

The Northern Delaware Community Garden Toolkit

Created by the



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Welcome to The Northern Delaware Community Garden Toolkit assembled by the Delaware Urban Farm and Food Coalition (DEUFFC). The DEUFFC formed in 2008 to support Wilmington, Delaware's first urban farm; it organized the region's first urban agriculture summit in 2011 during Delaware's Ag Week with nearly 100 farmers, health advocates, and community gardeners in attendance, this summit led to an annual Ag Week event, which is still held today.

The DEUFFC's mission is to provide a network of support for community-oriented urban agriculture and community garden projects that seek to expand access to healthy foods in Northern Delaware. DEUFFC works to achieve its mission through resource sharing, event coordination, networking, partnership, collaboration and community building activities. The principal beneficiaries of the DEUFFC's work are residents of Wilmington and northern New Castle County; much of this area includes extensive USDA designated food deserts, locations with limited access to affordable, nutritious, and culturally relevant food. These food deserts affect over 33,000 households in New Castle County, which equates to nearly 64,000 individuals who are considered food insecure (USDA Food Access Research Atlas).

Together, the Coalition represents a broad spectrum of individuals all working to support urban agriculture in Northern New Castle County. These collaborations allow the furthering of the DEUFFC's mission through workshops, garden tours, virtual movie screenings, happy hours, and more!

**LEARN MORE ABOUT HOW TO GET
INVOLVED BY VISITING OUR WEBSITE:
WWW.DEUFFC.COM**

WHAT IS A COMMUNITY GARDEN?

For the purpose of this guide, a community garden is broadly defined as any piece of land gardened by a group of people, using either individual or shared plots on public or private land. The land may produce fruit, vegetables, or ornamentals. Community gardens may be found in neighborhoods, schools, connected to institutions such as community agencies, churches or hospitals, or on residential housing grounds¹.

WHY COMMUNITY GARDENS MATTER

Community gardens grow community! These gardens are places where residents get together and build relationships with each other. They are also places where families, classmates, and neighbors share knowledge and learn from one another. Gardens serve as a space to grow food, play, and relax. Typically, community gardening offers its participants a source of recreation, education, and respite from the busyness of daily life. Community gardens can also serve as an alternate source of income and nutrition for gardeners.

GETTING STARTED

Creating a community garden is a substantial project requiring sustained effort over several years. It takes a strong commitment from several individuals to create and manage a successful garden. Just because you build it, doesn't mean they will come. In fact, seldom is a garden designed and built by outsiders adopted and sustained by a community. Without a community, you just have a garden. The community should be front and center from the beginning. Here are the basic steps to starting a community garden.

STEPS TO CREATING A COMMUNITY GARDEN

1. Determine community need and desire
2. Determine garden type and goals
3. Organize interested people and choose a leadership team
4. Understand the importance of soil health
5. Site selection and development
6. Determine budget and sponsorship
7. Understand safety, accessibility, and liability
8. Secure funding and resources
9. Garden maintenance
10. Overcome garden challenges



Photo courtesy University of Delaware Cooperative Extension

DETERMINING GARDEN NEED AND DESIRE

Community gardens start with ‘community.’ In order for a garden to be sustainable and a true community resource, it must grow from local conditions and reflect the strengths, needs, and desires of the local community. Involving many people at the beginning of the process increases the shared sense of ownership and responsibility for the success of the garden. Assistance from people or organizations outside the community can be helpful. However, the people who will use the garden should make most of the decisions about how the garden is developed and managed.

Several exercises, found in the back of the toolkit, are helpful in determining need and desire for a garden within the community:

- Appendix A: Developing a Vision for Your Garden²
- Appendix B: Assessing Community Readiness³
- Appendix C: Identifying Neighborhood Resources⁴

DETERMINING GOALS AND GARDEN TYPE

Once the need and desire for a garden is identified, the next step is to develop garden goals. These goals spell out the purpose of the garden and clearly state the garden’s intention. Use these goals to determine what kind of community garden should be built to ensure the identified needs of the community are being met.

Community, or neighborhood, gardens come in many different forms but generally have the following shared traits:

- Located on land divided into different plots for individual and/or family use. The land may be borrowed, rented, or owned by the gardeners
- Gardeners prepare, plant, and maintain their own plots. Produce from the garden is consumed by gardeners and neighbors rather than selling it.
- Tools, water, compost, seeds, and plants are shared amongst gardeners
- Are organized and managed by the gardeners themselves, having a garden committee to share the work with one or more leaders responsible for the day-to-day activities.

Below are just a few examples of specific garden types that one might consider:

YOUTH/SCHOOL GARDENS expose young people to gardening and nature, give them the opportunity to do some of their own gardening, and provide educational opportunities in a variety of subject areas. These gardens are typically associated with a formal or semi-formal program that incorporates classroom lessons with hands-on gardening activities.

ENTREPRENEURIAL/JOB TRAINING MARKET GARDENS are typically established by nonprofit organizations or other agencies to teach business or job skills to youth or other groups. They grow and sell their produce. Proceeds from the sale of garden products are often used to pay the participants for their work. Programs typically rely on outside sources of funding to offset costs.

COMMUNAL GARDENS are typically organized and gardened by a group of people who share in the work and rewards. Plots are not subdivided for individual or family use. Produce is distributed among group members. Sometimes produce is donated to a local food bank or food pantry.

FOOD PANTRY GARDENS may be established at a food pantry, food bank, or other location. Produce is grown by volunteers, food pantry recipients, or both and donated to the food pantry.

THERAPY GARDENS provide horticultural therapy to hospital patients and others. A trained horticultural therapist often leads programs and classes.

DEMONSTRATION GARDENS at community gardens or other locations are often open to the public for display and classes. Demonstration gardens show different types of gardening methods, plant varieties, composting techniques, and more. They may be managed and maintained by garden members or a participating gardening group such as Cooperative Extension Master Gardeners or community members.



Photo courtesy Southbridge Community Garden

ORGANIZING A MEETING OF INTERESTED PEOPLE

Forming a manageable group of committed individuals ensures that one person will not be doing all the work. Gather people who are committed to maintaining an individual plot of their own, and the garden as a whole, for at least one season. Be sure to keep neighbors surrounding the garden informed about your plans. A Planning Committee should include an organized Garden Coordinator who is willing to coordinate plot assignments, water access, and communication with gardeners and the landowner. Another common position is a Treasurer to handle the fees and money generated by fundraising.

The committee should have both people who are interested in being gardeners and people who have good community contacts. An expert gardener, such as a Master Gardener from the University of Delaware Cooperative Extension Office, would be a good person to act as a reference and committee member. Other committee members could include representatives from local schools and/or nonprofits, neighborhood council members, church leaders, local politicians, lawyers, and, perhaps most importantly, the neighbors who live near the garden.

Once you have a group of interested committee members, it's time to call the first meeting. This meeting will allow members to become acquainted with each other. This is when community building begins. The agenda should include envisioning what the garden will look like, discussion on what land is available, and what focus it could take (such as a youth education or food pantry garden).

CHOOSING A WELL-ORGANIZED LEADERSHIP TEAM

Inventory the group's skills and resources person by person. Match a person's skills to their role and how that fits into the mission. This keeps people personally invested in the project. A Community Garden Capacity Inventory⁵ may be useful in determining the skills and resources of community garden members. Find an adapted version of this exercise in Appendix D.

SHARE LEADERSHIP

- Everyone has some leadership qualities. Find ways they can be expressed
- Share leadership via roles, responsibilities, and committees
- Support each other in filling different roles

LEADERSHIP TIPS

- Learn to be an active listener
- Provide guidance with decision making by sharing consequences and options
- Learn to facilitate problem solving, instead of providing a quick answer
- Invest time in planning
- Developing a garden leadership group takes time, so create a long term plan
- Be prepared to alter your plans based on new information
- Take time to celebrate your accomplishments

Sample Community Garden Budget				
Items	Price/Unit	Expected	Actual	Notes
Start-Up Expenses				
15-Raised Beds (8X4X1)				
Lumber (8'X2"X6")	\$10/board	\$900		6 boards/bed so 90 boards. Price for spruce, pine, fir lumber
Lumber (8'X4"X4")	\$14/8' lengths	\$112		.5 post/bed so 8posts total
Decking Screws	\$30/box	\$60		
Soil	\$4/cub. ft	\$1,920		For raised bed soil with compost already included. Total volume for 15 beds is 480 cubic feet
Sub Total:		\$2,992		
Equipment				
75ft Hose	\$30/25ft hose	\$90		
Hose Nozzle	\$12/nozzle	\$12		*might get another in case first one breaks
2 Wheel Barrows	\$60/barrow	\$120		
2 Combo Locks	\$8/lock	\$16		one for shed, one for fence
4 Shovels	\$15/shovel	\$60		
8 Garden Trowels	\$6/trowel	\$48		
2 Rakes	\$15/rake	\$30		
4 Hand Tillers	\$6/tiller	\$24		
4 Buckets	\$4/bucket	\$0		Getting donated by local hardware store
Sub Total:		\$400		
General				
Soil Testing	\$17/sample	\$68		Testing from UDel
Water Hookup	varies	\$1,000		
Fencing (6' X 30')	\$24/linear foot	\$720		includes labor costs for installation
Shed	\$500/shed	\$500		
Start-Up Total:		\$5,680		
Yearly Expenses				
Lease	\$25/year	\$25		
Liability Insurance	\$400/year	\$400		*based on estimate give by XYZ insurance company
Water Bill	\$160/year	\$160		rate of .01421 a gallon @ 30 gallons/bed/week for 15 beds over 25 weeks
5 seed packets	\$3/packet	\$15		*see Donation Plots planting list
30 transplants	\$8/6-pack	\$40		*see Donation Plots planting list
Total:		\$640		
Grand Total:		\$9,712	TBD	
Revenue/Income				
Plot Fees	\$25	\$325	\$300	15 beds total, 2 used for donation plots, 1 bed left unfilled
Grants	-	-	\$2,000	Community Garden Start-Up Grant
Fundraisers	-	-	\$1,047.50	\$432-Garden BBQ; \$215.50-Bake Sale; \$400- Garden Art Sale
Donations	-	-	\$800	\$100-Local Hardware Store; \$550-XYZ Insurance; \$50-Grandma Patty; \$100-Green Thumb Garden Club
Grand Total:		\$325	\$4,148	

DETERMINING BUDGET

Above is an example budget that includes many of the expenses associated with starting a community garden. Budgets are extremely helpful tools for determining how much money needs to be raised and for keeping records for later reference. They also help when applying for grants, as many organizations will ask for a detailed budget as part of the application. Once the estimated cost is determined, the next step is to figure out funding sources. Some gardens “self-support” through membership dues, but for many, a sponsor(s) is essential for covering garden materials and/or costs. Churches, schools, private businesses, or parks and recreation departments are all possible supporters. Sometimes these partnering organizations can also help with the cost of water or insurance.

Please note the example is only to help guide the process of developing a budget. Depending on the location and resources available, each new garden will have different needs and prices of materials change overtime.

WHY SOIL MATTERS

WHAT IS SOIL?

A fundamental ecological principle is that “diversity equals stability” and nowhere is this more evident than in soil. ***Soil is the most important aspect in growing healthy, disease and pest resistant plants.*** In other words, the more variety and number of living organisms (bugs, fungal, bacteria, mycorrhizal, etc.) you have in your soil, the better off your plants will be. Soils are the stomach of the earth, consuming, digesting, and cycling nutrients and organisms. It is often said that a handful of soil has more living organisms than there are people on planet Earth and plants depend on these organisms to survive.

Growing soil biodiversity is a practice that all gardeners should weave into the regular practices of the garden. There are a few ways to do this and more details are included in later sections of this toolkit, but essentially, the tools are: compost, mulch, not tilling, cover crops, all of which seek to add organic matter to soils. Adding organic matter (no matter which method you use) is the number one way to improve your soil.

WHY IT MATTERS

Healthy soil is necessary to support the growth of high yielding, high quality, and healthy crops. Healthy soil provides adequate nutrition to plants and is porous with good tilth so roots can develop. It is biologically active, with many beneficial organisms to provide nutrients and growth promoting chemicals, as well as to keep disease populations low.

A fertile garden soil is also abundant with soil organisms and bioavailable mineral elements. These elements create soils with good structure that allow for good water and air flow for the soil organisms and roots of plants to grow happily. Overall, a healthy garden soil has:

- Abundant organic material (growing plants, fallen leaves, prunings, grass clippings, wood chips, etc.)
- No compaction
- Abundant soil life
- Mineral elements (macro-, micro- and trace elements from rock dust powder and naturally derived sources)
- Great crumbly structure

SOIL VOCABULARY

pH level: measure of hydrogen ion activity, optimal range for plant growth, 6.0-7.0

Organic matter: living organisms (microorganisms, earthworms, plant roots, insects, other animals), plant and animal residues at various stages of decomposition, cells and tissues of soil microbes (bacteria, fungi, yeasts, protozoa, nematodes), and substances that soil microbes synthesize

Tilth: soil can be worked freely

Compost: decomposed organic matter added to soil to increase nutrients and improve texture



SOIL TESTING

Most sites in the City of Wilmington are contaminated with a variety of metals and chemicals. If the site was residential, it is likely that lead is present. If the site was industrial, there is a strong likelihood that arsenic and/or other harmful chemicals are present. Due to the potential health hazards of soil pollution, it is a good precautionary practice to grow food crops in raised beds with a geotextile fabric layered underneath. See Appendix I for more information on raised beds.

If you plan to grow vegetables in ground (or even if growing in raised beds), determine the soil quality by having a soil nutrition, pH, and toxicity test done. The test will measure plant nutrients including Phosphorus (P), Potassium (K), Calcium (Ca), and Magnesium (Mg). The percentage of organic matter is also assessed. Soil pH (ranging from 0-14) measures the persistence of hydrogen in the soil and tells if the soil is acidic (0-6), is neutral (7), or is alkaline (8-14). Optimum plant growth is between 6.0 and 7.0. The presence of lead is measured in the standard test.

This test can be purchased from the University of Delaware Soil Testing Laboratory. The UD Soil Testing Program is offered as a public service of the College of Agriculture and Natural Resources and provides a variety of soil testing and educational support. Analyses are on a “Fee for Service” basis.

To learn more about soil health and testing visit the UD Soil Test website <https://www.udel.edu/academics/colleges/canr/cooperative-extension/environmental-stewardship/soil-testing/> or check out the resources in the back of the toolkit:

- Appendix E: UD Soil Tests Procedures In Absence of Official Kits
- Appendix F: Sample UD Soil Test Reports
- Appendix G: Overview of Plant Nutrients and Soil pH

SOIL MATERIAL OPTIONS FOR GARDEN BEDS

Contact local soil and mulch companies (see Soil Resources) to source topsoil, ready compost, leaf mould, and other rich organic material to create your raised beds. You can choose to add rock dust powders and stimulants for soil organisms to supplement your garden soil.

Try sheet mulching! If you have access to abundant organic materials such as leaves, wood chips, straw, hay, grass clippings, garden waste, or food waste from restaurants, you can layer these materials to compost-in-place and create soil from raw organic materials. This method takes some time to be ready to plant in, and is best built in the Fall to be ready for Spring planting

SOIL FERTILITY SUPPLEMENTS AND AMENDMENTS

Before adding supplements or amendments, it's important to have a soil nutrition test completed (even in raised beds). Just like humans, plants require different ratios of certain nutrients in order to be happy and healthy. A soil nutrition test will help identify what nutrients are already in the soil and which ones are lacking. This knowledge allows for strategic applications of specific amendments which is not only better for the plants, but can prevent money being spent on unneeded materials.

If you do need to apply amendments, always opt for natural materials instead of synthetic ones. Natural materials work over time to improve your soil quality, meaning less future inputs and healthier plants. Synthetic materials, on the other hand, provide only short term plant improvements, forcing you to continually add those materials. This leads to a constant expense and can actually damage your soil over time.

SOIL RESOURCES

- Copeland's Mulch Depot,
2 Honeysuckle Drive, Stanton DE 19804
<https://copelandsmulchdepot.com/>
- Holland Mulch,
135 Hay Road, Wilmington DE 19809
<http://www.hollandmulch.com/>
- Score Seed and Garden Supply,
2721 Philadelphia Pike, Claymont DE 19703
<http://www.scoreseedandgarden.com/>

SITE SELECTION

The Wilmington Neighborhood Conservancy Land Bank returns vacant, dilapidated, and abandoned properties to productive use in Wilmington, DE. Residents interested in starting community gardens or urban farms on land owned by the Land Bank can visit www.wilmingtonlandbank.org to find a list of vacant lots available for urban agriculture. Information on how to apply to lease or purchase vacant lots will also be available on this site.

If there is a site in mind not listed with the Wilmington Land Bank, find out the owner of the lot and the lot's history. If you know the exact address, you can go to the Recorder of Deeds Office in the City County Building to find this information. If you only know an approximate address, go to the Mapping Department. If you have Internet access, you can also find ownership information, land use, and parcel search information on New Castle County's GIS Map Viewer: https://gis.nccde.org/gis_viewer/

SITE ASSESSMENT

Once a potential location is determined, prepare a site assessment of the site and map the assets of the neighborhood. This process allows for a clearer understanding of what features and/or opportunities currently exist and what challenges will need to be overcome. Below are a few examples of the types of questions that should be asked.

- How much sunlight does the site get (a good site needs at least 6-8 hours a day)
- What current structures exist on the site. Is there leftover rubble from prior use of the site?
- Are there trees or invasive plants on the site?
- Is there a slope to the site?
- How easy is it to enter and exit the site?

WATER ACCESS

When picking a site, be sure there is a water source or that a water source can be installed on the site.

The City of Wilmington works with community gardeners to ensure they can get water to their gardens. If the property already has a water service line, the City will examine the line to see if it is functional. If the line works, the City will extend the line into the property. If the property does not have a water service line, the City will install a line into the property. The City will also install a water meter, but the community garden is responsible for the standpipe connection. All community gardens pay for water service and the stormwater fee, but do not pay the sewer fee. The City will shut off and remove water meters at the end of the growing season and reinstall and turn on water meters in the spring. For those outside of Wilmington contact the local water company to find out this information.

Once a source is chosen, determine if you will water by hand or use a drip irrigation system that will water for you. Collecting rainwater in barrels for irrigation is an inexpensive and environmentally friendly way to supplement water access. Be sure to check out the “Water Conservation” section on page 13 for suggestions on how to reduce water loss in your garden.

LEASE/RENTAL AGREEMENT

The next step is to prepare a lease or rental agreement with the land owner to use the site. It is a good idea to make this for at least three years. A sample rental agreement can be found in Appendix O.

SITE DEVELOPMENT

GARDEN DESIGN

Make sure to involve community members in the planning and designing of the garden. Consult Appendix M for a suggested garden layout and planting schedule for inspiration.

There are many ways to design a garden, but here are a few suggestions:

- Measure and map the lot on graph paper including any pre-existing features
- Determine the size and number of plots in the garden. Remember, if building raised beds to consider height!
- Include plans for a storage area for tools and other equipment, as well as a compost area
- You may want to add a fence with a wide gate, a picnic table, and/or other garden amenities
- Place flower or shrub beds around the visible perimeter. This helps to promote good will with non-gardening neighbors, passersby, and municipal authority.



Photo courtesy University of Delaware Cooperative Extension



Photo courtesy Southbridge Community Garden

SITE CONSTRUCTION

After a garden plan has been agreed upon by all parties, it's time to turn those dreams into reality!

- Gather your resources (free materials if possible)
- Organize volunteer work crews
- Mark plots with flags or string and clearly label with gardeners names
- Arrange for land preparation, plowing, etc., or let gardeners do their own prep
- Construct raised beds if you will be growing vegetables. (Appendix L)
- Install a composting system to recycle your garden debris for use as a soil amendment to improve the overall health of your garden
- Put up a rainproof bulletin board for announcing garden events and messages
- Don't forget a sign letting others know about the garden!

COMMUNICATION STRATEGIES

For community gardens to succeed there must be effective communication amongst the leadership group, gardeners, and community members. This allows everybody to understand what is happening and to feel like there are channels to make their ideas or concerns heard. Without communication gardens often fall victim to misunderstandings, hurt feelings, and ultimately a withdrawal of community/gardener buy-in. Communication can take on many different forms, but the key to good communication is to:

MAKE IT CONSISTENT by sharing information at the same time and in the same location so people know when and where to get it.

MAKE IT CLEAR by minimizing technical jargon and calling out specific points, action steps, or takeaways.

MAKE IT ACCESSIBLE by using community preferred communication methods and posting things at the garden for everyone to see.

When starting out, aim for communication to be put out once a month. This can help ensure that you don't overwhelm people in the beginning and you can always change the frequency later. Below are examples of strategies for effective communication.

FOR THE LEADERSHIP TEAM

- Regular Meetings
- Emails
- Phone Calls and Text Messages
- Shared Cloud Drives (Dropbox or Google)

WITH AND AMONGST GARDENERS

- Regular Garden Meetings
- Bulletin or White Board
- Emails and Letters
- Phone Calls and Text Messages
- Social Media Page/Groups

WITH THE COMMUNITY MEMBERS

- Flyers
- Letters
- Face-to-Face Conversations
- Social Media Pages/Groups

In the experience of DEUFFC members, the best way to keep garden communications flowing (and problems to a minimum) is through regular garden meetings. Designate the same day each month to organize events, discuss concerns or projects, or just check-in with each other. This is particularly important in the first year or two of the garden. Be sure that everyone knows about the meeting and don't forget to send meeting reminders!

COMMUNITY GARDEN SAFETY AND ACCESSIBILITY

GARDEN SAFETY PRECAUTIONS

- Provide gloves, hats, solid shoes, and a careful selection of tools. Adequate supervision is key to ensuring the safety of youth/students and beginning gardeners
- Be aware of your surroundings. Avoid being in the garden alone, particularly in the evening. Avoid any secluded areas with high vegetation
- Do not leave unattended garden tools at the garden site. Place them in the locked garden shed (if available) or take them with you when you leave the garden site
- Rototillers, lawn mowers, power weed trimmers, wood chippers, chain saws, or other power equipment should be operated by individuals 16 years or older. Youth/students should be closely supervised and instructed in the use of such equipment
- Organic gardening techniques are preferred. The use of chemical herbicides, pesticides, and fertilizer should be discouraged or disallowed. These products should also not be stored or mixed at the garden site.
- Fires or fireworks should not be use garden site
- Drugs or alcohol shall not be consumed at the garden site

KEY CONSIDERATIONS FOR GARDEN ACCESSIBILITY⁶

- Places for people to remain seated, standing or leaning
- Shaded areas to limit sun and heat exposure
- Stable, flat, and slip resistant surfaces
- Barrier-free access to planting areas that accommodate height and reach limitations. Raised beds should be no more than 4' wide and at least 24" tall. Tabletop garden beds are also an option
- 36" wide pathways to accommodate wheelchairs, strollers, and crutches surface materials. Surface materials could include concrete, asphalt, compacted crushed stone or gravel to provide a stable walkway.
- Gates or handles at garden entrances should be easily opened with one hand

GARDEN TOOLS TO ACCOMMODATE MOBILITY CHALLENGES⁷

- Lightweight tools to reduce stress on hands/arms
- Telescoping pruners, loppers, rakes, hoes and cultivators (for height and reach limitations)
- Trowels with curved ergonomic or cushioned handles (adapt tools with foam tubing)
- Kneeling pads or benches
- Lightweight garden carts with wide handles to push and pull easily
- Use a tool carrier, carpenter's apron or bucket for frequently used garden tools

LIABILITY

Not all landowners require liability insurance, but for those that do, this involves an additional step in the development process. It should be noted that this insurance protects the organization that owns the community garden or the landowner in case they are sued, it does not protect the gardeners themselves.

Liability insurance can be expensive for individual gardens. Here are a few way that could reduce the cost:

- Larger organizations, such as a social service organization, church, or local business, can often obtain liability policies at a more affordable price or add them to an existing policy. Ask a local agency if they'd be willing to provide this type of support.
- Private landowners may be willing to add the community garden to their policy if the cost difference is paid by the community garden
- If you are unable to find insurance coverage locally, the American Community Gardens Association¹ has a partnering agency that insures community gardens.

At a minimum, anyone that is going to be working or participating in activities at the garden site should sign a liability waiver. While a waiver doesn't provide comprehensive protection, it's always better to have something in place in case an accident does happen. There is a sample Waiver of Liability Form for community garden members found in Appendix N.

FUNDING AND RESOURCES

Every garden needs a source of supplies and funding. Make a rough estimate of what your garden will need and create a budget for how that money will be used. Raise funds yourself through sales, block parties, and car washes. Sometimes local businesses, government officials, and organizations have money and/or materials available for community gardens. The Delaware Urban Farm and Food Coalition can help. Just ask!

SUSTAINABLE GARDEN MAINTENANCE

It is important to keep working and taking care of your plants throughout the summer, so that your garden stays healthy and happy. Weed, prune, and harvest plants as needed. During July and August when it's hot, gardener enthusiasm often tapers off, but the enthusiasm of pests and weeds does not! Keeping garden members excited and motivated takes work. Creating a harvest event or other communal celebration helps maintain enthusiasm throughout these hotter months.

This guide prioritizes the use of regenerative practices and encourages gardeners to think of themselves as stewards of the environment. Being mindful of how the garden is treated creates a healthier and safer space for everyone, including other plants and animals. It's also more cost effective because it creates a system that, over time, can self regulate and requires less money to be spent on items like fertilizer or pesticides.

Some of the listed practices might be unfamiliar to community gardeners. A great way to start building connections, and ensure everybody is on the same page, is to hold workshops that educate gardeners and community members about these different methods.

COMPOSTING

Composting is the keystone to a successful sustainable garden. Compost adds organic matter naturally; helps prevent soil and plant diseases; corrects sandy or clay soils; makes a great mulch or top dressing; provides a variety of nutrients; aerates soil; improves drainage; prevents erosion; and recycles garden waste. There are many different styles of composting that range in complexity, volume, and work to maintain them. As a baseline, try to implement a two bin system: one bin to collect new garden waste and one bin where waste has broken down and is ready to be added back to the garden. For more composting information, see Appendix I.

SEASON EXTENSION

Season extension is when a grower covers their crops to cushion them from the cold, thus extending the time the crops can grow outside. One of the most common methods is adding a floating row cover. This porous garden fabric is placed gently on top of the plants to keep heat and water underneath but still allows for some air flow. It can also be used year round to keep insect pests off plants! Low tunnels are another cost effective method. In this system, a small frame is made from pipe or wood and a thick garden plastic is tightly wrapped around to create a greenhouse type effect. As a general rule of thumb, the more robust the structure/thicker the material used, the more protection it provides.



Photo courtesy University of Delaware Cooperative Extension

COMPANION AND INTERPLANTING

Companion plants are ones that produce better yields when they grow near each other. Interplanting is the practice of sowing two or more varieties together (e.g., beans using corn as a living trellis). Some plants are useful in repelling pests, while others attract beneficial insects. Borage, for example, helps control tomato worms while its blue flowers attract bees. Follow the guidance of companion planting charts. To learn more about the importance of diversity in the garden, see Appendix J.

COVER CROPPING

If you don't intend on gardening over the winter, apply a thick layer of mulch or a winter cover crop to inhibit weed growth and build soil health. Cover crops are any type of planting that covers your soil when it is not being used for active production. Cover crops include those that produce dry matter for the compost bin (rye, wheat) and ones that "fix" nitrogen from the air to the soil, called legumes (peas, vetch, clover). Cover crops can be turned under or harvested and composted. Using cover crops protects soil in winter months; attracts beneficial insects; increases nutrients in your soil; conserves soil moisture; suppresses weeds; and increases organic matter in your soil.

WATER CONSERVATION

The use of drip irrigation that slowly applies water at the base of the plant over a longer period of time is recommended. Drip irrigation allows deep watering without wasting water. Don't over-water. Be sure gardeners allow their beds to dry out between waterings. Watering should be done less frequently, but more deeply to encourage deeper and stronger roots.

Mulching plants with materials such as straw, leaves and grass clippings is also highly recommended. Mulch not only adds organic matter, but keeps the soil temperatures consistent, inhibits weed growth, and greatly conserves water.

INTEGRATED PEST MANAGEMENT

Integrated Pest Management (IPM) works to reduce pest problems in an environmentally friendly way by including preventative measures before treatment methods are used. This could look like:

- Planting a diversity of plants
- Choosing plants bred for resistance to insect pests and diseases
- Watching for early signs of pest damage
- Monitoring crops for insects (pests and beneficial)
- Identifying insects through photographs, books, or online resources

It also encourages balancing the damage being done with the impact of treatment. This means changing one's expectations and understanding some pest damage is normal. If treatment is required, IPM includes numerous strategies which are divided amongst four categories based on the method of control. Below are a few examples for each method. For more information regarding IPM, see Appendix H.

CULTURAL IPM METHODS focus on management of plant health, usually through considering the surrounding space or context. Pests target weak plants, so keep plants healthy by:

- Planting plants in a suitable locations
- Provided proper water and nutrition (soil health!)
- Replacing out-of-season crops with in-season ones
- Removing brush/weeds where pests can live
- Crop Rotation



Photo courtesy Southbridge Community Garden

BIOLOGICAL IPM METHODS are the reduction of pests through natural enemies called beneficial insects. To use biological control:

- Encourage spiders, wasps, and ladybird beetles (all beneficial insects) around the property
- Research natural predators of a specific pest and attract those to the garden
- Provide food and shelter by planting a variety of plant and providing shallow water dishes
- Don't spray pest-killing substances on plants, even organic ones
- Being patient- it takes time for the population of beneficial insects to grow.

MECHANICAL/PHYSICAL IPM METHODS are anything that directly removes or physically keeps pests away. Examples include:

- Hand removal
- Exclusion (netting, row covers*, wire mesh)
- Disruption (soil and design)
- Traps

*Row covers are a very effective strategy, but they need to be removed for plants requiring pollination like tomatoes and peppers.

CHEMICAL IPM METHODS are often what most people have been trained to think about when considering pest management. However, best practice teaches that spraying should always be considered a last resort.

Before spraying, determine if it is the best course of action. For example, if you harvested a great crop and toward the end of the season the plant is getting damaged by pests, that's a success! Instead of spraying, use the situation as an opportunity to replace the old crop with a new one. Less pests and more veggies for you!

In addition to synthetic pesticides, chemical control also includes a wide variety of other sprays and compounds that can be less toxic. This includes DIY sprays**, botanical pesticides, and horticultural soap and oils. These sprays are considered less toxic, but should still be used sparingly.

**Sample Recipe can be found in Appendix E.

COMMON GARDEN CHALLENGES

As with any worthwhile project, there will be plenty of challenges that will need to be overcome in order for the garden to continue thriving. Below are some common challenges that community gardens face.

LEADERSHIP - Community gardens are management intensive. They demand patience, time, and the capacity to work with and organize people and projects. They also typically require systems to enforce rules and resolve conflicts. Many gardeners may not have the skills or the time to take a leadership role at their respective garden

PREVENTION: Pick individuals with developed leadership skills or those willing to learn, establish procedures to guide individuals, set clear expectations and be realistic about the commitment requirements from the beginning

MANAGEMENT: Partner with other organizations to provide support for garden leaders and make sure to share the workload equitably

MAINTENANCE - Community gardens are maintenance intensive. Grass will need to be mowed, equipment will need to be repaired, and plant debris will need to be composted, among other things.

PREVENTION: Work with gardeners to establish a signed agreement that clearly states the maintenance expectations for everybody, and be in the garden regularly to stay on top of tasks

MANAGEMENT: Create a schedule for regular maintenance of common spaces, establish a routine to inspect the garden so concerns can be identified quickly and early, ask gardeners what related maintenance skills they might contribute to the garden (carpentry, landscaping, etc.)

PARTICIPATION - From year to year, gardeners and garden leaders come and go from community gardens for a variety of reasons. This can cause challenges in maintaining a sense of community and consistency at gardens.

PREVENTION: While you can't prevent someone from moving on, you can work to build an environment that encourages gardeners to come back year after year. Be inclusive and welcoming to all, clearly identify participation expectations at the beginning of the season, and encourage extensive communication.

MANAGEMENT: Plan social events for where gardeners to interact outside of regular gardening activities, provide encouragement when a gardener goes above and beyond, or set up a volunteer rotation to take care of someone's plot if they go on vacation or have a sudden emergency.

THEFT AND VANDALISM - Theft and vandalism are commonplace at many community gardens. As a general rule, theft is the result of adult activity and children carry out vandalism. A majority of the time these acts are not personal towards the garden but rather that gardens can be easy targets.

PREVENTION: Clearly identify the garden as a community space through signage and actively work to invite community members, especially youth, to use/take ownership of the space. Add art, keep the space well maintained, store equipment in sheds with locks, and install fencing/motion activated lights.

MANAGEMENT: Work with gardeners and the community to brainstorm solutions and address concerns as whole. Is there somebody who lives nearby willing to keep an eye on things? What might be potential causes and is there a way to address those issues?

GARDENING SKILLS - Many new and some returning gardeners don't know a lot about gardening. Gardeners who lack gardening skills and have poor gardening experiences may be more likely to give up.

PREVENTION: There isn't much in the way of prevention, but by asking individuals who sign-up for plots their experience level can help you know what level support might be needed

MANAGEMENT: Invite local organizations or experienced community members to host workshops, set up a mentor-ship program, or make a social media page to share information or collect resources.



Photo courtesy University of Delaware Cooperative Extension

SERVICES AND SUPPLIES - Plowing, tilling, and the delivery of compost and mulch can be challenging services for gardeners to arrange for themselves.

PREVENTION: Before any contracts/deliveries are scheduled, work with gardeners to determine what exactly they need. Chances are there will be many gardeners with similar situations who can work together. You can also ask other community gardens or local agencies for recommendations and advice.

MANAGEMENT: Once a date has been scheduled, make sure the entire garden knows when it will be happening and what preparations, if any, they need to take beforehand. If the garden is expecting a large delivery, organize a community/gardener volunteer day to help distribute the materials where they need to go.

WATER - Most gardens need some way to irrigate fruits and vegetables during the summer. Finding a source of water can be challenging. Because most community gardens are located on borrowed land, installing water may not be feasible or cost effective.

PREVENTION: When picking a site, think about how you are going to access water before committing to the location. Knowing the situation beforehand can help ensure that proper preparations are made.

MANAGEMENT: Try implementing various water conservation techniques such as rain barrels or mulching; use drip irrigation instead of hand watering for more effective water usage.

SITE PERMANENCY - Most community gardens are located on borrowed land. This limits the amount of infrastructure that can be added to a particular site. It may also create an atmosphere of instability among gardeners which sometimes results in reduction in member participation.

PREVENTION: Whenever possible sign a lease that spans for multiple years or from an organization that already values the benefits of community gardening.

MANAGEMENT: Be innovative with non-permanent solutions and always celebrate each growing season (in case it is your last).

FOOTNOTES

¹American Community Gardens Association - <https://www.communitygarden.org>

²Gardening Matters, Minneapolis, MN, Community Garden Start Up Guide

³Denver Urban Gardens, Assessing Community Readiness

⁴ Kretzmann, John P. and John L. McKnight Asset Based Community Development, Evanston, IL, Institute for Policy Research

⁵Kretzmann, John P. and John L. McKnight (1993) Building Communities from the Inside Out: A Path Toward Finding and Mobilizing a Community's Assets. Evanston, IL: Institute for Policy Research. Pp 19-25

⁶ Madison Area Master Gardener Association (2007) Accessible Garden Design, Part A

⁷Delaware Master Gardeners (n.d.) Garden Smart... Garden Easy... Tools Make a Difference

INSPIRATIONAL DOCUMENTS

- Springfield Food Policy Council, Springfield, MA (2014) Community Garden Management Toolkit
- University of Missouri Extension, Community Gardening Toolkit
- Wasatch Community Gardens, Salt Lake City, UT, Components of Sustainable Gardening Practices

GOOD LUCK AND HAVE FUN!



Appendices

Photo courtesy New Castle Conservation District

APPENDIX A: DEVELOPING A VISION FOR YOUR GARDEN EXERCISE

Defining why you want to develop a community garden will help you create a vision for your garden project. Similarly, it will help your garden group identify what you want to accomplish and how you will organize your garden's goals. This will help to recruit new garden members and gain community support. A community garden doesn't just happen, it takes hard work and commitment. List three aspects of what excites you about community gardening and why your group wants to develop a garden.

- 1.
- 2.
- 3.

Define what you want to accomplish and prioritize your goals. What activities do you see happening in the garden? Who will use the garden and what will they use it for?

Examples:

1. Our primary goal is to produce fresh nutritious food for our families and our neighbors.
2. We want to clean up our neighborhood and create a beautiful garden where people can come together.
3. We want to educate youth about gardening and the importance of environmental stewardship.

List three goals your group wants to accomplish and then prioritize.

- 1.
- 2.
- 3.

Use your garden goals to create a brief mission statement. Create a mission statement that unites the group and garden to a larger purpose. Identify how your garden will benefit your neighborhood and community.

A quick way to develop a mission statement is to have each garden committee member describe in one or two words why they think the garden is important and what they hope will be accomplished. After everyone has shared their thoughts, themes should emerge, and the words can be strung together to develop a mission statement.

- 1.
- 2.
- 3.
- 4.
- 5.

Source: Gardening Matters, Minneapolis, MN, Community Garden Start Up Guide

APPENDIX B: ASSESSING COMMUNITY READINESS

When a group of community members comes to agreement that a community garden compliments their vision for their neighborhood, the community must assess its own readiness to support and sustain a community garden. This requires a community to affirm that there is:

- A critical mass of committed participants
- Broad based support
- Agreement from the participants on the need for the garden and the multiple purposes it may serve
- An available, sustainable, long term site

We encourage groups to answer the following questions:

1. Is there a demand for the garden, by whom?
2. Does a broad base of support reflect the demographic makeup of the surrounding neighborhood?
3. Do you have partnerships to strengthen the connection between the community garden and the surrounding community? (Examples may include culinary arts programs, service learning programs, youth education organizations and senior centers).
4. Is there a local group or organization that can benefit from a partnership with your community garden? (Examples may include schools, food pantries, and organizations that prepare meals for people in need).
5. Have individuals/organizations been contacted to help with day-to-day support with various activities? (Examples may include storing of equipment, help with grass cutting or snow removal, and teaching gardening classes).
6. Is there any skilled/unskilled local labor to support garden construction, financial management, material donations, etc.? (Local support may include connecting with a local hardware store, service organizations, or corporate or college volunteer programs).

Source: Denver Urban Gardens, Denver, CO

APPENDIX C: IDENTIFYING NEIGHBORHOOD RESOURCES

The key is to focus on what the neighborhood has, not what it doesn't. This process is sometimes called **ASSET BASED COMMUNITY DEVELOPMENT**. The overall process includes doing surveys and developing a neighborhood inventory, as well as a Reciprocal Map.

Before undertaking the exercise, consider five categories of assets or resources:

1. **INDIVIDUAL GIFTS:** Identify the specific talents and skills of yourself and others. Consider also identifying who the community leaders are, who knows the neighborhood history, who seems to know everyone, etc.
2. **ASSOCIATIONS:** Identify the small formal or informal groups of people working together for a common goal – scouts, service organizations, alumni organizations, book clubs, park friends groups, neighborhood crime watch, etc.
3. **INSTITUTIONS:** Identify the local government, businesses, and community organizations, religious, health care, and educational entities, just to name a few.
4. **LAND AND BUILDINGS:** Determine if any of the above have available land or facilities that could be used for meetings and celebrations, etc.
5. **LOCAL ECONOMY:** Identify businesses and lending organizations that can donate, publicize, and provide support.

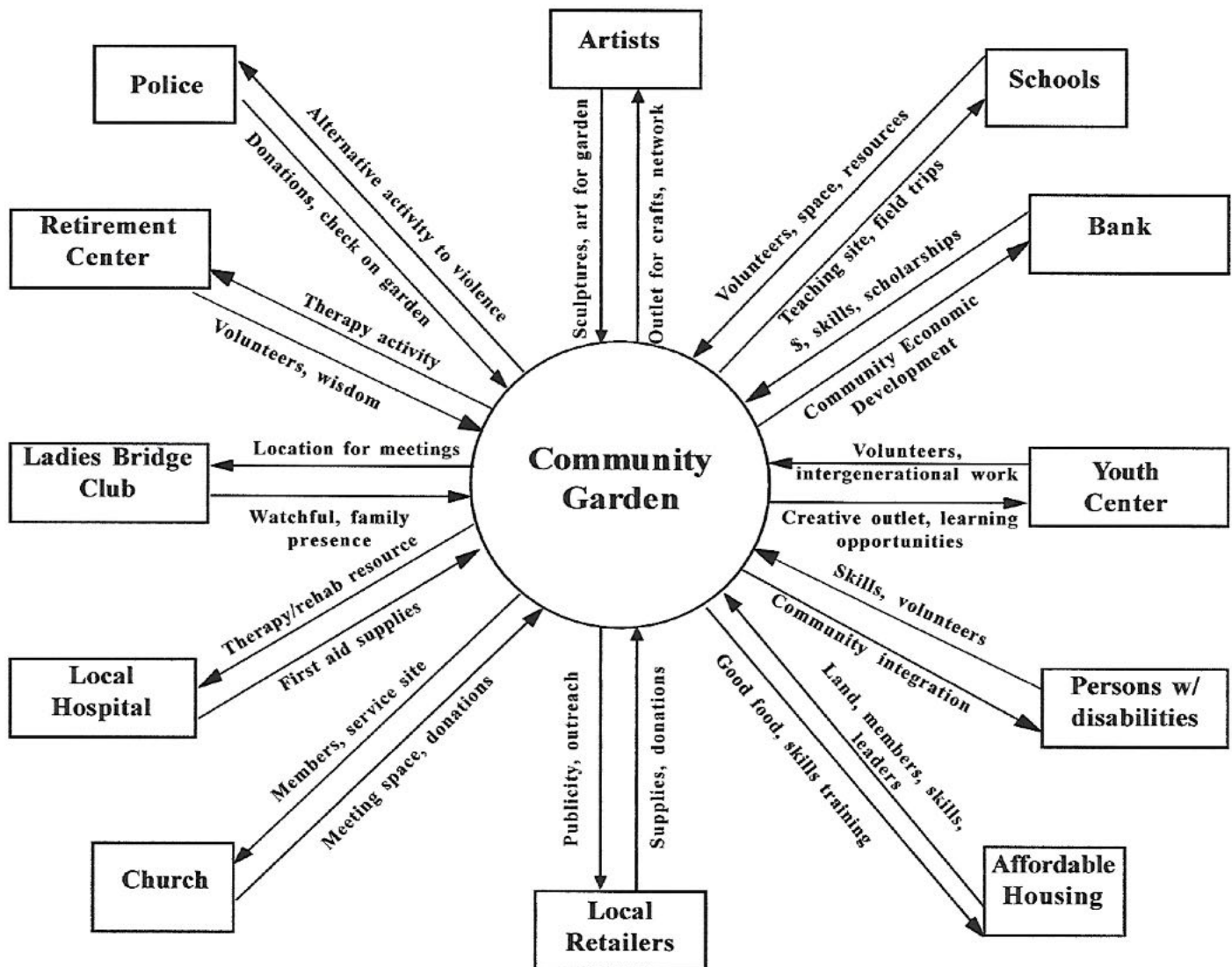
Exercise Instructions:

1. On a large sheet of paper, draw a circle in the middle and write "Community Garden."
2. Around the circle, write the names of individuals, associations, institutions, businesses, etc, from each of the asset/resource categories listed above.
3. Draw two lines from the Community Garden to circle to each of the assets/resources listed. On the line with the arrow pointing to the garden, indicate what could be obtained from that Asset/Resource. On the line with the arrow pointing to the Asset/Resource, indicate what benefit the garden could provide.

Adapted from John P. Kretzmann and John L. McKnight, Asset Based Community Development, Evanston, IL: Institute for Policy Research)

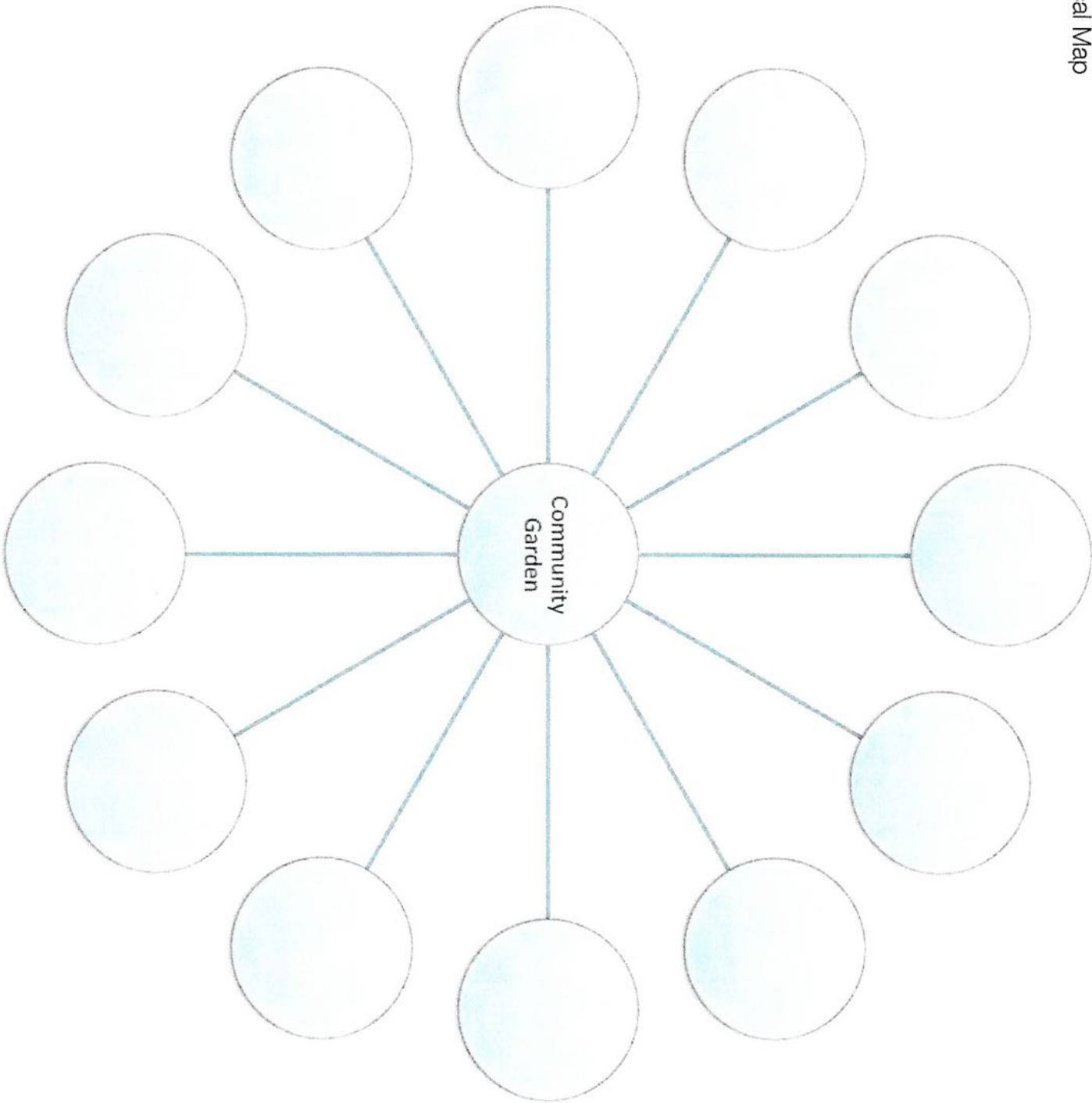
APPENDIX C: IDENTIFYING NEIGHBORHOOD RESOURCES

MAPPING RECIPROCAL PARTNERSHIPS



APPENDIX C: IDENTIFYING NEIGHBORHOOD RESOURCES

Blank Reciprocal Map



APPENDIX D: COMMUNITY GARDEN CAPACITY INVENTORY

Hello, I'm with (local organization's name). We are talking with people in the neighborhood about their gardening related skills, to help us start a community garden. May I ask you about your skills and abilities?

PART 1 – SKILLS INFORMATION

I'm going to read you a list of skills. I'll read the list and you just say yes whenever we get to one you have. You may have learned them at home or with your family, on the job, at church, or in the community.

Office

- Entering information into computer ____
- Using email ____
- Keeping track of supplies ____
- Bookkeeping ____
- Budgeting ____
- Using spreadsheets ____
- Word processing ____

Construction and Repair

- Building or repairing fences ____
- Carpentry skills ____
- Painting ____
- Building raised beds ____
- Building sheds or garages ____
- Building or repairing hoop houses or high tunnels ____
- Plumbing repairs ____
- Electrical repairs ____
- Concrete work ____

Garden Maintenance

- Mowing Lawns ____
- Planting and caring for Ornamental Gardens (flowers, shrubs) ____
 - Planting ____
 - Watering ____
 - Weeding ____
 - Dividing/transplanting ____
- Planting and caring for Edible Gardens (vegetables, fruits) ____
 - Planting ____
 - Watering ____
 - Weeding ____
 - Transplanting ____
 - Staking ____
 - Harvesting ____
- Pruning Trees and Shrubbery ____
- Hooking up and repairing hoses ____
- Laying and repairing drip irrigation lines ____

Are there any other skills that you have which we have not mentioned?

APPENDIX D: COMMUNITY GARDEN CAPACITY INVENTORY

PART 2 – COMMUNITY SKILLS

Have you ever participated in any of the following community activities?

- Boy Scouts/Girls Scouts _____
- Church Fundraising _____
- Bingo _____
- School-Parent Associations _____
- Sports Teams _____
- Political Campaigns _____
- Block Clubs _____
- Community Groups _____
- Community Gardens _____
- Neighborhood Organizations _____
- Any other groups or community work? _____

PART 3 – PERSONAL INFORMATION

Name _____

Address _____

Phone _____

Email _____

Age _____

Sex Female ____ Male ____

Adapted from The Capacity Inventory, John P. Kretzmann and John L. McKnight, pp. 19-25, from Building Communities from the Inside Out: A Path Toward Finding and Mobilizing a Community's Assets, Evanston, IL. Institute for Policy Research (1993)

UD SOIL TESTS PROCEDURES

IN THE ABSENCE OF OFFICIAL KITS

How to Submit Samples Without Regular Soil Test Bags:

Since County Extension offices are presently closed, you may need to submit your sample(s) without the normal soil test bags. To do so, please follow the steps listed below:

1. Collect a representative sample by following the directions in the brochure "How to Take a Soil Sample":
<https://www.udel.edu/content/dam/udelImages/canr/pdfs/extension/environmental-stewardship/Circular-19-How-to-Take-a-Soil-Sample-for-Home-Lawns-and-Gardens.pdf>
2. Thoroughly mix all 8 individual soil samples together and place 1-1.5 cups of the mixed sample into a zip lock bag. Label the bag with your name and the sample ID (e.g., Field 6, Backyard, etc.)
3. Download the appropriate information sheet i.e. Lawn and Garden from the "Soil Testing Program Forms" found here:
<https://www.udel.edu/academics/colleges/canr/cooperative-extension/environmental-stewardship/soil-testing/soil-testing-forms/>; one copy of the information sheet for the sample submitted (or one for each sample(s) submitted). Be sure that the sample ID on the bag and the sample ID on the information sheet match.
4. Enclose payment or indicate on the back of the information sheet that you wish to pay by credit card. Checks should be made payable to the University of Delaware. If paying by credit card, DO NOT write your card number on the information sheet. Instead, list a daytime phone number and our office will contact you for payment.
5. Place the samples and information sheet in a box or mailing envelope and send to the laboratory using the following address (Do not use the address on the soil testing form):

UD Soil Testing Laboratory
PO Box 9089
Newark, DE 19714

Additional Questions - Please call the office at 302-831-1392 or email Soiltest@udel.edu with any additional questions you may have. We are in the office Monday - Friday from 9 am - 4:30 pm and happy to help. This institution is an equal opportunity provider.



UNIVERSITY OF DELAWARE
COOPERATIVE
EXTENSION

APPENDIX F: SAMPLE UD SOIL TEST REPORT

SOIL TEST REPORT UNIVERSITY OF DELAWARE — SOIL TESTING LABORATORY NEWARK, DELAWARE 19717-1303



BACKGROUND INFORMATION:

Agent copy

BLUEBERRIES		NEW CASTLE	6/28/19	7/02/19	10/01/19	15	558550
FIELD NAME OR NO.	ACRES	COUNTY	DATE SAMPLED	DATE RECEIVED	DATE COMPLETE	LAB NO.	BAG NO.

SOIL TEST FOR: GROWER

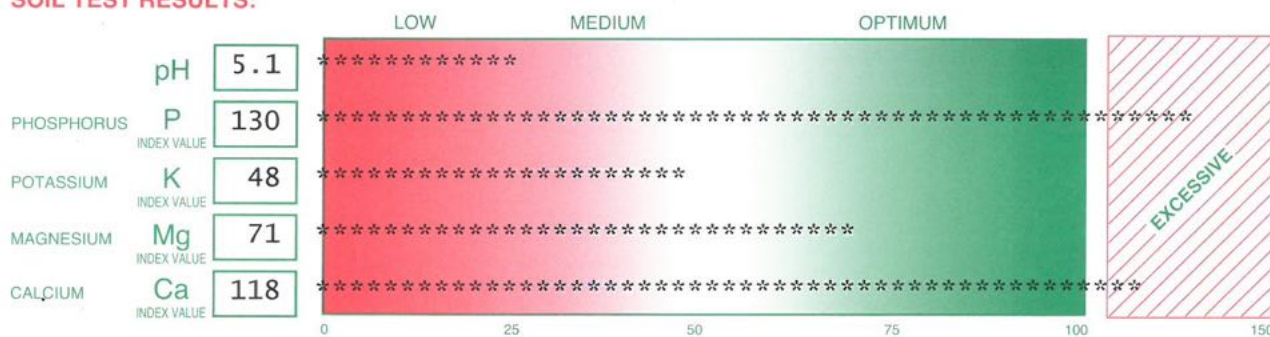
ADDITIONAL COPY TO:

COUNTY AGENT

	RD. 9707		CARRIE MURPHY NEW CASTLE CO. EXT. 461 WYOMING RD. NEWARK, DE 19716-1303 302-831-2506					
	SOIL NAME	SOIL COLOR	SOIL TEXTURE	SAMPLE DEPTH	TILLAGE	PRESENT COVER	IRRIGATION	INJ. PUMP

						0-6				
LAST CROP	YIELD OF LAST CROP	TYPE	T/A WHEN MANURE	N	P ₂ O ₅	K ₂ O	MOS. AGO	T/A LAST LIME	TYPE	OTHER NUTRIENTS

SOIL TEST RESULTS:



1.1	50.0	16.4	81.8	12.0+		7.27	26.6	12.7	54.2	1
B	Mn	Zn	SO ₄ -S	% ORGANIC MATTER	SOL. SALTS MMHOS/CM	BUFFER pH	% Phosphorus Saturation	CEC meq/100gm	% Base Saturation	ENCLOSURES

SUGGESTED FERTILIZER PROGRAM:

CROP: STRAWBERRIES

YIELD GOAL: N/A

*****	*****	SEE BELOW	*****	*****	*****	*****
T/A	TYPE	N	P ₂ O ₅	K ₂ O	S	B
LIME		LBS/A	LBS/A	LBS/A	LBS/A	LBS/A

FOR NEW PLANTINGS

1. Before planting, broadcast and work in 10 lbs. ground limestone per 100 square feet.
2. At planting, broadcast and work in 2 lbs. 12-4-8 or equivalent water-soluble fertilizer per 100 sq. feet.
3. In August or September, broadcast 1 cup urea OR 1 1/2 cup ammonium nitrate per 25 feet of row.

FOR ESTABLISHED PLANTINGS

1. Apply 10 lbs. ground limestone per 25 feet of row. Spread the lime evenly over all open areas between plants.
2. In March, broadcast 1/3 cup urea OR 1/2 cup ammonium nitrate per 25 feet of row.
3. At renovation in July, broadcast 2 pints 10-10-10 or equivalent water-soluble fertilizer PLUS 1 cup muriate of potash (0-0-60) per 25 feet of row.

APPENDIX F: SAMPLE UD SOIL TEST REPORT

SOIL TEST REPORT UNIVERSITY OF DELAWARE — SOIL TESTING LABORATORY NEWARK, DELAWARE 19717-1303



BACKGROUND INFORMATION:

Agent copy

FIELD FALL 115		NEW CASTLE	0/00/00	9/21/15	10/02/15	544	406696
FIELD NAME OR NO.	ACRES	COUNTY	DATE SAMPLED	DATE RECEIVED	DATE COMPLETE	LAB NO.	BAG NO.

SOIL TEST FOR: GROWER

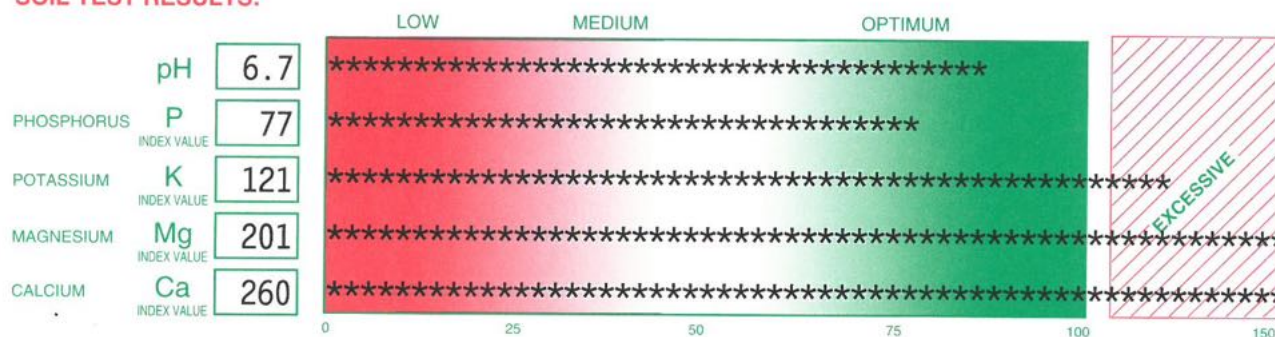
ADDITIONAL COPY TO:

COUNTY AGENT

	19802	GARDEN HELPLINE NEW CASTLE CO. EXT. 461 WYOMING RD. NEWARK, DE 19716-1303 302-831-2506					
SOIL SAMPLING	SOIL COLOR	SOIL TEXTURE	SAMPLE DEPTH	TILLAGE	PRESENT COVER	IRRIGATION	INJ. PUMP

						UNKN			
LAST CROP	YIELD OF LAST CROP	TYPE MANURE	T/A WHEN	N LAST FERTILIZER	P ₂ O ₅	K ₂ O	MOS. AGO	T/A LAST LIME	OTHER NUTRIENTS

SOIL TEST RESULTS:



4.3	100.3	42.3	93.1	7.1		7.82	27.2	17.2	91.6	1,11
B	Mn LBS/ACRE	Zn	SO ₄ -S	% ORGANIC MATTER	SOL. SALTS MMHOS/CM	BUFFER pH	% Phosphorus Saturation	CEC meq/100gm	% Base Saturation	ENCLOSURES

SUGGESTED FERTILIZER PROGRAM:

CROP: VEGETABLE GARDEN

YIELD GOAL: N/A

*****SEE BELOW*****						
T/A	TYPE	N LBS/A	P ₂ O ₅ LBS/A	K ₂ O LBS/A	S LBS/A	B LBS/A
	LIME					

1. Apply 1 lb of N per 1000 square feet of garden area. This can be supplied by 3 lbs ammonium nitrate (34-0-0) or 2.5 lbs of urea (46-0-0). If these two fertilizers are not available, select an alternate source that is low in P as soil levels of P and K are already in the "Optimum" or "Excessive" range.

Apply recommended fertilizer to the soil surface and rake in just before planting.

2. For nitrogen sidedressing instructions, see Soil Test Note 11 (enclosed).

APPENDIX G: OVERVIEW OF PLANT NUTRIENTS AND SOIL pH

FUNCTIONS OF SOIL- Soil has many important functions including anchoring plants, being a medium for root growth, and allowing for water and air exchange. However arguably the most important function soil performs is acting as a reservoir for nutrients.

PLANT NUTRIENTS- Some key nutrients are available in air and water such as Carbon (C), Hydrogen (H), and Oxygen (O) while all other nutrients must come from the soil. Each of these nutrients plays a specific role in maintaining plant function and are required by the plant in different amounts. The nutrients that a plant needs the most of are called **Major Nutrients** which are further broken down into primary and secondary nutrients.

Primary nutrients Nitrogen (N) as a key component of amino acids; Phosphorus (P) for energy transfer; and Potassium (K) for water transfer.

Secondary Nutrients: Calcium (Ca) and Sulfur for cell walls and Magnesium (Mg) for photosynthesis

Last are **Micronutrients** which are still essential for plant health/growth but are just needed in smaller amounts. There are eight micronutrients including: Cobalt (Co), Copper (Cu), Zinc (Zn), Iron (Fe), Molybdenum (Mo), Boron (B), Manganese (Mn) and Chlorine (Cl).

SOIL PH AND EFFECTS ON PLANT GROWTH- pH is the measurement of hydrogen ion activity and is used to determine if the soil is acidic or alkaline. pH is given in levels ranging from 0-14; less than 7 is acidic, 7 is neutral, and greater than 7 is alkaline. Most plants need to be between 6.0-7.0 for optimal growth.

Soil pH is important because it impacts plant nutrient availability, as well as the availability of toxic elements like Aluminum (Al) and Manganese (Mn). Simply put, different pH levels can make some nutrients (or toxic elements) easy for the plant to absorb and vice versa. Here are a few examples:

- Nitrogen availability is maximum between pH 6.0 and 7.3 because bacterial mineralization of N is maximum in this pH range.
- Phosphorus (P) is less available in acidic soils (low

pH levels) because it reacts with Iron (Fe) and Aluminum (Al)

- and in alkaline soils, P combines with Ca^{2+} making it unavailable for plant uptake.
- Al and Mn can cause plant toxicities at pH below 5.5.
- Ca^{2+} and Mg^{2+} deficiencies occur at low pH levels. Soils with pH above 6.5 usually contain adequate amounts of Ca^{2+} for crops.

ADJUSTING SOIL PH- Mid-Atlantic soils are naturally acidic and sometimes it's required to adjust the pH for better plant/crop performance.

If you have low soil pH (acidic soil), adjust pH by adding lime (calcium carbonate), Dolomite lime (lime with magnesium carbonate), Quicklime, or wood ash.

If you have high soil pH (alkaline soil) adjust pH by adding elemental sulfur or aluminum sulfate

TAKING SOIL SAMPLES- In order to have a soil test, you will first need to submit soil samples. Here are a few considerations when collecting your samples.

- Planting area should be sampled and tested every three years.
- For gardens and beds pick 10 random areas for gardens or beds and collect samples at a depth of 6-8 inches.
- For larger fields, pick 10 random areas and collect samples at a depth of 6-8 inches PLUS 1-2 subsamples at a depth of 8-16 inches.
- Make sure to do separate samples for different conditions and crops

SOIL TEST RESULTS - Your soil test results will contain plenty of information and recommendations for your garden. Below are a few of the key things to look for:

- pH level and buffer pH level for lime recommendations
- Soil texture and percentage organic matter
- Available P, K, Ca, Mg, (Very Low, Low, Optimum, High, Very High)
- Estimated CEC (Cation Exchange Capacity)
- Estimated Base Saturation
- Nutrient recommendations (N, P_2O_5 , and K_2O)
- Specific application recommendations

APPENDIX H: IPM RESOURCE LIST

COMMON DE INSECT PESTS	PREFERRED HOST PLANTS	CULTURAL CONTROLS	PHYSICAL CONTROLS	BIOLOGICAL CONTROLS (PREDATORS)	CHEMICAL CONTROLS
APHIDS	Aphids do not have a preferred host plant and can be found on any type of garden plant.	- Don't plant transplants already infected with aphids - Keep ant populations low to prevent aphid farming	- Gently spray plants with water to wash away aphids	Lady Beetle; Minute Pirate Bugs; Damsel Bugs; Big Eyes Bugs; Solider Beetles; Tachinid Flies	In extreme cases and as a last resort treat plants with an insecticidal soap
BEAN BEETLE	Legumes, especially lima and snap beans	- Pull up any bean plants immediately after harvest and dispose of them in plastic bag - Plant a small section of beans early in spring as a trap crop. Dispose of the trap crop before planting a true bean crop in early summer	- Use row cover directly after planting until mid summer when primary threat has passed - Hand pick and crush eggs, larvae, and adults	Parasitic Wasps (which are non-stinging)	Few chemical agents are effective against bean beetle, but insecticidal soap has some success when used on eggs or larvae stages.
CABBAGE WORM	Brassicas (cole crops): cabbage, broccoli, brussels, cauliflower, collards, kale, turnips, and radish	- Select fast growing cultivars to ensure crop production before issues arise - Reduce insect habitat but keeping down tall weeds and brush - Keep some bolted flowers to attract predators	- Use floating row cover directly after planting - Check plants daily and handpick any found larva	Parasitic Wasps; Tachinid Flies	Treat leaves with either spinosad, neem, or pyrethrum combined with dish soap (helps the spray stick to leaves)
CUCUMBER BEETLE (SPOTTED OR STRIPED)	Mostly Cucurbits: cucumber, squash, pumpkin, muskmelon, but can affect legumes and tomatoes	- Clean up debris to remove overwintering sites for insects - Plant preferred host plants in mid June after adults have dispersed elsewhere	- Use floating row cover after planting; remove once plants begin blooming for pollination	Parasitic Wasps; Solider Beetles	Pyrethrum, neem, or spinosad
HARLEQUIN BUGS	Some Brassicas (cabbage, kale, collards, broccoli, cauliflower) but can also affect potato, squash, beans, and tomatoes	- Clean up gardens of debris and brush to remove over wintering sites - Use Cleome as a trap crop - Plant resistant varieties	- Use floating row cover or screens over plants all season - Hand pick and crush eggs, nymphs, and adults	Praying Mantis; Minute Pirate Bugs	Nymph stages are susceptible to insecticidal soap or neem oil
LEAF HOPPER	Pretty much everything, but tends to favor potato, beans, and eggplant	- Select hairier varieties of vegetables to keep leaf hopper away - Keep weeds down which harbor leafhopper eggs	- Use row cover when plants are small and more susceptible - Put up sticky traps	Minute Pirate Bugs, Damsel Bugs, and Big Eyes Bugs; Lady Beetles; Lacewings; Spiders	Insecticidal soap is effective on nymphs stages and dusting leaves diatomaceous earth helps keep adults away
SQUASH BUG	Mostly squash and pumpkins, sometimes cucumbers, cantaloupes, and watermelon	- Remove mulch and plant debris around plants to limit habitat - Pick squash bug resistant varieties	- Use floating row cover after planting; remove once plants begin blooming for pollination - Hand pick adults and nymphs or remove leaves with egg clusters	Parasitic Wasps, Tachinid Flies, Damsel Bugs	Neem oil is effective on nymphs stages

APPENDIX H: IPM RESOURCE LIST

PLANTS THAT ATTRACT PREDATORS

- For Parasitic Wasps: Yarrow, Dill, Coriander, Queen Anne's Lace, Tansy, Parsley, White Alyssum
- For Tachinid Flies: Parsley & Dill flowers, Tansy
- For Lacewings: Yarrow, Dill, Coriander, Queen Anne's Lace, Tansy, Lemon Gem Marigold
- For Ladybugs: Yarrow, Dill, Fennel, Butterfly Weed, Coriander, Tansy
- For Hoverflies: Yarrow, Dill, White Alyssum, Parsley, Queen Anne's Lace, Coriander, Fennel, Lemon Gem Marigold
- For Spined Soldier Bugs: Perennials, planted around the garden border
- For Soldier Beetles: Goldenrod, Hydrangeas
- For other miscellaneous predators: White Sensation Cosmos, Fennel, Lemon Gem Marigold

SAMPLE PEST CONTROL GARDEN SPRAY RECIPE

This recipe was adapted from The Prairie Homestead website in 2019. As with any DIY spray take proper precautions by wearing gloves and goggles and test spray only a few leaves (then wait 24-48 hours) before spraying the whole garden.

Ingredients:

- 1 medium onion
- 4 cloves garlic
- 2 cups mint leaves or 20 drops peppermint essential oil
- 2 tbsp cayenne pepper
- 2 tbsp liquid biodegradable soap
- Water

Instructions:

1. Place the onion, garlic, peppermint, cayenne, and 1 cup water in a blender and pulverize.
2. Let mixture stand for a couple hours (optional, but highly encouraged), then strain into a 1-gallon container with a fine mesh strainer.
3. To the container add the soap and enough water to fill the rest of the container.
4. Pour into a spray bottle and spritz on any plants being attacked by bugs 1-2 times a week or after a heavy rain.

WEB RESOURCES

University of Delaware Cooperative Extension

<https://www.udel.edu/academics/colleges/canr/cooperative-extension/environmental-stewardship/pest-management-homeowner/garden-pests-diseases/>

University of Maryland Cooperative Extension

<http://extension.umd.edu/hgic/topics/vegetable-problems>

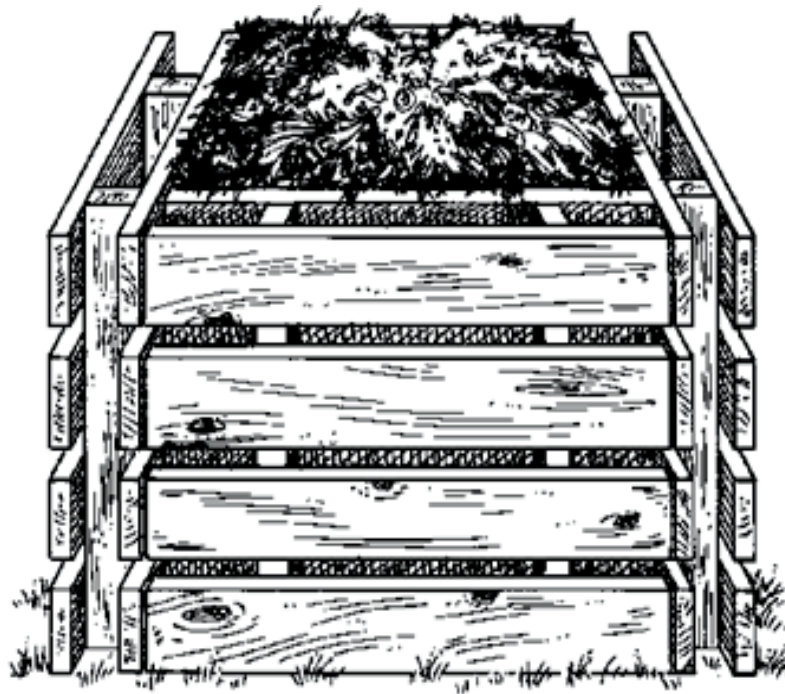
University of Oklahoma Cooperative Extension

<http://extension.okstate.edu/integrated-pest-management.html>



Photos courtesy University of Delaware Cooperative Extension

Backyard Composting



recycling.delaware.gov

APPENDIX I: COMPOSTING BROCHURE

Why should I compost?

If you had a choice, which would you rather see grow – vegetable and flower gardens in your yard or that ever-expanding landfill down the road? Probably, you would choose your garden. By composting your food scraps with *yard wastes** you can reduce the amount of waste that you are "feeding" to the landfill and at the same time produce a "food" for your yard and garden that is as good as any soil conditioner you can buy. (**yard wastes should not be disposed in your household trash or at Delaware landfills. See additional information for management options*).

What is so good about compost?

-  Improves soil structure, texture, aeration, and quality, and stimulates healthy root development in plants
-  Provides nutrients and trace elements essential to growth and releases them slowly throughout the growing season
-  Adds beneficial organisms to the soil
-  Reduces the need for chemical fertilizers, which can save you money and reduce chemical run-off into streams and rivers
-  Can increase moisture retention in soils to reduce erosion and the need for watering
-  Can reduce the amount of organic waste you send to the landfill by recycling it into a valuable resource

In addition, the act of producing and working with compost can help fulfill your need to "get back to nature." You might say that composting is good for the soil and good for the soul.



What exactly is composting?

Composting is simply the controlled process of the natural decomposition of organic matter. It is a process that is occurring constantly all around us. Compost is produced through the activity of naturally occurring soil microbes known as

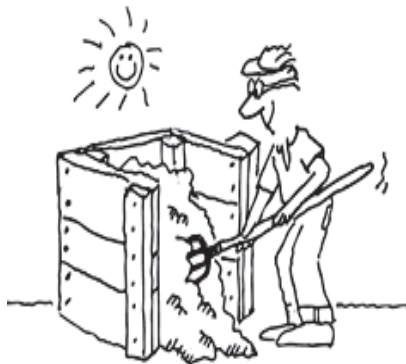
APPENDIX I: COMPOSTING BROCHURE

decomposers. Given a favorable environment with the right conditions of food, air, water and temperature, the decomposers will break down your food scraps and yard wastes and recycle them into a humus-like material that can serve as an excellent soil amendment for your yard and garden. Once you have established your compost pile, a food web – bacteria, fungi, molds, snails, millipedes, beetles, worms, and others – soon develops and work to break down the organic matter and convert the nutrients into a form plants can use. Different organisms prefer different organic materials and temperatures. Organic materials provide carbon and nitrogen as nourishment for the tiny organisms in the compost. As conditions in the pile change, the mix of organisms will change too. Organisms will become dormant, die, or move to more hospitable parts of the pile. It is important to know that the most desirable decomposers require oxygen to survive. If your pile becomes oxygen deficient, these desirable decomposing organisms will die, and anaerobic decomposers (those not requiring oxygen) will take over. Anaerobic decomposers generate bad odors, as well as acids and alcohols that can harm plants. Make sure your compost remains oxygen rich by turning or mixing regularly or every week or two.



How do I start composting?

First, decide what type of compost system you want. Options may



include: an open pile, a tumbler, a wire collector, or a bin. A pile or wire collector work great for yard wastes, but if you want to compost food scraps it's best to use a tumbler or a bin with a lid. You can construct your own with scrap lumber, wire, blocks, or pallets or purchase a bin made with rot resistant wood or recycled rigid plastic or a turning

style tumbler unit. Choose a suitable location that is flat, well drained, and ideally shady. Avoid placing the bin against a tree or wooden building and make sure the bin is close to a source of water such as a garden hose or rain barrel.

APPENDIX I: COMPOSTING BROCHURE

Table 1: What goes in my compost pile?

<u>Put it in</u>		<u>Leave it out</u>	
Weeds	Grass clippings	Bones	Vegetable oil
Bread	Wood ash	Lard	Nut butters
Fruit	Vegetables	Chicken	Fish
Egg shells	Wood chips	Treated wood	Painted wood
Leaves	Yard wastes	Oils	Mayonnaise
Straw	Tea bags	Meat	Kitty litter
Old potting soil	Sawdust	Dairy	Diseased plants
Shredded paper	Paper towels	Dog and cat feces	
Horse manure with straw		Weeds gone to seed	
Coffee grounds and filters		Coal or charcoal ash	

Start with a base of coarse twigs or wood chips to aid in aeration. Layer other materials 2–6” deep in the composter. Alternating the types of materials will speed up the decomposition process, especially if you alternate high-carbon (browns) materials with high-nitrogen (greens) materials (See Table 2). Mix 75% “brown” organic materials with 25% “green” organic materials (by volume). When first building your compost pile, mix in a small amount of rich garden soil or finished compost to spike your pile with decomposers. Mix alternating layers of materials to form a pile of at least 1 cubic yard in size. This size provides enough food and insulation to keep the organisms in the compost warm, happy, and working hard.

Table 2: Browns and Greens

High carbon values “Browns”	High nitrogen values “Greens”
Shredded paper	Fruit peels and cores
Fallen leaves	Vegetable scraps
Sawdust	Grass clippings
Twigs and bark	Coffee grounds
Straw	Hair and fur
Livestock bedding	Horse, chicken, and rabbit manures

APPENDIX I: COMPOSTING BROCHURE

Compost pile maintenance

You can choose how much effort to put into maintaining your compost pile. If you are not able or inclined to work on your pile regularly, it will still turn into compost – it will simply take longer. Here are some tips for speeding up the process:

Small particles decompose faster than large ones. Chop or shred materials before adding them to the bin. Run over leaves with the lawn mower and cut yard trimmings into short pieces. Chop up fruit and vegetable scraps and mix fresh materials into the pile as they are generated. Be sure to turn and aerate the pile to incorporate the new materials into the “hotter” sections of the pile, where decomposition activity is highest.

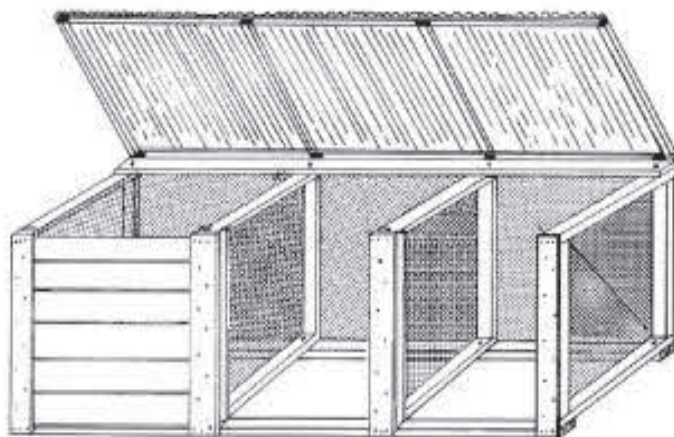


Keep the compost pile as damp as a wrung-out sponge. Remember to mix the contents of your bin or pile regularly with a pitch fork or compost turning tool to aid the composting process and reduce the potential for odor. The proper blending of carbon and nitrogen rich materials helps ensure the pile reaches the temperature needed to promote the composting process.



Turning bins

A series of three or more bins allows you to make compost in a short time by turning the materials from bin to bin or for storing extra “browns” and “greens” like leaves or grass clippings for later use.



APPENDIX I: COMPOSTING BROCHURE

When will my compost be ready to use?



Finished compost tends to accumulate in the bottom of the pile or bin. It is ready to use when it is a dark brown, crumbly, soil-like material with a sweet or musty smell. If you have observed the techniques listed above, you may have usable compost in 2 to 3 months. If not, it may require as much as a year or two to completely decompose. Screen the compost for large particles or for materials not yet decomposed and throw them back into the pile.

How do I use the finished compost?

Compost can also be used in a variety of ways to benefit your lawn and garden.

In the garden

-  Spread a 1-2" layer on the surface, work it into the soil before planting
-  Apply as top dressing to shrubs and plants either on the surface or work it into the soil
-  When transplanting, add finished compost to the transplant hole for smaller plants, shrubs, and trees

Around the yard

-  When building or reseeding lawns, spread a 1/2" layer over the area, work it into the soil to a depth of 4 - 6" about one month before planting
-  On an existing lawn, apply 1/4" top dressing in the fall using a fertilizer spreader, or broadcast by hand and rake lightly

On house plants

-  Add a thin layer of compost over house plant soil to provide nutrients
-  Combine finished and screened compost with equal parts sand and loam to make your own potting mix

APPENDIX I: COMPOSTING BROCHURE

Table 3: Troubleshooting your compost

Symptoms	Problems	Solutions
Material not heating up or decomposes slowly	Pile too small	Add more organic matter
	Insufficient moisture	Turn pile and add water
	Lack of nitrogen	Incorporate “greens” into the pile
	Not enough air	Turn pile regularly
	Cold weather	Increase pile size or insulate with straw bales or tarp
Rotten egg smell	Insufficient air or too much moisture	Turn pile and incorporate coarse brown materials
Ammonia smell	Too much nitrogen materials	Incorporate coarse brown materials
Rodents attracted to compost	Meat, dairy, fatty or uncovered foods	Keep these items out of the pile or cover food scraps with browns
Flies and gnats	Uncovered food items in pile	Mix and cover food scraps with brown materials

APPENDIX I: COMPOSTING BROCHURE

Additional information

Department of Natural Resources and Environmental Control

Division of Waste and Hazardous Substances

89 Kings Highway, Dover, Delaware 19901

(302) 739-9403

Delaware Recycles Program

www.de.gov/recycling

Compost Bins are available through pre-order on-line sales.

Call (302) 739-9403 for more information.

University of Delaware's Cooperative Extension Offices

For more information see: extension.udel.edu/

Contact: New Castle (302) 831-2667/ Kent (302) 730-4000/

Sussex (302) 856-7303

Delaware Solid Waste Authority

www.dswa.com

*Yard waste management options

- 1) Manage your yard waste on your own property.
 - Grasscycle by using a mulching lawn mower and leave grass clippings on your lawn.
- 2) Take your yard waste to a drop-off facility.
- 3) Hire a collection service to pick up your yard waste.



Thank you for composting!

Source of Graphics:

Heart of Texas Master Composters

City of Edmonton, CA.

Printed on recycled paper

April 2019

APPENDIX J: COMPANION PLANTING



Publication Date: August 1, 2018
Prepared by: Dr. Judy Hough-Goldstein,
Delaware Master Gardener

A New Approach to Companion Planting: Adding Diversity to the Garden

Do tomatoes love basil but hate brussels sprouts? Traditional companion planting, which involves planting different types of plants together or in close proximity, makes many such statements, often based on little more than folklore. In recent decades, however, scientists have found that in fact there are definite benefits to adding diversity to your garden, primarily because certain plants attract and support beneficial insects that either help control pests or help pollinate your crops.

Why add diversity?

Resources from flowers, i.e. nectar and pollen:

- Attract and support **predators and parasitoids** (natural enemies) for pest control. Some **tiny parasitoids** require nectar or another source of sugar, and abundant nectar improves their survival and increases reproduction. **Syrphid or hover flies** feed on nectar and pollen, and lay hundreds of eggs near soft bodied insects such as aphids. The eggs hatch into larvae that are voracious feeders on those small pests. **Lacewings** and **ladybird beetles** are also attracted to flowers and can effectively control aphids.



Syrphid or hover fly on alyssum flower



Lacewing on alyssum flower

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APPENDIX J: COMPANION PLANTING

- Attract and support **pollinators**, providing nectar and pollen that bees and butterflies need.
- Some flowers support **alternate prey** for natural enemies. For example, marigolds often support numerous tiny pest insects called thrips, which in turn are fed on by tiny voracious predatory bugs, *Orius* species, also known as minute pirate bugs. The *Orius* may also patrol nearby crop plants, reducing populations of soft-bodied pests.
- Marigolds are also well-known for their ability to control nematodes due to the toxic chemicals exuded by their roots; however, this works better when marigolds are planted as a **cover crop**, with their residues tilled into the soil before the crop is planted.



Marigolds planted with squash



Orius predatory bug feeding on thrips

- The presence of different plant species grown together can **disrupt the ability of pests to find their host plants**. Plant-feeding insects, especially those that only feed on one or a few types of plants, find their host plants by sight and smell, and these cues can be disrupted by surrounding plants, especially **aromatic or bushy plants**.
- Adding **ground-level complexity**, for example strips of grass, weeds, or cover crops, can increase populations of ground-dwelling generalist predators, such as ground beetles and spiders, which can feed on plant-feeding insects, especially those that spend a part of their lives in the soil. Grassy “beetle banks” also provide sheltered overwintering habitat for insect predators.
- **Caution:** although there are many studies showing that diverse plantings increase populations of natural enemies, this does not always translate into fewer pests on the desired crop plant, since the predators and parasitoids **may not disperse** to where they are needed. You will still need to check your plants frequently for unwanted pests, and control them in some other way if the good bugs are not effective enough!
- In addition, the added plants will **compete** with the crop for light, water, and nutrients, and therefore crop yield may be reduced compared to a monoculture of the crop. Select companion plants that are not overly competitive with the main crop.
- **Other examples where diverse plantings make sense.** Plants with different characteristics can be used to support soil nutrition and better yield in a small space. For example, legumes, such as alfalfa, clover, peas, and beans, fix nitrogen and can be planted in rotation with non-legumes; deep-rooted plants can be grown with shallow-rooted plants; and sun-loving plants

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APPENDIX J: COMPANION PLANTING

can provide shade for shade-loving plants and also help to reduce weeds. A classic example of this type of companion planting is the so-called “**three sisters**” planted together by Native Americans. Corn, pole beans, and squash were planted together, with corn providing support for the beans and the large squash leaves suppressing weeds.

How to add diversity?

Combine crop plants with other **annual or perennial plants in the vegetable bed:**

- **Herbs** are desirable crops themselves, and often produce small flowers with exposed nectaries that attract and support predators and parasitoids. They also tend to be aromatic. Herbs that have been shown to attract natural enemies or repel herbivores in at least some studies include **basil, coriander, rosemary, lavender, parsley, borage, dill and chives**.



Basil planted with tomatoes



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APPENDIX J: COMPANION PLANTING

- **Annual flowers** can be planted in the beds around vegetables. In the Master Gardener Vegetable and Fruit Demonstration Garden (VFDG) at the New Castle County Cooperative Extension Office, **sweet alyssum** has been planted within vegetable beds for several years to attract and support beneficial insects. Alyssum is inexpensive, easy to grow, low growing and compact (so it doesn't compete with the vegetables), has a long growing season, and doesn't leave significant biomass at the end of the season. It can be grown from seed, but at the VFDG plants are typically purchased, for convenience and quick establishment. Numerous syrphid flies (mentioned above) can be seen swarming about the flowers in the spring. Other popular choices are **marigolds** and **nasturtiums**. Some popular annual plants such as pansies, however, have been selected primarily for large colorful flowers and may not produce the nectar and pollen needed by beneficial insects.



Alyssum in the Master Gardener Vegetable and Fruit Demonstration Garden in Newark, DE

- Plant **flowering native perennials in a bed near the garden**. The VFDG also has a native perennial bed, consisting of various species that bloom at different times and are known to attract and support beneficial insects (see RESOURCES for plants to consider).



Perennial flower border in the Master Gardener Vegetable and Fruit Demonstration Garden in Newark, DE



- Plant **flowering shrubs and trees in a nearby hedgerow**. If you have room for trees and shrubs, this is a great way to add additional flower resources, in addition to berries and habitat for birds. Trees are often the first source of flowers in the spring (see RESOURCES).

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APPENDIX K: COVER CROPS FACT SHEET

COVER CROP TABLE

Delaware Cooperative Extension

DE Cooperative Extension

4

Fall Cover Crops

CROP	CHARACTERISTICS	WHEN TO PLANT
Barley	A non-legume	Late Season to mid- Fall (August – November)
Crimson Clover*	A winter annual legume that prefers sandy, well-drained soils. N content about 2 - 4% or 80 lbs of N per acre.	Plant it by September 15 to get established before winter arrives.
Clover – Red*	A short-lived perennial. Provides about 60 – 110 lbs of N per Acre.	Late August to late September
Clover – Subterranean*	Cool season annual that tolerates low soil fertility and pH. N content about 2.3% or 30 to 90 lbs of N per acre. Will die on its own in June if not turned under.	Plant late August no later than September 15
Forage Radish (Daikon)	Frost will kill the tops and the long roots will break down over winter. Sometimes half the root is above ground. Reduces soil compaction by bio-drilling (large root growth).	Plant late August, no later than Labor Day
Oats	A non-legume	Late August to mid-November
Peas- Field*	A winter annual legume. N content 3 - 4 % or about 50 – 150 lbs of N per Acre does not re-establish itself.	Plant anytime in September
Rapeseed	Used to help control soil nematodes, bio-fumigation (nematode species differ in their response to toxicity).	Plant by mid-September and turn under in April before it flowers
Rye	A winter annual grass that tolerates a wide range especially heavy, waterlogged soil conditions. N content about 1.3%.	Late August to mid-November
Triticale	A cereal grain cross between wheat and rye.	Late August to mid-November
Vetch – Hairy*	A legume with thick, vine-like growth habit. Be sure to have good seed/soil contact to improve germination rate. Does very good in well-drained soils.	Plant anytime in September
Winter wheat	A non-legume that should be turned under in the spring before it forms a seed head.	Late August to mid-November

**Need a specific inoculate for roots to fix nitrogen.*



Fall Cover Crops is a publication of Delaware Cooperative Extension, a partnership between Delaware State University and the University of Delaware. For more information, contact Maggie Moor-Orth at (302) 857-6437/mmoor@desu.edu, or Gordon Johnson at (302) 730-4000/gjohn@udel.edu.

Cooperative Extension Education in Agriculture, 4-H and Home Economics, Delaware State University, University of Delaware and United States Department of Agriculture cooperating. Dr. Dyremphe B. Marsh, Dean and Administrator. It is the policy of Delaware Cooperative Extension that no person shall be subjected to discrimination on the grounds of race, color, sex, disability, age, or national origin.

DE Cooperative Extension 2008

Delaware Cooperative Extension

By Maggie Moor-Orth
Delaware State University

and

Gordon C. Johnson
University of Delaware

FALL COVER CROPS

Introduction

During spring and throughout the summer, gardeners are busy harvesting from crops that were planted in their gardens. Our garden soils provide an abundance of harvested peas, lettuce, peppers, tomatoes, sweet corn, yellow squash, zucchini, basil, zinnias and many other vegetables and flowers. Planting a cover crop is one of the best ways to thank our garden soil at the end of the gardening season and to help improve and rebuild it for the next growing season. Cover crops are used as mulches, green manures, nitrogen sources, catch crops and soil covers. A cover crop gives many benefits to the soil. These are:

- Protects soil surface from water runoff
- It protects the soil from being eroded by harsh winter winds and rains.
- It helps reduce or suppress weed growth.
- Helps manage certain insect pests and plant pathogens
- Some cover crop species suppress nematodes
- When turned under in the spring, the decomposition of the plants adds organic matter to your soil
- The organic matter improves soil structure
- It provides ideal conditions/habitats/food for earthworms and other beneficial soil organisms
- Roots from cover crops increase soil aeration and water infiltration
- Reduces soil crusting and soil compaction
- Cover crops return minerals and nutrients to the soil (nutrient cycling).
- Legume cover crops add nitrogen to the soil
- Reduces nitrogen leaching



Crimson clover is a winter annual legume that prefers sandy, well-drained soils. Plant it by September 15 to get established before winter arrives.

FALL COVER CROPS

Winter wheat is a non-legume that should be turned under in the spring before it forms a seed head.



When should you plant a cover crop?

One way to determine this is when your annual garden plants (vegetables, flowers and herbs) are finished producing good quality and quantity of fruit. It may also be when you are tired of gardening and/or your schedule permits. Remove all plastic mulches, plant cages and stakes. Remove plants and add them to your compost pile (no weed plants that have gone to seed; chop plant debris into small pieces before adding to your compost pile). Rotary till the garden and prepare the soil surface for seeding.

Which crop should I choose for a cover crop?

Barley, oats, triticale, wheat or rye are small cereal grains that are used for cover crops. They are known as non legumes. Winter varieties are planted in the autumn (between late August and November) and make a great cover crop during the winter. They grow well on soil with fairly good drainage and a pH between 6 and 7. The seeds for any of these crops are available at most gardening supply stores. When planted in the early fall, they have an excellent chance to germinate

and grow several inches. During the winter they will grow very little. With the arrival of warmer days in late February and early March, they will again begin to grow several more inches—just in time to be turned under as a green manure crop and to add rich organic matter to your garden soil.

Crimson clover is an example of a winter annual legume also used as a cover crop. It is planted in the fall and grows quickly in the spring with warmer weather. It also decomposes when turned under adding organic matter to the soil for warm season crops (tomatoes, peppers, sweet corn, melons, squash and lima beans) to use. It should be sowed mid-August to late September. Other winter annual legumes that make good cover crops include hairy vetch and Austrian Winter field peas.

Legumes, like cereal grains when turned under in the spring, add organic matter to your soil, but they also increase the amount of nitrogen in your soil. A Delaware study by Mitchell and Teel, 1977, found hairy vetch and oats together as a cover crop added 154 lbs/acre of nitrogen. These results suggest that cover crops may replace or help reduce the need to apply additional commercial nitrogen fertilizer to your garden soils during the growing season.

APPENDIX K: COVER CROPS FACT SHEET

How do I plant the cover crop?

Once plant debris is added to your compost and the garden soil is tilled, then take a soil sample. As with other crops, your garden should have a smooth seed bed for planting. After selecting the cover crop that is best for you, either broadcast your cover crop seeds by hand for a small site, or use an adjustable lawn seeder by selecting the correct opening size for the seed. After seeding, gently rake the seed and soil surface, making sure that you have good soil and seed contact. If the weather conditions are dry and hot, irrigate the seed bed. If dry weather continues, keep the seeds moist while they are germinating and continue to water them as they grow into young plants.

When should I turn the cover crop under in the spring?

Research shows that your cover crop should be turned under around the beginning of April. Legume cover crops, such as crimson clover and hairy vetch, can be allowed to grow to the early flowering stage to maximize the nitrogen benefit. Larger plants can be difficult to turn under, however, if you are going to put in some early cool season crops (potatoes, onions, peas, lettuces, etc.) you may want to turn under just enough to plant these crops. If turned under in April, the cover crop's underground residue will have time to break down. Cover crops turned under in the spring are called green manure. Green manure provides nutrients to the new crops planted and growing. Cover crops (green manure) break down and release nutrients as the new crop needs them.

How do I turn under my cover crop?

For small spaces, you can use a shovel to turn under the cover crop. This method will test the strength of your back. Just dig up a slice and put the green side down. Be sure to chop the slice. The better method calls for a rear-mounted rotary tiller. Depending on your garden size, the ideal method is to use a



Oats are a small cereal grain that are used for cover crops. They are known as non-legumes.

tractor and plow for turning under and doing the primary tillage. It is best not to mow your cover crop first,

because the green plant material is the nutrient source for the future crop. Your garden soil should be ready for planting about two weeks after turning your cover crop under, however, you may prefer to wait four weeks to reduce seed corn maggot problems in direct-seeded crops as they are attracted to decaying organic matter.

Planting a cover crop is a wise and good gardening practice; it is an important part of maintaining productive soils and helps our crops to have higher yields during the growing season.

APPENDIX L: RAISED BEDS

Raised Bed Gardening



L: Community gardeners clean up a raised bed growing strawberries in the 12th and Brandywine Urban Farm in Wilmington.

R: Raised beds are built on top of asphalt in Duffy's Hope Youth Garden in Wilmington.

What are advantages of raised beds?

Better Drainage: A raised bed permits plant roots to develop in soil held above water-logged or compacted sites. You can easily incorporate compost and other organic material to insure good drainage.

Higher Yield: Yes, it's possible! Through intensive planting, and the use of good soil to promote healthy plant growth, you can grow a healthy harvest and increase your yield.

Extended Growing Season: The soil warms up faster in the spring, allowing you to plan and grow earlier in the season. Quick and easy covers can be used with a raised bed to begin early, or extend the season well into the winter.

Easier Access and Maintenance: Depending on the height of the bed, you can minimize the bending you'll need to do while working in the garden (weed, water and more).

Challenging Site: A raised bed can make gardening possible in small spaces, and also where growing plants would otherwise be impossible, particularly in urban areas where paving and/or potentially unhealthy (contaminated, rocky, or otherwise poor) soil is present.

APPENDIX L: RAISED BEDS

What materials can be used in the construction of raised beds?

- Cedar and cypress are good choices because they are naturally insect and decay resistant
- New pressure treated woods such as pine are safe, but should not be considered for organic gardening
- Recycled lumber can last about as long as cedar and cypress and fits into a philosophy of reuse
- Cinderblocks, bricks
- There may be other choices- use your imagination!

Availability, price and durability are factors to consider when selecting the materials you will need to construct a raised bed. A variety of raised bed kits, often pricier but the materials are all inclusive, are also readily available. DO NOT USE recycled tires or lumber treated with creosote or pentachlorophenol such as railroad ties.

When building a raised bed on suspected or confirmed contaminated soil (see the [Community and School Garden Checklist](#)), asphalt, or concrete use a barrier fabric between the raised bed and its soil, and the contaminated ground. Specifically, geotextile fabric is recommended; for more information contact the Delaware Center for Horticulture and visit the raised bed demonstration site outside of the Delaware Nature Society's DuPont Environmental Education Center (DEEC) on the Wilmington Riverfront.

Raised bed design

Typically, raised beds are laid out in a square or rectangular pattern. However, be creative to meet your needs. Consider the gardener(s) you are accommodating, accessibility (reaching all sides of the raised bed without climbing into, and compacting, the soil), the space you have to site the garden, and the amount of growing space you need.

Width: 4' (four feet) is a convenient width for beds because the center of the bed is easily accessible from either side and wood is readily available with this length.

Length: typically 4' or twice this length at 8'.

Depth: At least 1' to accommodate enough soil to grow a healthy and productive garden. Again, consider accessibility and your gardener(s); beds can be much taller to accommodate, for example, gardeners who have difficulty bending or need wheelchair accessibility. Visit local community garden sites to see a variety of raised beds before you make a decision*.

As long as the site where you're building your raised bed has healthy soil, you can remove any existing vegetation. Also, break up and loosen the ground soil so that it's not compacted to allow for better drainage and then level the area to create a more even surface before you build and site your raised bed. Make pathways between raised beds wide enough for easy access to beds. Plan on at least 4' paths for walking access, and for wheel barrows, garden carts, and gardeners who might need more space to navigate and work in the bed.

APPENDIX L: RAISED BEDS

Soil

Fill your raised bed with a good quality topsoil and compost blend. Soil is the foundation, and the most important ingredient, of your garden. It is worthwhile to invest in a good bagged or bulk mix. Contact your local Cooperative Extension office to learn more about soil including mixes, availability, the amount you will need, soil sampling, adding organic matter, and more.

When and where to plant your raised bed garden?

The best time to begin building a raised bed is in the fall or early winter. But do not work the ground soil if it is too moist. Your raised bed must be sited so that it receives at least six hours of direct sunlight per day (preferably in a north/south orientation), good drainage, and easy access to a water source. By the time spring arrives, the soil in your raised bed will have settled and you'll be ready to plant.

What to plant?

Keep it simple at first and then expand as you become comfortable with the crops that work in your location. Cool season crops to try: peas, lettuce, Swiss chard, radishes, beets. Warm season crops to try: tomatoes, peppers, green beans, cucumbers, and herbs like basil or oregano. For additional suggestions, as well as growing information, refer to *Suggested Vegetables for the Home Garden*.

*Visit local gardens to see what's growing

- UD Cooperative Extension Master Gardener Demonstration Garden, 461 Wyoming Road, Newark, Delaware 19716
- Conscious Connections Inc. Northeast Community Garden and Urban Farm, 22 E. 23rd Street, Wilmington, Delaware 19802
- E.D. Robinson Urban Farm at 12th and Brandywine Urban Farm and Community Garden, 1116 E. 12th Street, Wilmington, Delaware 19802
- Planting Hope Urban Farm, Herman Holloway Campus, 1901 N. Dupont Highway, New Castle, Delaware 19720
- Southbridge Community Garden, 406 S. Heald Street, Wilmington, Delaware 19801

Prepared by Carrie Murphy, Extension Educator, and Delaware Master Gardeners, in partnership with:



<https://extension.udel.edu/lawngarden/>

APPENDIX M: GARDEN PLAN AND PLANTING SCHEDULE



SUGGESTED GARDEN PLAN and PLANTING DATES FOR A HOME VEGETABLE GARDEN

UNIVERSITY OF
DELAWARE
Cooperative Extension
COLLEGE OF AGRICULTURE &
NATURAL RESOURCES

Minimum
Distance to
Adjacent
Rows

Row
No.

1	Spinach -- 4/1 - 3/31 (5/15 - 6/10) [Lettuce -- 7/15 - 9/1 (9/15 - 11/10)]	Spinach -- 4/7 - 4/15 (5/25 - 6/15)	Chard -- 4/10 - 5/30 (6/10 - 11/1)	2-1/2'
2	Lettuce -- 4/1 - 4/15 (5/15 - 6/25) [Carrots -- 7/10 - 8/15 (9/15 - 10/20)]	Lettuce -- 4/15 - 4/30 (6/1 - 7/5)	Onions -- 3/25 - 4/15 (7/4 - 8/30)	2-1/2'
3	Carrots -- 4/1 - 4/30 (6/1 - 7/15) [Spinach -- 8/15 - 9/10 (10/1 - 11/15)]	Carrots -- 5/1 - 5/15 (6/25 - 8/1)	Beets -- 4/1 - 4/15 (6/10 - 8/1) [Greens -- 7/20 - 8/20 (9/1 - 10/30)]	2-1/2'
4	Peas -- 3/15 - 4/1 (5/20 - 6/20) [Kale -- 7/10 - 8/10 (9/15 - 11/30)]	Peas -- 4/10 - 4/30 (6/25 - 7/10)	Bush Beans -- 5/20 - 5/30 (7/20 - 8/10) [Cabbage -- 7/20 - 8/20 (9/20 - 11/15)]	2-1/2'
5	Peas -- 3/15 - 4/1 (5/20 - 6/20) [Brussels Sprouts -- 7/10 - 8/1 (10/10 - 11/30)]	Peas -- 4/10 - 4/30 (6/25 - 7/10)	Bush Beans -- 5/20 - 5/30 (7/20 - 8/10) [Broccoli -- 7/20 - 8/20 (9/20 - 11/15)]	2-1/2'
6	Radishes -- 3/25 - 4/1 (5/1 - 5/10) [Beets -- 6/20 - 8/1 (9/1 - 10/30)]	Radishes -- 4/7 - 4/15 (5/8 - 6/1)	Greens -- 4/7 - 5/10 (5/20 - 6/30) [Kohlrabi -- 3/25 - 4/15 (6/1 - 6/30)]	2-1/2'
7	Cabbage -- 3/25 - 4/15 (6/1 - 7/10) [Peas -- 7/25 - 8/5 (10/1 - 10/30)]	Kale -- 3/25 - 4/15 (6/5 - 7/30) [Bush Beans -- 7/25 - 8/15 (9/25 - 10/15)]	Radishes -- 8/1 - 8/10 (9/1 - 9/20)	2-1/2'
8	Broccoli -- 3/25 - 4/10 (6/1 - 6/15) [Peas -- 7/25 - 8/5 (10/1 - 10/30)]	Cauliflower -- 4/1 - 4/15 (6/1 - 7/1) [Bush Beans -- 7/25 - 8/15 (9/25 - 10/15)]		2-1/2'
9	Tomatoes -- 5/10 - 5/30 (7/20 - 10/15)			3'
10	Summer Squash -- 5/10 - 5/30 (7/1 - 9/15)	Peppers -- 5/10 - 5/30 (7/15 - 10/20)	Eggplant -- 5/10 - 5/30 (7/20 - 10/15)	3'
11	Cucumbers -- 5/10 - 5/30 (6/25 - 9/15)		Cantaloupe -- 5/10 - 5/30 (8/1 - 9/15)	5'
12	Watermelon -- 5/15 - 5/30 (8/1 - 9/15)		Winter Squash -- 5/10 - 5/30 (8/15 - 10/15)	6'
13	Sweet Corn -- 5/1 - 5/15 (7/15 - 8/10)	Sweet Corn -- 5/20 - 6/5 (8/5 - 8/30)	Sweet Corn -- 6/15 - 7/1 (9/1 - 9/20)	2-1/2'
14	Sweet Corn -- 5/1 - 5/15 (7/15 - 8/10)	Sweet Corn -- 5/20 - 6/5 (8/5 - 8/30)	Sweet Corn -- 6/15 - 7/1 (9/1 - 9/20)	2-1/2'
15	Sweet Corn -- 5/1 - 5/15 (7/15 - 8/10)	Sweet Corn -- 5/20 - 6/5 (8/5 - 8/30)	Sweet Corn -- 6/15 - 7/1 (9/1 - 9/20)	2-1/2'

30 feet

Italics = Transplants - all others are direct sow seeds

Total Length

~50 feet

[] = optional fall succession plantings () = Typical Harvest Period (May vary depending on specific varieties planted and local weather conditions)

It is policy of the Delaware Cooperative Extension System that no person shall be subjected to discrimination on the grounds of race, color, sex, disability, age, or national origin.

<http://extension.udel.edu/>

NCC Master Gardeners
Revised 1 January 2016

APPENDIX N: GARDEN WAIVER

Community Garden Waiver of Liability

We hope your gardening experience is safe and rewarding, but accidents can happen. The following waiver must be signed by all gardeners to protect the _____ from liability.

Waiver: In consideration of being permitted to participate in any way in the Goodwin College Community Garden I, for myself, my heirs, personal representatives or assigns, do hereby release, waive, discharge, and covenant not to sue _____ Garden or its employees, volunteers and agents from liability from any and all claims resulting in personal injury, accidents or illnesses (including death), and property loss arising from, but not limited to, participation in the Community Garden. (Initials _____).

Indemnification and Hold Harmless: I also agree to INDEMNIFY AND HOLD _____ and its employees, volunteers and agents HARMLESS from any and all claims, actions, suits, procedures, costs, expenses, damages and liabilities, including attorney's fees brought as a result of my involvement in the Community Garden and to reimburse them for any such expenses incurred (Initials _____).

Severability: The undersigned further expressly agrees that the foregoing waiver and assumption of risks agreement is intended to be as broad and inclusive as is permitted by the law of the State of Delaware that if any portion thereof is held invalid, it is agreed that the balance shall, notwithstanding, continue in full legal force and effect (Initials _____).

Photo Release: I authorize _____ to use my or my child's photo in any manner _____ desires, or advertising, display, audio-visual, exhibition or editorial use (Initials _____). Acknowledgment of understanding: I have read this waiver of liability, fully understand its terms, and understand that I am giving up substantial rights, including my right to sue. I acknowledge that I am signing the agreement freely and voluntarily, and intend by my signature to be a complete and unconditional release of all liability to the greatest extent allowed by law.

Print Name Signature Date

Parent or Guardian (if child is under 18): I am the parent or legal guardian of the above named minor child and, as such, I am authorized to enter into this agreement. I agree that my minor child and I are bound by and subject to the terms of this agreement. I understand that my signature here reflects my agreement to hereby release, waive, discharge, and covenant not to sue _____ or its employees, volunteers and agents from liability from any and all claims resulting in personal injury, accidents or illnesses (including death), and property loss arising from, but not limited to, participation in the Community Garden.

Parent/Guardian Name Parent/Guardian Signature Date

APPENDIX O: RENTAL AGREEMENT

Sample Lease Agreement

For
Community Garden Site at
926 Grand Avenue

This lease is between Property Owner, the owner of the property at 926 Grand Avenue, and the lessees: the Sunshine Community Garden and the Neighborhood Council (their address).

The duration of the lease shall be from March 31, 2008 to November 30, 2008 and will be renewed a yearly basis after November 30, 2008 unless one of the three parties does not approve. There shall be no charge for use of the land for the purpose specified herein.

The lease is for use of land for the purpose of building and operating a community garden. The garden shall be located on the eastern portions of the lot owned by Property Owner. The Property owner shall provide access to and reasonable use of water.

The Sunshine Community Garden will prepare a plan for the garden in consultation with the church showing the location of the beds and submit the plan to the church for approval.

In the future, features may be added to the garden such as a decorative fence, compost bins, a pergola/gazebo type structure, a sign, etc. Plans for such improvements will be presented to the church for design and location approval.

Liability insurance will be provided The Neighborhood Council, and the Sunshine Community Garden and Property Owner will be listed as additional insured parties on the insurance policy.

Signing of this agreement constitutes acceptance of the above terms and conditions.

Property Owner

Date

Sunshine Community Garden

Date

The Neighborhood Council

Date



To create a garden is to search for a better world.
In our effort to improve on nature, we are guided by a vision of paradise.
Whether the result is a horticultural masterpiece or only a modest vegetable
patch, it is based on the expectation of a glorious future.
This hope for the future is at the heart of all gardening.

~ Marina Schinz

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