



## *Duke Campus Farm's* **STARTING A FARM: MATERIALS CHECKLIST**

*You want to start a campus farm or garden but don't know where to begin. We've compiled a list of the most essential materials and infrastructure you need to get your project off the ground and have a successful growing season.*

### THE ESSENTIALS

#### **Land**

*\$0-\$500 acre/year*

Finding land will likely be the biggest obstacle to starting a farm at your school but also the most important piece of the puzzle. Consider making a list of priorities in terms of size, access and cost, and then be willing to make compromises since it is unlikely you'll find the perfect location. The minimum area you will need is  $\frac{1}{4}$  to  $\frac{1}{2}$  acre depending on your business model and expectations for expansion. You'll also want to consider how accessible the future farm plot will be to students and trucks for deliveries, proximity to utilities like water and seasonal amounts of shade/sunlight the plot receives. Ideally, you'll be able to find land that is already owned by your school in which case you'll likely be able to use the land for free, or pay a reasonable annual rent. In the case that land is not available, consider convincing your administration to rent or buy a parcel of land nearby.

At DCF, we use land rent-free from the [Duke Forest](#). The farm occupies 1.5 acres of a larger research plot consisting of 12 acres, which gives us the potential to expand some day. The farm plot is about 6 miles from main campus, which creates a barrier for students without a car. However, it was the only rent-free plot made available to us by administrators.

#### **Water: pond, well, or campus utilities**

*\$0-\$10,000*

Water is the most important resource for a farm, second only to land. If your farm is located close to campus you may be able to use campus water free of charge or pay based on usage. Pond water can be used for irrigation, but you need to buy a pond pump and filter system. Pond pumps can cost \$500 or

more. If there are no other water options on sight, digging a well on-site may be necessary which can cost upwards of \$10,000.

If using well water or pond water it is good practice to conduct a water test. Regulations may exist for water used in the irrigation of food crops. Consult your state's agricultural department for regulations and directions on how to get a water test.

At DCF, we are too far from campus to use campus utilities and no pond existed on the site. We dug a well, which cost approximately \$10,000 and took 3 months to complete including the permitting process.

### **Pest fence**

*\$1,000 and upwards*

Deer, rabbits, and other four-legged pests can decimate your crops. If your farm is located in a suburban or rural area, a fence will be absolutely necessary. However, if you are in an urban area a fence may still be a good idea to protect your crops from two-legged pests. To deter deer, your pest fence must be electrified OR eight-feet in height. Consult your local extension service about common four-legged pests in your area. The cost of the fence is largely determined by the size of your farm plot and quality of materials.

At DCF, we bought locally timbered 11-foot cedar posts and [mesh fencing online](#) to enclose our one-acre plot. Using a manual post-hole digger and tamper, we set the posts 3ft in the ground giving us an 8ft tall fence. We constructed three gates, one large enough for a dump truck and two others for human access. We used wire, u-nails and zip ties to hold the fence taught and attach to the posts. We used landscape fabric stakes to connect the mesh to the ground and keep out smaller animals. Excluding labor the fence cost approximately \$3,000.

## BREAKING GROUND

### **Soil test**

*\$0-\$20*

Before breaking ground you should get your soil tested. A soil test examines the chemical make-up of your soil including prevalence of a variety of minerals essential for plant growth as well as pH level. A soil test is important in determining which amendments to add to your beds to make the most ideal growing conditions for your crops. Once you get your test results back, you'll need to [analyze](#) them to determine the appropriate amendments to add. You should contact your state's agricultural department to determine the soil testing process, and in some states, like [North Carolina](#), they are free. If you are submitting soil tests during peak times, expect a delay in getting back results.

## **Tool shed**

*\$0-\$500*

Before you purchase tools and equipment it will be important to have a place to store them. You can build your own tool shed, find one no longer needed on campus or buy a prefabricated shed.

At DCF, we bought a [prefabricated shed](#) at the beginning but quickly outgrew it and then built a much larger permanent structure. If your budget allows, consider where you want to be in 3 years when building infrastructure.

## **Power equipment: tractor, tiller, lawnmower**

*\$120-\$20,000*

Assuming you're planting in the ground and not using raised garden beds, you'll need equipment to work the ground. If you plan to use no-till practices, then investing in power equipment might not be a priority and you can higher someone to break the ground for you the first time. Investing in a tiller or tractor, depending on your size of operation, will be critical for bed prep throughout the year. Tractors can be expensive but allow you to do a broad range of activities by buying additional attachments. In addition to a tiller, you'll want invest in a lawnmower or scythe, or a bush hog attachment for your tractor since controlling weeds in and around your farm plot will be one of the most time consuming tasks.

At DCF, we hired a neighbor farmer to break the ground for us initially and then purchased a 5HP walk behind tiller and walk behind lawnmower. We practice no-till as much as possible, so use our tiller sparingly and rely heavily on our mower. While these tools have served us well over the past 3 years, they need upgrading as we expand into new territory. We're hoping to invest in [BCS walk behind tractor](#) in the coming year.

## **Soil amendments**

*Variable*

Each crop has specific minerals needs for healthy plant growth, which need to be applied seasonally in most cases. Nitrogen, potassium, phosphorus, and lime are the most common amendments and come in lots of different forms. You'll want to research which amendments are available locally or on site, like chicken manure for example is high in nitrogen, and wood ash contains many other trace elements.

At DCF, we use feather meal for nitrogen, rock phosphate for phosphorus, and green sand for potassium, which we purchase in 50lb bags from our local feed and supply stores, [Pittsboro County Farm and Home Supply](#), [Southern States](#), and [Fifth Season](#).

## **Compost**

*\$12-18/cubic yard*

If your initial farm soil is anything like ours was, it will need some serious TLC. Compost plays an important role in rebuilding soil and providing organic matter necessary in crop growth by making nutrients more readily available to plants. You can do your own large-scale composting on site from campus food and plant waste, and later your on-farm plant waste but you'll probably want to get a jump start on improving your soil health by buying compost since large-scale composting takes a lot of work and usually a tractor to make it worth your effort. Consumer-ready compost comes in all different forms so you should call around to local mulch/soil operations and nearby farms to see what's available in your area.

At DCF, we started out using composted horse manure from a neighbor farm but it wasn't always available and we were never quite sure if there were lingering pesticides or herbicides from the horses' food. We switched to industrial compost made from the pre-and post-consumer waste from the campus dining halls and processed by [Brooks Contractor](#) at their facility.

## **Irrigation**

*\$200 and up*

There are many forms of irrigation but we recommend drip irrigation because it conserves water and is an efficient way to water your crops. We purchase our irrigation equipment from [Berry Hill](#), a popular resource for the mid-Atlantic.

## **Seeder**

*\$90-\$400*

Seeders aren't necessary, but they sure make things go faster when direct seeding large areas. Seeders also come in a wide range of quality but you can get started with the common [EarthWay](#) seeder for \$90, which is great for larger, more uniform seeds like peas, beans, beets and corn.

## **Trellis materials**

*Variable*

Most summer vegetables require some form of trellising, from tomatoes to peppers, eggplants, pole beans and snap peas. There are many ways to trellis so try to use whatever materials you have readily available or can find for cheap nearby.

At DCF, we use t-posts and animal fencing wire to trellis pole beans and snap peas. We use tomato clips and synthetic twine to train our tomatoes up in our hoop houses. For eggplants and peppers we use individual cages made from animal fencing wire.

## BEFORE PLANTING

### **Greenhouse**

*\$50-\$8,000*

Some crops are best direct seeded and others are best transplanted. Most crops that do well transplanted can be purchased at a plant store and ready to go in the ground. However, this can be costly in the long run and your options for varieties are limited so having the ability to start crops on site is very important. A greenhouse provides a somewhat temperature controlled environment that is protected from the elements where seedling can be nurtured until they are ready to go in the ground. You can build your own greenhouse very inexpensively or order a prefabricated greenhouse online. You may also want to consider [cold frames](#).

### **Seeds**

*\$50-150 per season*

Ask your neighbor farmers what varieties grow best in your region and soil conditions and consult a planting guide for a timeline of when to plant. You can purchase seeds at supply stores but if you buy from seed catalogs you have many more varieties to choose from. Below are some of our favorite heirloom and GMO free seed companies.

[Fedco Seed Company](#)

[Johnny's Seed Company](#)

[Sow True Seeds](#)

[Southern Exposure Seed Company](#)

### **Potting soil and start trays**

*\$30/bale, \$4/tray*

If you are starting plants in a greenhouse, you'll need potting soil and start trays. The potting soil for sale at big box stores like Home Depot is usually very expensive and has water already added to it. Try buying soil at your local feed and supply store in bulk. This soil comes with no amendments so you'll want to add small amounts of your amendments depending on what you're planting. At DCF, we like to use Sunshine Potting Mix.

## WORKSHOP TOOLS

### **Cordless power tools: drill, circular saw, reciprocating saw**

*\$200*

If you want to build anything from scratch you'll need some cordless power tools. They are incredibly useful and worth investing in so you can construct things like compost bins, tool shed, picnic tables, wash table, greenhouse, etc.

### **Hammer, screwdriver, wrench set**

*\$50*

Invest in a basic toolbox with your essentials. They will come in handy sooner than you think.

## MAINTENANCE AND WEED CONTROL

### **Hand tools: shovels, rakes, hoes, trowels and pitchfork**

*\$15-70 per tool*

Hand tools are essential for bed prep, planting, and weed control. You'll want to be sure to buy several of each so staff and volunteers can work on the same task together. If possible, avoid purchasing tools from places like Home Depot or Lowes because they break incredibly quickly. Try your local supply store or ordering online. Also, buy a tool file to keep your tools sharp.

At DCF, we use stir-up hoes from [Johnny's](#), a variety of hoes from [Rogue Hoe](#), and sturdy shovels, rakes and pitchforks from local supply stores.

### **Wheelbarrows or garden cart**

*\$40-100*

You'll need a couple of wheelbarrows or garden carts to transport harvested produce, compost, mulch etc. around the farm. Just like with hand tools, you'll want to invest in well-made products that will last a long time.

### **Gloves**

*\$5-10/pair*

Make sure to buy multiple sets of gloves for volunteers and staff. Gloves with extra protection on the palms are particularly useful for pulling spiny weeds.

### **Weed control: newspaper, burlap, black plastic**

*\$0-?*

Again, keeping weeds under control is going to be one of the most challenging aspects of getting your farm going. We highly recommend layering down a weed control and then covering with mulch. We use newspaper as our main source, which we get for free from Duke Recycling. Many farms use cardboard or burlap, which you can usually find for free from recycling centers or coffee roasters.

### **Mulch: leaf, wood chips, pine straw**

*\$0-100/load*

There are lots of different kinds of mulch for different purposes. At DCF, we use composted leaf mulch (which we get from a nearby municipality) or straw (from neighbor farmers, guaranteed to not be sprayed) for mulching beds, wood chips (free from Duke Grounds) or pine straw (inexpensive to buy in bulk at stores) for mulching aisles and perimeter areas.

## HARVESTING AND TRANSPORTATION OF PRODUCE

### **Washing station**

*\$0-300*

Vegetables need to be washed on site with potable water. Stainless steel restaurant grade sinks and tables work really well because they are easy to clean and hold up to the elements. You can find these through restaurant surplus stores or on craigslist.

### **Harvest bins**

*\$10 per bin*

You need something to put harvested vegetables in and there are lots of different options. We've found that bins with attached lids and that are easily stackable work best.

### **Harvest utensils**

*\$5-20 per item*

To harvest you'll need sharp knives and scissors. You can find great used kitchen knives at thrift stores for cheap. Again, go for quality because a sharp knife is a safe knife.

### **Transportation**

*Variable*

Chances are you'll need to deliver your product somewhere and depending how far you are from campus dining halls or local restaurants you'll need a truck or a bike cart. At DCF, we were able to secure an old maintenance truck through the university surplus. We've also found the truck to be useful for any number of farm-related tasks.

### **Cooler**

*\$100 – \$5,000*

Keeping freshly harvested produce temperature controlled is important. There may be some regulations about the temperature at which vegetables must be stored, especially if you are selling to an institutional market, such as a university dining hall. If you're able to do same day deliveries to buyers, consider buying heavy-duty portable coolers to cut down on cost. If you need to store produce overnight or are located in a particularly warm region, building a walk-in cooler will probably be necessary. An industrial walk-in cooler can be very expensive, which a lot of farms have avoided by building a [CoolBot](#).

### **Scale**

*\$30*

A scale is useful to have on site when packaging, pricing and selling products.

## OTHER NECESSARY INFRASTRUCTURE AND EQUIPMENT

### **Bathroom with hand washing station**

*\$3,000 upwards*

Most states require that farms have a bathroom onsite with hand washing facilities for employees. At DCF, we built [an outhouse](#) to accommodate our bathroom needs.

### **Social space**

*Variable*

Providing a covered space for volunteers and staff helps build community and makes farm work much more enjoyable. At DCF, we started off with a basic shade sail and three picnic tables but demand for event space soon turned into a full-fledged [pavilion](#).

## SEASON EXTENSION

### **Hoop houses, high tunnels and low tunnels**

*\$100-10,000*

Hoop houses, high and low tunnels extend the growing season for your crops by providing warmer or cooler weather protected spaces. At DCF, in attempts to align our growing season more with the demands of the campus dining halls, we've built two [high tunnels](#) and construct [low tunnels](#) during certain seasons. The price of these season extenders are highly variable depending on size and technology.

### **Row covers and shade cloth**

*Variable on thickness and length*

Row covers and shade cloth is fabric of different thicknesses used to protect crops from cold weather, direct sunlight and pests, depending on the crop and time of year.