant DEEP in soil - to base of top leaves, pull off lower leaves
- Use Row Covers when possible
- Fertilize regularly with N-heavy Organic
- Practice preventative pest control (more to come)!
Cole Crops

Common Pests:
- White Flies
- Cabbage Worms
- Aphids
- Cabbage loopers
- Slugs
- Harlequin beetles

Common Brassica Diseases:
- Powdery Mildew
- Clubroot
- Wire stem
Controlling White Flies

- Tiny white moth-like bugs. Not true flies or moths; related to aphids and mealy bugs.
  - Look for powdery white spots.
  - Emerging in a cloud when leaves are shaken.

- Reproduce rapidly in summer months and suck out phloem, stunting the plant

- Exude a sticky residue, called honeydew, which can attract sooty mold.

Prevention:
- Avoid low light conditions
- Use row covers if whiteflies have not been present before

Treatment:
- Dust Buster, eliminate highly infected leaves
- Neem oil, insecticidal soap can reduce, but not eliminate (they build up immunities quickly)

- Cabin fever resistant, health and happy roots and beneficial nematodes
Cole Crops

Slugs: did you know?

- At any time, 95% of slugs are **underground**: digesting, laying eggs, and feeding on roots and seed sprouts.
- Some slugs live 6 years!
- Slug eggs can lay up to 100 eggs several times a year
- Slugs don’t need to mate to reproduce
- Eggs can lay dormant for years before hatching
- Slugs need to eat and drink constantly to keep moist**
- Slime contains fibers that help it both glide and stick

Also common pests on Lettuces, and Goosefoots.
Managing Slugs

- Beer traps (bonus: lid!)
- Slug pellets (iron phosphate)
- Clean, Trap & Kill!
- Dry it out – raise your beds further

Slug damage: jagged holes

less Effective

- Copper Strips
- Coffee Grounds
- Cornstarch
- Eggshells or other “rough surfaces”
Cole Crops

Wondrous Diversity of “Cabbage Moths”

- Agricultural Fabric (row covers)
- Hand-picking!
- Bacillus thuringiensis (Bt)
  - Toxic to larva when ingested
  - only affects leaf-feeding insects
  - Toxins attack gut walls of insect
  - Safe for adult insects
  - Harmless to humans
  - Not to be overused

Pieris rapae
Cabbage Moth

Trichoplusia ni
Cabbage Looper

Plutella xylostella
Diamondback Moth

Bt Application: Timing and location are key

Evergestis rimosalis
Cross-striped Cabbage Moth
20-30 eggs!
**Club Root** - *Plasmodiophora brassicae*

- Weird class of fungus
  - More severe on cold, wet, acidic soils
  - Spreads by drainage water, infested soil on tools, or shoes, and infected transplants
  - Affects ~10% of brassicas nationwide

- Yellowing, wilting leaves, stunted growth, Galls on roots
  - Spores cause root hairs to rapidly divide, forming galls that prevent root function
  - Spores survive in soil 18 years

**Prevention:**
- Maintain a high pH by regular applications of lime.
- Long crop rotation intervals (5-7 years)
- Improve soil drainage with raised beds and compost
- Control weeds in brassica family
- Love & Carrots
- Trouble-shooting Major Crop Families
  - Goosefoots
  - Squash
  - Nightshades
  - Brassicas
- Sunlight Challenges
- Succession Planting
Sunlight Challenges

Blight flourishes in lower light conditions
Tailor your crop list

- >8 hours................. Go nuts!
- 6 to 8 hours............. Some fruit, Herbs, Greens
- 4 to 6 hours............. Focus on certain Herbs & Greens
- < 4 hours .............. Get Creative
Shady Spaces

5-6 Hours of Sun

- Cherry Tomatoes (only)
  - Supersweet 100
  - Sungolds

- Herbs
  - Oregano
  - Sage
  - Rosemary
  - Thyme
  - Chives
  - Basil
  - Cilantro
  - Lovage

- Greens
  - Swiss Chard
  - Kale
  - Collards
  - Asian Greens

- Others
  - Scallions
  - Trombocino Squash
  - Suyo-long Cucumbers
  - Hot Wax Peppers
  - Peas

- 5-6 Hours of Sun
Shady Spaces

4-5 Hours of Sun

- Cherry Tomatoes (only)
  - Supersweet 100
  - Sungolds

- Herbs
  - Oregano
  - Sage
  - Rosemary
  - Thyme
  - Chives
  - Basil
  - Cilantro
  - Lovage

- Salad Greens
  - Swiss Chard

- Greens

- Others
  - Scallions
  - Trombocino Squash
  - Suyo-long Cucumbers
  - Hot Wax Peppers
  - Pea shoots
Shady Spaces

3-4 Hours of Sun

- Osaka Red Mustard
- Baby Lettuce Mix
- Arugula
- Garlic Chives
- Basil
- Winter Lettuces

Stick to crops you eat the leaves of.

Grow in a larger area to compensate for slow growth.
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Succession Planting

Undersowing

- Pair Light feeders with Heavy Feeders
- Layer quick growing crops under young slow-growing crops
  - Baby greens under kale
  - Radishes around squash
  - Cilantro under Peppers

Succession Planting

- Start fall crops early
- Install irrigation to help with seeds and young transplants
Succession Planting

- Cucumbers under Peas
- Carrots under Tomatoes
- Lettuce under onions
- Fall Brassicas under Nightshades
Stay in touch!

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