Growing Places Indy Workshop - Getting Started with Soil & Seeds:

Bed options, tilling, irrigation, soil health, testing, amendments, and seed starting.

- **A successful garden creates the optimal condition for plants to grow with light, water, and healthy soil.**
- **Picking a location**
  - Full sun is best. Pick locations that face east or south
  - Spend a day mapping out the shadows in your yard to determine the optimal sunny location.
  - Make sure the spot you pick also has easy access to water.
- **Bed options**
  - Raised beds and container gardens.
    - Can be started from scratch and don't require acres of fertile land to have a productive garden. Can be used when outdoor space is limited or you only have access to a paved surface. Container gardens are great if you have very little space or you are not yet fully committed to the idea of gardening. Both options offer easy access, meaning less strain on your body, as well as easier maintenance, fewer weeds and rodents, and a quicker start to the season. While they have ample drainage with little erosion, rapid drainage and increased heat in raised beds and container gardens can boost the risk of drought-stress and plant dehydration during the summer.
    - Remember all plant need different space to grow. Do your research when choosing container and bed size to suit what you want to grow.
    - Fill your raised beds and containers with topsoil, compost, and other organic material, such as manure, to give your plants a nutrient-rich environment. You can also buy pre-mixed potting soil.
- Turing a lawn into a garden.
  - Before you try to turn your lawn into a garden, it's good to know what you are working with and if it's safe.
  - Call before you dig! Dial 811 to have your plot marked for underground utilities. This process usually takes about two business days. May also be requested online. https://www.indiana811.org/fivesteps.pdf
  - Due to possible past uses of urban sites, having soil tested is important to learn as much as possible about any contaminants, such as unsafe levels of lead or other heavy metals. Elevated levels of lead in particular are fairly common in urban soils and pose health risks, especially to young children who can ingest soil while playing or helping in

gardens. Other contaminants are possible, especially if the site has any industrial or manufacturing history. Test soil at a qualified laboratory. http://cwmi.css.cornell.edu/guidetosoil.pdf

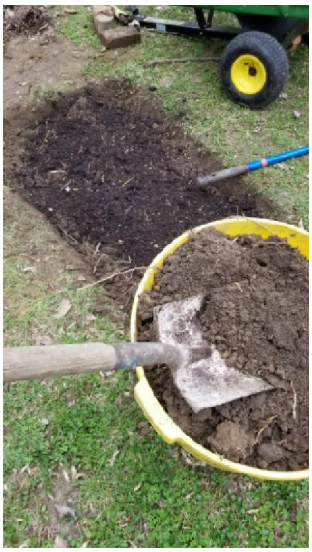
- Soil Test for nutrients from agriculture lab.
  - Knowing what nutrients are already in the ground is a great starting point in creating healthy soil, to balance pH and add lacking nutrients. If you amend soil without knowing what nutrients are there, you could cause toxicity. You can easily amend soil if it's lacking nutrients, but you cannot remove excess nutrients.
  - Store bought kits are not accurate. Lab tests are inexpensive and give more information. We had our tests at done for $20 each at Agri-Labs Inc. – out of Aubrun IN. https://www.agri-labsinc.com/analytical-services/soil-analysis
  - What information will you get?
    - Cation Exchange Capacity – a measurement of surface area. The soil's ability to attract, retain and exchange cationic elements (nutrients). When the soil tests indicate a higher CEC level, the soil has the ability to hold a greater capacity of cations. https://www.youtube.com/watch?v=HmEyymGXOfI.%20
    - Base Saturations - the total percentage of the soil exchange sites (CEC) occupied by basic cations. As base saturation increases, so does the availability of the soil cation nutrients. The base saturation number should be used as a guide to maintain optimum fertility levels. Ideal levels:
      - Na - <6%
      - K - 2-7%
      - Mg - 15-20%
      - Ca - 65-75%
      - https://www.youtube.com/watch?v=9-aOvYH-HNQ
    - Soil pH influences nutrient intake. A pH test measures the soil acidity (pH 0-7.0) or alkalinity (pH 7.0-14). Ideal pH for most crops for optimum uptake is 6 to 7.5.
    - Buffer pH is important if you have acidic soil. Generates lime recommendations. The difference between the pH level and the buffer pH level indicates how easily the soil will be changed when applying lime.
    - Macronutrients – plants require larger amounts of these.
      - Nitrogen - our test did not test for nitrogen.
      - Phosphorous - Bray P1 equivalent.
      - Potassium
      - Calcium
      - Carbon - organic matter is a vast array of carbon compounds available in soil made from decomposed plants. It plays a major role in your CEC levels by increasing the nutrient holding capacity of the soil. Organic matter also acts as

a binder for nutrients so that many become more readily available to plants. https://www.sare.org/Learning-Center/Books/Building-Soils-for-Better-Crops-3rd-Edition/Text-Version/Amount-of-Organic-Matter-in-Soils/How-Much-Organic-Matter-Is-Enough
    - Sulfur
    - Magnesium
    - Micronutrients - only small amounts are needed.
    - Zinc
    - Manganese
    - Copper
    - Boron
- Now that you have all this info about your soil, you can use it to make any needed amendments to your soil. Amounts needed need to be looked up and calculated by garden size.
  - Macronutrients
    - Carbon (organic matter) - compost, manure, humus, peat.
    - pH
    - pH up - ground lime or dolomite.
    - pH down - ammonium sulfate or sulfur.
    - Nitrogen - blood meal, fish meal, soybean meal, composted manure, coffee grounds, composted grass clippings.
    - Phosphorous - bone meal, soft rock phosphate.
    - Potassium - wood ash (will also increase pH), greensand (also improves soil structure), sulfate of potash, fish meal, soybean meal.
    - Calcium - lime, Aragonite, gypsum, Bone Meal.
    - Magnesium – lime, Epsom salt, greensand.
    - Sulfur - ammonium sulfur, gypsum, manure.
  - Micronutrients - The best long term way to keep your garden soil rich with the micronutrients it needs is by adding organic compost. The living things that go into compost like grass clippings, leaves, plants trimmings, and table scraps, already contain various amounts of micronutrients. Foliar spays are a quick way to get micronutrients to plants, such as fish emulsion and seaweed. If you do decide to fix specific nutrients in your soil:
    - Zinc - chelated zinc.
    - Manganese - manganese sulfate.
    - Copper - copper sulfate.
    - Boron - borax, boric acid, solubor.
  - Other beneficial amendments:

        - Alfalfa meal - a source of readily available nitrogen and feeds soil organisms. It contains vitamins, folic acid, and trace minerals.
        - Kelp meal - contains over 70 different nutrients. Provides trace minerals, amino acids, and enzymes that stimulate plant and root growth and are beneficial to soil life. Improves soil structure.
        - Diatomaceous earth - skeletal remains of single cell algae. Improves soil structure and is great for pest control.
        - Bio char (charcoal) - stimulates soil fertility and improves soil quality by increasing soil pH, increasing the ability to retain moisture, attracting more useful fungi and other microbes, improving the ability of cation exchange, and preserving the nutrients in the soil.
        - Azomite - ancient volcanic dust that merged with sea water 30 million years ago. It contains over 60 minerals that are good for plant growth.
- Sheet mulching or "lasagna mulching" - an easy way to turn a lawn into a garden. http://lawntogarden.org/how-to-sheet-mulch
    - Composting in place. Need at least 6 months before they are ready to plant in.
        - Cut grass short, moisten and loosen soil, then add amendments. You then start the layering process with organic matter- manure, newspaper, leaves, hay, grass, mulch, etc. Many people have their own "recipes." Research ways people have done theirs to find what will work best for you using what you already have on hand.
- Double Digging is a quick way to start a garden, but can be a lot of work. https://www.youtube.com/watch?v=19I1y-N999U
    - Remove grass

    - Dig a trench one shovel-length deep (about 10 inches) and the length of your planting area.

- Pile the soil in a wheelbarrow. Loosen the soil at the bottom of the trench another nine to ten inches. (Spading fork works great for this)
- Add organic material, such as compost, and any necessary soil amendments. Using a spading fork, thoroughly mix them into the subsoil.



- Dig a second trench parallel to the first and repeat steps 2 and 3.

- Use the topsoil from the second trench to fill the first one, adding more organic matter and mixing it in.

- Repeat the procedure until you've dug, enriched, and amended the entire planting area.

- Fill the last trench with the topsoil you put in the wheelbarrow when you dug the first trench, enriching it with organic matter as you did before.

- Whether you pick a raised bed or turn your lawn into a garden, make sure the dimensions you choose are easy and comfortable for you to access the whole bed.
- Most importantly, don't go overboard! Keep it simple at first. Start small and get good at growing a few plants your family loves. Maybe you could sheet mulch a few other spots for future in the meantime. Give yourself time to learn so you don't become overwhelmed.

Irrigation

- To know how your soil holds water and nutrients, it's good to know what texture and structure you are working with.
  - Texture - particle size.
    - Sand - does not hold onto nutrients well. Has large particles, drains quickly, and feels gritty.
    - Silt - medium particle size, feels silky or floury.
    - Clay - negatively charged, holds on to positively charged nutrients (i.e. Na, K, Mg, Ca), small particles can compact and get water-logged easily, feels sticky.
    - Loams - are a mixture of textures. This is ideal for your garden

        - How to test for soil texture. https://www.the-compost-gardener.com/soil-texture-testing.html
    - Structure - how soil particles clump, bind together, and aggregate, resulting in the arrangement of soil pores between them.
        - Most urban/suburban lawns have no structure and are referred to as “massive”, which is very compacted soil.
        - Ideal soil structure has a lot of aggregates. The pore space between these aggregates is essential for water/air entry and exchange, which promotes root growth.
        - Organic matter acts as a glue to bind particles together and creates these soil aggregates.
        - Optimal soil structure is easy to penetrate, resistive to the erosive forces of wind and water, and will hold and drain water similar to a sponge.
- It’s ideal to keep your soil nice and moist.
    - Don’t under water, leaving the soil dried out for too long. This will cause drought stress- severe dehydration they cannot recover from. Wilt is a symptom
    - Don’t over water. Plants can get water-logged, causing a lack of oxygen. Plants can drown too! Improper soil drainage can cause this problem as well. Yellowing and wilting are symptoms
- It’s better to water early in the day. When the plants are watered at night, the foliage stays wet for a long period which can cause disease problems. Don’t water on a hot sunny day anytime after noon, as the water on the foliage will scorch the leaves.
- Remember, if you have raised bed or containers, they will dry out faster, starting near the edges. If you set up soaker hoses or drip lines in your raised bed, place them near the edges of the bed.
- Sprinklers are best for plants that can handle being wet, such as leafy greens.
- Drip line, soaker hoses, or bottom watering with a hose and hand held attachment is best for plants that should only be bottom-watered. They don’t like to be wet because they’re more susceptible to fungi, such as cucumbers, zucchini, and tomatoes.
- Drip lines systems can be more expensive than sprinklers, but waste less water in the long run.
- Mulch! With wood chips and leaves to keep the soil covered and will prevent it from drying out too quickly. Mulching your garden beds also helps keep out weeds and eventually is consumed and degraded by our micro friends, returning nutrients to our gardens.

- **Tilling**
    - Before you understand the impact tilling has (good or bad), you need to understand soil life.

- The Grand Recyclers of Nutrients: The decomposition of organic matter by soil organisms, fungi, bacteria, nematodes, worms and other bugs has an immense influence on soil fertility, plant growth, soil structure, and carbon storage.
- Bacteria and fungi (mycelium) have symbiotic relationships with plants, exchanging nutrients for sugars. Mycelia create webs of hyphae, or "roots," that move nutrients to plants in exchange for sugars. These webs also help hold aggregates together.
- The healthier the soil life, the more nutrients flow, which leads to better fertility and healthier, more nutrient-dense crops.
    - "Think of soil life as the base of a pyramid. Stacked upon this base are plants, then insects, and finally animals, each dependant on the creature below it. The greater the number and diversity of soil organisms- that is, the broader the pyramids base, the larger and more diverse will be the flow of nutrients among them as they release the fertility stored in the soil. Bigger nutrient flows mean that more plants, both in numbers and varieties, can thrive on that abundant fertility."-Toby Hemenway, Gia's Garden - A Guide to Home Scale Permaculture.
- Herbicides/pesticide are terrible!! There are entire ecosystems in our soil. These poisons wipe out the soil life, thus hindering nutrient uptake in plants. This causes us to rely on synthetic fertilizers and the issues that come with them.
- The goal is to grow topsoil. In the beginning, the soil compaction needs to be loosened and aerated. The need to do this lessens with time, as you grow healthy topsoil. Over tilling will:
    - Degrade soil structure, break up aggregates, leads to poor water retention.
    - Break up and kill mycelium hyphea.
    - Super-charge microbes with oxygen, leading to overconsumption/wasted nutrients.
- No-till confusion - when farms refer to being no-till, it means they use good tilling management. Their goal is to till very little as they build up topsoil, and eventually not need to till. This takes a lot of time. True no-till is accomplished with intensive cover crop rotations.

- When to till?
    - If your soil is compacted, you need to aerate and loosen the soil. Those growing microbes and roots need oxygen and space to grow. You can do this with a broad fork or spade fork about 12 to 16 inches deep.
    - To mix in compost or other amendments. This is a shallower till of 1 to 4 inches. We use a stirrup hoe.

Starting seeds

- Direct sown- sowing seeds outside in your garden.

- Seeds to start in April: lettuce, arugula, spinach, beets, radish, carrots. Seeds that can germinate in cooler weather typically mature fast and don't like the heat. They are good fall crops as well.
- Seeds to start in May: tomatoes, cucumbers, zucchini, melons, squash, peppers, eggplant. These are seeds that need constant warm temps to germinate. They typically don't mind the summer heat and mature slower.
- Spacing- your seed packet will give direction for this, as every type of plant has different space requirements. You can plant unrelated plant families closer together because they don't compete for the same nutrients and take up different space above and below ground. Examples of this are tomatoes and basil, or cucumbers and radishes. We will go into this more in our companion planting workshop!
- Water in after seeding.

- Transplanting - starting seeds indoors or buying them from a greenhouse, then transplanting them to you garden. This is done to get a head start on the season. The plants will have a good head start on growth as the temperatures are warming up enough for them to go outside. It's a little too late to start transplanted plants now, but it's the perfect time to buy some from your local greenhouse. The same rule for spacing will apply as for direct seeding. Water soil before or water around base of plant right after transplanting

Book References:

Eliot Coleman, *The New Organic Grower: A Master's Manual of Tools and Techniques for the Home and Market Gardener*, 2nd Edition

John Jeavons, *How to Grow More Vegetables (And Fruits, Nuts, Berries, Grains, and Other Crops) Than You Ever Thought Possible on Less Land Than You Can Imagine*

Toby Hemenway, *Gaia's Garden.*

Keith Reid, *Improving Your Soil.*