



Market Gardens  
for Small Farms  
in North Carolina

**NC STATE**

EXTENSION

This guide provides an overview of market gardens for small and beginning farmers in North Carolina, with a focus on planning that can result in a profitable market garden enterprise. This publication is a starting reference point for anyone interested in market gardens. Links to internet resources are presented throughout this publication. Additional information is available from N.C. Cooperative Extension centers, the North Carolina Farm School ([ncfarmschool.ces.ncsu.edu](http://ncfarmschool.ces.ncsu.edu)), and other state university resources.

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## Introduction

For generations, North Carolinians have grown large gardens for selling their produce locally. North Carolina consumers have shown increased interest in purchasing locally grown produce, reflecting national food purchasing trends. Consumer interest in local foods has helped increase the number of farmers markets in North Carolina. In 2017, 230 farmers markets in North Carolina accounted for 3 percent of all U.S. farmers markets.

A market garden is a space cultivated for “the commercial production of vegetables, fruits, flowers, and other plants on a scale larger than a home garden, yet small enough that many of the principles of gardening are applicable.” The rising number of farmers markets has been accompanied by an increase in the number of market gardens and methods for marketing the produce grown there. Besides community farmers markets, market gardeners sell direct to consumers through community supported agriculture (CSA) and other subscription-based services; at roadside stands or other temporary locations; directly from the farm; and through informal local delivery networks. Some market gardeners may supply wholesale produce to local food service outlets, including restaurants, schools, and grocers.

Having a goal for market gardening is an important foundation for the farmer’s design of the garden and preparation of the business and marketing plan. Some farmers are starting a small-scale farm enterprise to supplement their income. Others may want to generate income from a pastime they enjoy. Market gardens are a common farm enterprise for beginning farmers and established farms aiming to diversify a production base.

This guide provides business and production principles for people interested in starting a market garden in North Carolina. Readers can use this guide to evaluate their potential for market gardening and as a general resource for developing future garden enterprises.

## Site Selection and Soil

Good market gardens need quality soil and a feasible market. A promising, real market for the produce is as important to success as doing a great job growing the crop. Although it is hard to say which is more important, good soil or good markets, this guide will start where all good gardens start: the site and the soil.

## Site Selection

Good site selection can help market gardeners avoid production problems. The keys to good site selection are sun, water, and surroundings.

Sun is needed for photosynthesis, in which vegetables and fruits convert solar energy into chemical energy. A market garden site should receive eight to ten hours of full sunlight; six hours is the minimum for most home vegetable gardens. Some crops will tolerate shade, even benefiting from it in the summer. Most traditional warm-season crops—like tomatoes, melons, and sweet corn—grow best in full sun.

Water is also vital for plant health. Supplemental watering is almost always needed for a successful market garden in North Carolina. Irrigation is addressed later in this guide.

Irrigation is just one water-related concern when selecting a market garden site. Good soil drainage is important for healthy crops; avoid land that is low-lying or prone to flooding. Low areas are also prone to temperature inversions. In addition, morning dew can last longer and be heavier in low-lying areas, creating more potential for plant disease.

Market garden surroundings are also important. The proximity of trees can limit suitability—large trees can block sunlight, and smaller trees may create future shade problems. A previously wooded or untilled site can contain roots, rocks, and other obstacles. Soil diseases from past crops may be present at older garden sites.

Plant the market garden on flat or gently sloping land. Slopes greater than 5 percent will require more intensive management and may adversely impact the garden’s production potential. If the slope is greater than 5 percent, consider planting rows on the contour and establishing a diversion ditch at the top of the garden site.

## Assessing Soil Health

Crop production starts with healthy soil, and soil management is vital for market garden success. Soil fertility and soil structure are equally important components of soil management.

Soil fertility is one component of soil health and refers to the availability of nutrients. Fertility is determined by the soil’s chemical properties, such as pH, and the presence of major nutrients (nitrogen, phosphorous, and potassium) and micronutrients in the soil. Soil pH, the measure of soil acidity or alkalinity, is one of the

benchmarks for soil fertility. Different crops require different pH ranges for optimal production. Lime is often applied to maintain the proper soil pH required by many crops. Some soils may require immediate attention to macronutrients, such as magnesium and calcium, or micronutrients, such as boron.

Most garden crops will require fertilization to produce yields that will generate positive financial returns. The type of fertilizer or soil amendment will influence when nutrients are available to the crop. Some fertilizers provide nutrients for immediate plant benefits, while other fertilizers may release nutrients over time.

A soil test from a reputable soil testing lab is the best starting point for assessing soil fertility. The test will provide information about soil pH and identify any nutrient deficiencies that may need to be corrected with fertilizer and other inputs. The North Carolina Department of Agriculture & Consumer Services (NCDACS) maintains a soil testing lab ([www.ncagr.gov/agronomi/sthome.htm](http://www.ncagr.gov/agronomi/sthome.htm)) that is available to market gardeners.

While evaluating soil health includes measuring soil fertility, it also includes assessing the soil's texture, structure, water-holding capacity, and other physical characteristics. Healthy soil promotes productivity throughout the entire growing season, and good soil health management continues long after the last harvest. Good soil health practices are essential in a market garden.

Soil health is “the continued capacity of soil to function as a vital living ecosystem that sustains plants, animals, and humans.” Good gardeners have long used techniques that promote soil health, including rotating cover crops with production crops, amending soils with compost, and covering soils with organic mulches whenever appropriate.

Soil is made up of different size particles. Clay is the smallest size particle, silt is the next, and sand is the largest. The term *soil structure* describes how these different soil particles group together with organic matter into soil aggregates. The space in between these soil aggregates is called the soil's pore space—where water and air flow through the soil. Lack of adequate pore space for water and air movement can have significant adverse impacts on plant health.

*Organic matter* is the decaying remains of plant and animal life in the soil. Organic matter helps maintain adequate amounts of soil pore space. Adding organic matter such as leaf molds or compost to garden soils is

one of the most common ways to maintain soil health. Applying organic mulch may also be beneficial.

Cover crops can provide a wide range of soil fertility and soil health benefits. Cover crops are planted between or sometimes alongside other crops. Cover crops are most commonly used to cover the soil in the off-season or planted between crops, helping to retain topsoil and nutrients. Legumes such as clover and field peas are often used in cover crop seed mixes because legumes host bacteria that can provide soil with nutrient benefits.

## Garden Layout

Market garden success depends on a well-planned and well-executed design. Many principles of home vegetable garden design apply to a market garden, including the following from the North Carolina Extension Gardener Handbook. See Additional Resources for more design and planning information.

- Design and draw a garden plan to scale, noting the sun's pattern throughout the day to help determine row orientation.
- Identify water access.
- Understand planting and harvest dates for each crop.
- Plant tall crops (for example, corn, okra, and sunflowers) and trellised vines (for example, peas, beans, and squash) in a way that avoids shading shorter plants.
- Leave pathways to easily access plants.

Market gardens will likely include some raised beds and sheltered production, such as high tunnels. High tunnels can extend the production season and produce relatively large amounts of produce in a concentrated space. A high tunnel or a small greenhouse may be used to grow transplants. High tunnels and greenhouses should be positioned in a way that allows for optimal exposure to sunlight. Using appropriate covering materials for high tunnels and greenhouses is also essential for delivering the appropriate amount of sunlight to the crop. Growers should choose plastics designed for horticultural use, which will capture maximum sunlight and deteriorate less quickly (than nonhorticultural plastics) from exposure to ultraviolet light.

Raised beds can improve soil warming in the spring and fall and provide weed control and soil drainage advantages. Some market gardeners establish relatively small, permanent, or semi-permanent raised beds to produce high-value crops like specialty greens and herbs. Raised beds, in long rows, may be combined with plasticulture for crops needing more space, for example, melons, cucumbers, and squash.

## Tools and Equipment

The required garden tools and equipment will be determined by the market garden’s size, crop mix, and marketing methods. This section summarizes the main categories of market garden tools and equipment: tillage and planting; fencing and trellising; disease, weed, and pest control; harvest and marketing; and irrigation.

### Tillage and Planting

Tillage and planting operations for a market garden can require a tractor instead of just a tiller, depending on the size. Beginning market gardeners may rent equipment or custom hire tillage service to forgo the expense of purchasing and maintaining a tractor. Smaller market gardeners frequently invest in a used rototiller for preparing seedbeds.

Various hand tools, such as rakes, shovels, and hoes, are also needed for tillage and planting. The qualities of hand cultivation tools have improved significantly in recent years, including new ergonomic designs for tools like stirrup hoes and collinear hoes. Updated wheel hoe designs feature attachments like finger weeders.

Hand tools range from fairly inexpensive hoes and trowels to specialized hand-drawn precision seeders that can cost more than \$500 new. Talking to experienced market gardeners can help you decide what equipment purchases are most prudent.

Market gardeners using plasticulture (plastic mulch with micro-irrigation) will need a way to create the raised bed and lay the plastic. Options for completing these tasks include hand-drawn and machine-powered equipment. Plasticulture systems require distinct planting tools for both hand and mechanical use.

Gardeners may also need seed starting and transplanting supplies, including seed trays, soil block makers, seedling trays, seedling heat mats, and lighting for starting seeds indoors.

Market gardeners should base equipment investments on which crops are most likely to be profitable. If salad greens are a market focus, for example, the market gardener might justify investment in a precision seeder. A market focused on heirloom tomatoes might entail buying seed-starting equipment and building a transplant starter house. Consider the actual market potential and estimated profitability for each crop before making crop-specific investments.

Tables 1, 2, and 3 list example tillage and planting equipment costs for three scales of market gardens, based on the North Carolina Farm School budgets. Table 1 represents equipment costs for a garden of 1 acre or less prepared with a rototiller and hand tools. Table 2 represents costs for a 1.5-acre garden prepared with a walk-behind tractor and more extensive hand tools. Table 3 represents costs for a 2.5-acre garden prepared with a small utility tractor and 3-point tractor implements.

**Table 1. Sample Equipment Costs, 1 acre or Less Market Garden, North Carolina**

Equipment Type	Cost	Useful Life (years)	Annual Depreciation Cost
Used Tiller + Accessories	\$1,000.00	10	\$100.00
Used Tiller for Farm	\$5,000.00	12	\$416.67
Cold Room (converted shed)	\$600.00	10	\$60.00
Drip Irrigation System (well present)	\$506.82	5	\$101.36
Fertigation Unit: bypass and tank	\$250.00	5	\$50.00
Multipurpose Trellis, T-post+Woven Wire	\$2,000.00	5	\$400.00
Hand Operated Seeder	\$300.00	5	\$60.00
Rakes, Shovels, Wheel Barrow, etc.	\$250.00	5	\$50.00
Harvest Cart	\$350.00	5	\$70.00
Row Covers, Insect Netting, Hoops	\$1,000.00	5	\$200.00
Sprayer	\$120.00	5	\$40.00
Harvest Baskets, Scales	\$350.00	5	\$70.00
Electric Fencing (Deer Fence)	\$500.00	5	\$100.00
Transplant Starter House	\$1,200.00	5	\$240.00
Hand Wash Station	\$500.00	10	\$50.00
Benches and Soil Block Tools	\$500.00	5	\$100.00

Source: North Carolina Farm School Market Garden Budget

**Table 2. Sample Equipment Costs, 1.5-acre Market Garden, Walk-Behind Tractor, North Carolina**

Equipment Type	Cost	Useful Life (years)	Annual Depreciation Cost
Used Walk-Behind Tractor with Tiller	\$2,000.00	10	\$200.00
Used Truck for Farm	\$5,000.00	12	\$416.67
Cold Room (converted shed)	\$600.00	10	\$60.00
Drip Irrigation System (well present)	\$506.82	5	\$101.36
Fertigation Unit: Bypass and tank	\$250.00	5	\$50.00
Multipurpose Trellis, T-post+Woven Wire	\$2,500.00	5	\$500.00
Hand Operated Seeder	\$300.00	5	\$60.00
Paper Pot Transplanter	\$1,000	10	\$90.00
Rakes, Shovels, Wheel Barrow, etc.	\$250.00	5	\$50.00
Harvest Cart	\$350.00	5	\$70.00
Row Covers, Insect Netting, Hoops	\$1,500.00	5	\$300.00
Sprayer	\$120.00	5	\$40.00
Harvest Baskets, Scales	\$350.00	5	\$70.00
Electric Fencing (Deer Fence)	\$750.00	5	\$100.00
Transplant Starter House	\$1,200.00	5	\$240.00
Hand Wash Station	\$500.00	10	\$50.00
Benches and Soil Block Tools	\$500.00	5	\$100.00

Source: North Carolina Farm School Market Garden Budget

## Fencing and Trellising

A fence can be one of the most expensive, essential investments for North Carolina market gardeners. Fences keep deer and other wildlife pests from damaging garden crops. Electric fences, which are cost-effective and practical, are often placed around the garden perimeter.

Trellises are used to produce higher volumes of tomatoes, beans, and other vining vegetables in less space while also helping prevent disease resulting from soil contact. Market gardeners usually choose trellis equipment that can be used for multiple crops or across multiple seasons.

## Disease, Weeds, and Pest Control

Controlling disease, weeds, and insect pests results in healthier plants and potentially higher yields. Some simple tools may be required for hand weeding. Mulch is another method of weed control, and equipment may be needed to transport and spread it. Plastic mulch is another weed-suppressant option. Producers will need to select appropriate thickness and color.

Insect control can be accomplished using chemical insecticides or exclusion methods (for example, row

covers and other barriers). A sprayer, insect netting, row cover, and low tunnel hoops are the most common equipment expenses for insect control.

Market gardeners often draw on a wide range of disease control methods. Gardeners should identify the major potential pests and diseases and select controls that are established to be reliable and proven to mitigate the risk of crop damage. In North Carolina's growing zones and climate, control of some key diseases in garden crops requires a rotation of pesticides labeled for the chosen system of production and pest pressure. (For more information about pest control, see Section 3.)

## Harvest and Marketing

Start-up market gardeners often overlook expenses for harvest aids and equipment needed to get a crop to market. Investing in the appropriate harvest equipment—including carts, knives, picking aids, tubs, or totes—can save time and hassle at harvest.

Transporting the product to market may require a truck or other special vehicle and delivery containers. Subscription or pre-order marketing may require reusable containers for delivering portions of produce. Before making substantial investments in reusable containers, market

**Table 3. Sample Equipment Costs, 2.5-acre Market Garden, 30-50 HP Tractor, North Carolina**

Equipment Type	Cost	Useful Life (years)	Annual Depreciation Cost
Used 30 – 50 HP Tractor*	\$9,000.00	10	\$810.00
Tractor Loader/Bucket*	\$600.00	10	\$54.00
3-pt Rotary Mower*	\$1,000.00	10	\$90.00
3-pt Tiller*	\$3,000.00	10	\$290.00
3-pt Field Cultivator*	\$500.00	10	\$45.00
3-pt Sprayer and Tool Bar*	\$1,500.00	10	\$135.00
Used Grain Drill	\$750.00	10	\$67.50
Used Small Manure Spreader	\$500.00	10	\$45.00
4'x6' Trailer	\$500.00	10	\$45.00
Spring Tine Cultivator	\$2,000.00	10	\$180.00
Used Bedding (Mulch) Chopper	\$500.00	10	\$45.00
Transplanter (Used)	\$4,000.00	10	\$360.00
Used Truck for Farm	\$5,000.00	12	\$416.67
Cold Room (Converted Shed)	\$600.00	10	\$60.00
Drip Irrigation System (well present)	\$506.82 (Per Acre)	5	\$101.36
Fertigation Unit: Bypass and tank	\$250.00 (Per Acre)	5	\$50.00
Multipurpose Trellis, T-post+Woven Wire	\$2,500.00 (First Acre)	5	\$500.00
Hand Operated Precision Seeder	7250.00	5	\$60.00
Rakes, Shovels, Wheel Barrow, etc.	\$250.00	5	\$50.00
Harvest Cart	\$350.00	5	\$70.00
Row Covers, Insect Netting, Hoops	\$1,500.00 (First Acre)	5	\$300.00
Harvest Baskets, Scales	\$750.00	5	\$150.00
Electric Fencing (Deer Fence)	\$750.00	5	\$150.00
Transplant Starter House	\$2,400.00	5	\$480.00
Hand Wash Station	\$500.00	10	\$50.00
Benches and Soil Block Tools	\$500.00	5	\$100.00
High Tunnel (Varies by size/quantity)	\$1.50 to \$4.00 (Per Square Foot)		

Source: North Carolina Farm School Market Garden Budget

gardeners should evaluate their customers' preferences for packaging and understand any related food safety implications.

Costs of post-harvest storage and handling are also frequently overlooked when planning the market garden enterprise. A cold room, constructed from a converted shed, is a common need.

Food safety and proper handling practices should be deployed at a scale appropriate to the farm size. Portable hand-washing stations, which can be used on the farm and at the farmers market, are needed anywhere that plumbed hand-washing sinks are not available. Hydrocooling and produce washing require large volumes

of potable water and should be undertaken where potable water and a sanitary drain system are available.

## Irrigation

Water is a vital plant nutrient. Irrigating crops provides a steady volume of water to plants, helping reduce plant stress and improve crop yields.

Drip irrigation systems are the most efficient means of delivering water and are essential for plasticulture systems. Some crops, as well as all production using a bare ground system, require overhead irrigation. Certain irrigation systems can be designed to feed both drip systems at about 15 pounds per square inch (psi) and

small-scale overhead irrigation systems (like wobblers and microsprayers) at about 50 psi.

Investing in proper irrigation equipment, including pumps and pipelines, helps the market gardener manage weather uncertainties and produce an abundant, salable crop.

Private wells and municipal systems are the typical water sources available to North Carolina gardeners. Market gardeners usually choose wells for irrigation, though municipal water may be the only option for some market gardens, such as those in urban settings.

Drip irrigation delivers water and nutrients in precise volumes while avoiding inconsistent application and overwatering that can occur with overhead systems and hand watering.

Drip irrigation costs may be divided into two categories: variable costs and fixed costs. Variable costs are the costs in a particular season. These costs include drip tape and plastic mulch. Costs of plastic and drip tape ranged from \$0.15 to \$0.20 per foot in 2018. (These costs would be different if the gardeners own their own plastic laying equipment.) These costs depend on the thickness of the plastic and availability of custom machine hire.

Fixed costs are the costs of equipment needed to run the irrigation system year after year. These include (1) the water supply tube and fittings needed to source water from the well, and (2) the valves and filters that are installed at the point where the water flows into the drip tape. The cost of the supply tube will be influenced by the distance from the well to the garden. Costs for valves and filters in 2018 ranged from \$250 to \$500 for a small-scale drip irrigation system suitable for up to 2 acres.

Well pump repair or replacement may be required if the well pump is not in good working order or is unable to deliver the required water pressure for a drip irrigation system. As with any expense, market gardeners should consider whether the garden may expand when determining how much to initially invest in irrigation.

Market gardeners should plan for the modest cost of water testing as part of irrigation expenses. Water from private wells should be regularly tested for its suitability for consumption. Some production requirements (such as Good Agricultural Practices [GAP] certified, Food Safety Modernization Act [FSMA], and/or certified organic) may require proof of irrigation water testing. It is wise to certify both the safety and quality of the market garden water supply.



# Crop Management and Rotation

Though the right location, design, tools, and cultural practices are vital, the key pathway to a successful market garden is to understand the market. Who will be willing to pay the price necessary to make your market garden a viable enterprise? You must select crops with the most local sales potential. This section summarizes the most common channels that North Carolina market gardeners use for selling their produce. In addition, it discusses general guidelines for market garden crop selection, crop rotations, pest management, and season extension techniques.

## Crop Selection: Marketing Options

The three most common market channels for North Carolina market gardens are:

- Community supported agriculture (CSA)
- Community farmers markets
- Direct to restaurant

Market gardeners may capture premium prices by either selling direct to the end consumer (CSA and farmers markets) or bypassing wholesale markets (direct to restaurant).

### **Community Supported Agriculture**

CSA first appeared in the United States in the 1980s. The original CSA program (also called CSAs) recruited community members to share financial risks with local farmers. Community members paid an upfront fee for a “share” of the farm and then received a weekly basketful of food grown on the farm. The basket contents varied depending on the local production season. The first CSAs focused on certified organic production. CSAs have since expanded to include many different production systems. The CSA marketing model became more popular as consumer interest in locally sourced food increased. Many CSAs are now characterized by more flexible share arrangements and weekly ordering options.

Advantages of the CSA model for market gardeners include potential upfront payments that can help with start-up costs, building a community of repeat customers, and attracting customers willing to pay premiums for certain crops. Challenges for CSA marketers include potentially high customer turnover and rigorous production requirements. Running a CSA market garden has sometimes been called “graduate-level gardening.”

### **Community Farmers Markets**

Community farmers markets range in size from large urban markets with dozens of vendors to very small, rural community farmers markets. There are about 230 farmers markets in North Carolina, including very large farmers markets that provide wholesale bulk quantities of produce.

Advantages to selling at a farmers market include potential price premiums from selling directly to consumers and growth opportunities in product mix and volumes. Disadvantages include the potential lack of control over market location and customer turnout; potentially limited consumer willingness to pay price premiums based upon local consumer preferences; and high marketing costs that may include the time spent selling at the market, losses from unsold produce, and market membership fees.

When evaluating the farmers market as a possible sales outlet, consider these questions:

- When does the market open and close?
- Are there enough customers at the market to support more vendors?
- Is there space available for new vendors at the market?
- What are the vendor responsibilities and obligations to the market (for example, membership fees)?
- What crops are most popular with market customers? Are these crops sold at prices that can cover production costs and generate profits?
- Are there crops not being offered at the market that a new producer could introduce?
- How is the market promoted locally, and does there appear to be potential for market growth?

### **Direct to Restaurant**

Selling directly to restaurants can be a good way to move large volumes of produce in a single order, and some chefs are very willing to work with nearby farmers and gardeners to feature locally grown food. In addition, many restaurants will mention or feature the names of local farmers and gardeners on their menus and promotions.

Selling to restaurants can be challenging. Chefs require uniform, high-quality produce. Chefs may also have preferences for produce sizes and varieties. Regular delivery is essential. The market gardener must make sure the restaurant business office or business manager receives the proper invoices for deliveries. Restaurants and other food service customers may also require producers to carry product liability insurance (this also may be required at farmers markets).

# Planning: Crop Rotation and Succession Plantings, Variety Selection, and Time of Planting

Following are tips for designing crop rotations, selecting varieties, and deciding how long the market garden will be in production.

## Crop Rotation and Succession Plantings

Crop rotation is the practice of planting a subsequent crop that is different from the one just grown. This is different from succession planting, in which the same crop is planted continually.

Crop rotations may be annual, for example, planting beans where corn was grown the previous year. Crops may also be rotated in-season, with short-season crops like turnips and greens followed by a longer-season crop to be harvested in the fall. Crop rotations should be designed with the market in mind. A rotation should incorporate the crops most demanded by likely customers.

Crop rotations are intended to enhance soil quality and fertility, as different crops use or contribute different

nutrients to the soil. Crop rotations are also important for disease management; growing the same crop season after season may increase the likelihood of diseases and insect pests specific to that crop.

Market gardeners often apply two general principles when planning plantings. The first principle is to rotate crops, planting crops from different plant families in successive years.

A simple three-year rotation that is often recommended for North Carolina vegetables is tomatoes/beans/squash, in which those crops are planted in different spaces each year, returning to the first space in year four.

The major plant families for North Carolina market gardeners are listed in Table 4.

The second principle of planning is to use succession plantings, as shown in Table 5. Instead of planting all the green beans at once, for example, gardeners may plant beans a few weeks apart to allow for a steady harvest.

### Variety Selection

Customer preferences should also drive variety selection. Certain customers may prefer different varieties of the same crop. For example, some customers may be

**Table 4. Major Plant Families for North Carolina Market Gardeners**

Family	Plants
Sunflower Family	lettuces, sunflower
Goosefoot Family	beets, spinach, chard
Mustard Family	mustard greens, rutabaga, kale, broccoli, cabbage, cauliflower, turnip, radish, watercress
Onion Family	garlic, shallots, leeks, onions, chives
Gourd Family	melons, squashes, gourds
Pea Family	peas, beans, peanuts
Nightshade Family	peppers, tomatoes, eggplant, potato
Carrot Family	celery, dill, chervil, fennel, carrot, parsnip, parsley
Grass Family	corn

**Table 5. Common Succession Planting Intervals**

Planting Interval	Plants (*denotes transplants)
Two-Week Intervals	Bush beans, beets, broccoli*, sweet corn, kale, kohlrabi, lettuce, muskmelon, greens, green onions, radishes, spinach, tomato, turnip
Three-Week Intervals	cabbage*, carrots
Four- to Five-Week Intervals	cucumbers
Four- to Eight-Week Intervals	summer squash
Eight-Week Intervals	eggplant

seeking red kale, while others may prefer dinosaur kale, depending on how they will be using it.

Variety selection is also a useful tool in managing diseases. Different varieties may have varying degrees of resistance to common diseases. Selecting disease-resistant varieties is especially important for minimizing the use of chemical fungicides. Consult with NC State Extension to determine the most common diseases of vegetables grown in your area.

Different varieties of the same crop also have different season lengths. For example, some broccoli varieties are better suited for spring planting; others are recommended for fall planting, performing better with cooler temperatures and shorter days. Season length is an important consideration, especially if multiple crops will be planted in the same space.

### **Time of Planting**

Different crops need different numbers of days to reach maturity. A market gardener who plans to start selling in May might choose to plant cool-season crops, while a gardener who wants to start selling in June might bypass cool-season crops altogether.

Table 6 shows that different planting dates for different vegetable varieties may vary by region in North Carolina. More garden planting guides are available in the Additional Resources section.

The seasonal availability of harvest labor is also important for determining the planting time. For example, a market gardener may plan to employ local teenagers or younger

relatives to help harvest green beans and peas. But if early-maturing varieties are planted, and school is still in session, that labor may be unavailable. Pay careful attention to harvest labor needs when setting the time for planting different crops.

## **Market Garden Pest Management**

This section summarizes common pest management issues in market gardens.

### **Wildlife**

Deer, rabbits, and rodents can destroy a garden. Wildlife snacking on crops can greatly reduce yields, and pathogens introduced by wildlife can create food safety issues.

A fence is essential for controlling wildlife, especially deer, in many North Carolina locations. Electric fencing, which may be installed for about \$500 for 1 acre, is usually the most economical and effective barrier for deer control. For more information, see the North Carolina Wildlife Resources Commission webpage on deer exclusion ([www.ncwildlife.org/Learning/Species/Mammals/Whitetail-Deer/Fencing-to-Exclude-Deer](http://www.ncwildlife.org/Learning/Species/Mammals/Whitetail-Deer/Fencing-to-Exclude-Deer)).

Certain crops may also attract small mammals, such as rabbits, rodents, and birds. Consult with your local Cooperative Extension center or a wildlife control professional on science-based methods for keeping pests away from food crops.

### **Insects**

Insects affect market garden crops in two main ways: (1) by destroying or infesting edible plant portions, making

**Table 6. Planting and Harvesting Guide for Piedmont Vegetables**

<b>Crop (*denotes transplants)</b>	<b>Planting</b>	<b>Harvesting</b>	<b>Approximate Days to Maturity</b>
Beans (bush)	May to August	June to September	60
Beets	Feb. 1 to Apr. 15	Apr. 1 to Jun. 15	50 – 60
Broccoli*	Feb. 15 to Mar. 15	Apr. 15 to Jun. 1	70 – 80
Kale	Feb. 15 to Mar. 15	Apr. 1 to May 1	40 – 50
Cucumbers	May 1 to Aug. 1	Jun. 15 to Oct. 15	30 – 45
Lettuce, leaf	Feb/ March	Apr. to Jun.	45 – 60
Okra	May 1 to Jun. 1	Aug. 1 to Nov. 1	45 – 55
Peppers, Sweet*	Apr. 15 to Jun. 15	Jul. 1 to Nov. 15	90 – 100
Spinach	Feb. 1 to Apr. 1	Apr. 1 to May 15	60
Squash, summer	May 1 to Aug. 1	Jun. 15 to Oct. 15	42 – 67
Tomatoes*	Apr. 1 to Jun. 15	May 15 to Nov. 1	30 – 45
Watermelon*	May 1 to Jul. 1	Jul. 1 to Oct. 15	45 – 65

Source: Central North Carolina Planting Calendar for Annual Vegetables, Fruits, and Herbs

([content.ces.ncsu.edu/central-north-carolina-planting-calendar-for-annual-vegetables-fruits-and-herbs](http://content.ces.ncsu.edu/central-north-carolina-planting-calendar-for-annual-vegetables-fruits-and-herbs))

them unmarketable, and (2) by carrying and spreading diseases.

Examples of insect damage include tomato hornworms feeding on plant leaves and the presence of insect eggs on leafy greens. Chewing and sucking insects also feed on plant foliage, creating stress on the plant that may impact yields.

Insects can also function as vectors (transmitters) of diseases such as viruses. In market gardens, insects that carry viruses include beet leafhopper (a vector for tomato curly top virus), western flower thrips (a vector for tomato spotted wilt), and aphids (a vector for watermelon mosaic virus).

*Integrated pest management (IPM)* is a way to monitor and control market garden pests. The main principles of IPM are to identify and monitor pest populations, disease pressure, and weed threats, treating the problem when pest pressure reaches a certain threshold.

Prevention is a cornerstone of IPM. Prevention includes paying attention to soil health and other stressors that may make plants less healthy and more prone to insect damage. The IPM system also relies on properly identifying pests. Market gardeners should be familiar with pests likely to affect major crops.

The four categories of IPM related to insect control are cultural, mechanical, biological, and chemical.

*Cultural management* includes proper soil management, consistent irrigation, selecting appropriate varieties, managing soil health, practicing crop rotations, keeping weeds from competing with garden crops, and maximizing air circulation by training, pruning, or trellising where appropriate. Allowing adequate time for planning and preparation is a large part of good cultural management. Some cultural management practices may result in added financial expense, for example, sourcing trellising materials and resistant varieties that may be available only from limited sources.

*Mechanical management* is physically removing pests or creating barriers to their entry. Mechanical techniques can be effective but also tend to be time-intensive. Handpicking asparagus beetles, for example, can be a practical means of control in a small asparagus patch; handpicking asparagus beetles from a heavily infested 50-foot or 100-foot row would likely be too time-intensive for a market gardener with other crops to tend. Floating row covers are a common mechanical management technique in market gardens. Made of lightweight spun

polyethylene, row covers are placed over garden crops, creating a physical barrier to insects while allowing light to penetrate.

*Biological controls* use other living organisms and even pathogens to manage insects. One common means of biological control is *Bacillus thuringiensis* (Bt) bacteria (commercially marketed as DiPel, Javelin, and Xentari, among others), which is used to control some species of caterpillars in vegetable and fruit crops. Specific strains of Bt bacteria may be more effective on specific insect species. Other examples of naturally occurring biological controls include predator organisms (which prey on specific insects) and parasites and parasitoid organisms (which live in or on specific insect hosts). For example, certain tiny parasitic wasps may attack and kill problematic insects. Beneficial insect predators, like lady beetles, may feed on damaging insects. Timing of use, availability, and cost are all important factors when using biological controls. Some biological controls, like certain Bt strains, are widely available. Other biological controls may require special ordering and be cost-prohibitive.

*Chemical controls* are insecticides labeled to kill or manage insect pests. Insecticides are labeled with application restrictions that must be followed by law. Advantages of chemical insecticides include high mortality and control; however, insecticides can also kill beneficial insects. Consumer preferences are a consideration, and in some cases, there are safety concerns about human and wildlife exposure to chemicals.

## **Diseases**

The IPM categories for controlling insects also apply to diseases and weeds.

*Cultural management* is an important disease control strategy. Healthy plants are generally less prone to diseases. Diseases can overwinter in plant material, so removing and destroying diseased plants can lessen future disease pressure. Rotating crops, widening plant spacing, pruning, and trellising may also help prevent disease.

*Mechanical management* for disease control includes barriers and shelters to prevent insect vectors from transferring disease organisms to crops. Coverings such as high tunnels and small greenhouses also can limit the presence of airborne diseases, like those carried by molds and fungi.

*Biological and chemical control* strategies for disease control include products derived from natural sources

as well as chemical pesticides. Strictly adhere to label instructions for all products used to control disease. The market gardener must understand the potential implications of each production practice, weighing the costs and benefits of using different products for disease control.

### **Weeds**

*Cultural and mechanical management* are often used to lessen weed pressure in the market garden. Weeds compete with garden plants, robbing them of nutrients, so removing weeds by hand or machine is necessary. Mulching crops creates a physical barrier to weed seed germination. Removing weeds before they can develop seed heads is important in management, as is removing weed debris from the garden.

*Chemical management* involves the judicious use of herbicides to eliminate weeds. For major weed infestations, herbicides may be a reasonable and economical tool. As with pesticides, always apply herbicides according to the label requirements.

*Biological control* tools are less likely to be available for weeds than diseases or insects, so most organic producers rely on mulches, cover crops, or cultivation for effective weed control.

## **Season Extension Techniques**

Market gardeners often aim to extend the marketing season by producing crops over a longer period. Season extension involves bringing crops to market both earlier and later than usual. This section describes common season-extension techniques for market gardeners, with a focus on the financial costs and potential benefits of each system.

### **High Tunnels**

*High tunnels*, sometimes called hoop houses, are permanent or semipermanent structures covered with greenhouse-grade plastic coverings. High tunnels range in size from a few yards long to more than 100 feet. A high tunnel is tall enough for people to comfortably stand up in, and ideally has enough room for thorough side-venting and for a tractor or tiller to pass through. High tunnels can enable production of higher value crops, like fall-harvested tomatoes. Some crops, like root vegetables and some leafy greens, can be overwintered in a high tunnel.

Costs of high tunnel construction vary widely, with published estimates ranging from \$1.50 to \$3.00 per

square foot. A North Carolina Farm School budget estimates a cost of \$3,850 for the materials for a 20-by-100-foot high tunnel, or almost \$2.00 per square foot. The cost does not include hired labor that may be needed for construction. Some high tunnel sites may require additional preparation costs such as ground leveling and surface water drainage lines. The Farm School budget estimates that the high tunnel will return \$3,682 in the first year to labor and management, based on a crop mix of greens, cucumbers, peppers, and tomatoes.

High tunnels have become widely used on small farms that focus on growing produce for local sales. Besides extending the marketing season, high tunnels can improve crop quality and yields, and aid in pest management. However, high tunnels require additional production skills and exceptional crop management, maintenance, and attention, such as proper ventilation.

To reduce overhead costs, a market gardener should select tools and irrigation equipment that can be used in both field and high tunnel production.

### **Floating Row Covers and Low Tunnels**

*Floating row covers* are lightweight, spun-bonded plastics that may be placed over crops for frost protection and insect exclusion—"floating" on top of the plants. Row covers come in different thicknesses and generally can provide 2°F to 8°F of frost protection. They can extend crop season through early fall frosts and protect growing crops from late spring frosts. The lightest-weight row covers are most often used for insect protection.

*Low tunnels* are made of spun-bonded plastic material supported by plastic or metal hoops. They usually range in height from 2 to 4 feet. Low tunnels can be used to extend the season for crops like greens and root crops, and they can extend fall harvest of cucumbers and squash. Some crops can be overwintered in low tunnels, but snow and winter winds can limit extended winter use. Temperatures in low tunnels may reach levels that are higher than desired, which may require covers to be installed and removed daily.

Row covers and low tunnels can also be used within a high tunnel.

Costs of covering material for floating row covers and low tunnels are modest, ranging from \$0.15 to \$1.15 per row foot. Covers are available in different weights and widths; choice will depend on the specific crop needs. Low tunnel hoops can be purchased or made from materials commonly available at home improvement stores.

There are likely profitable uses for the appropriate row covering and low tunnels in many market gardens. Market gardeners should be sure they have appropriate finances and the time to maintain the season extension tools. See *Season Extension Tools and Techniques* ([www.uky.edu/ccd/sites/www.uky.edu.ccd/files/extension.pdf](http://www.uky.edu/ccd/sites/www.uky.edu.ccd/files/extension.pdf)) for more information.

## Postharvest Handling and Food Safety

A market gardener has a responsibility to provide consumers with the safest products possible. Maintaining food safety for a market garden starts long before harvest, with practices that include using safe water, restricting wildlife access to food crops, and never applying materials that may harbor disease pathogens.

Fresh produce can also be contaminated after harvest. Regular hand washing, maintaining clean containers for transporting produce, and storing produce at proper temperatures are some food safety best practices.

The NC State Extension Food Safety Infosheet *Asking Food Safety Questions at the Farmers Market* provides the following food safety tips:

- Use nonporous, cleanable, and sanitizable tables and other surfaces, or single-use packaging, to display produce.
- Shelter the market stand from direct sun, rain, and birds with an overhead covering.
- Provide farmworkers and farmers market customers with bathrooms and hand-washing facilities.
- Follow market rules for providing samples of uncut produce or other food samples.
- Store cut produce, leafy greens, and sprouts at temperatures lower than 41°F.

Developing a food safety plan is recommended for market gardeners, and one may be required under some market conditions. Plenty of educational resources are available from NC Cooperative Extension and other sources to help the market gardener develop safe handling practices for the food grown for local sale. *On-Farm Cold Storage Virtual Training* is a good resource from the Center for Environmental Farming Systems ([cefs.ncsu.edu/resources/on-farm-cold-storage-virtual-training](http://cefs.ncsu.edu/resources/on-farm-cold-storage-virtual-training)). DIY Postharvest Equipment ([ncfreshproducesafety.ces.ncsu.edu/ncfreshproducesafety-postharvest-diy-postharvest-equipment](http://ncfreshproducesafety.ces.ncsu.edu/ncfreshproducesafety-postharvest-diy-postharvest-equipment)) provides tips on cooling methods.

# Income Potential: The Economics of a Market Garden

For a market garden enterprise, it is prudent to understand how much income is likely. Developing a good projection of costs and returns can help the potential market gardener decide what crops to grow, where to sell those crops, or whether to produce a garden at all.

Following are five important components of market garden economics to consider before beginning.

## 1. Prices and yields

It is vital to know both the likely costs and the likely returns from market garden production. Many market garden production plans focus on costs: land preparation, seed, fertilizers, and pest control. But profitable production of vegetable and fruit crops is very dependent on returns, which are based on the crop yields and the prices received for those yields. It is a good practice to never assume the highest yields; crop losses are always likely, and the percent of marketable produce is rarely 100 percent.

Market gardeners often focus on a single, most profitable market channel; but developing markets for “seconds” helps diversify marketing risk and grow the operation. For example, smaller-sized potatoes might be sorted at harvest and sold in separate packs. Some market gardeners have discovered local restaurant markets for small-sized sweet potatoes, featured on menus as fingerling sizes.

Table 7 shows common market garden crops with sample yields for a 100-foot row and per square foot. These yields will vary considerably by season and market garden situation.

Sale prices for market garden crops may be highly variable. The best way to project a price for your crops is to determine what your customers will be willing to pay per unit of a crop (such as per pound) and multiply that by the likely marketable yield. (You can investigate the prices other growers are receiving at a farmers market.) Keep in mind that it is rare for an entire projected yield to be sold at the market price. Some produce may be unmarketable; market prices could change; and other unexpected yield changes can occur.

**Table 7. Common Market Crops with Sample Yields**

Crop	Yields per Square Foot	Yields in Pounds per 100 Feet
Bean, bush snap	0.2	36
Beet	0.7	80
Carrot	0.8	80
Cucumber	1.6	144
Lettuce (salad mix)	2.6	96
Squash (summer)	0.4	120
Tomato	5.6	200

Source: *Planting and Harvesting Guide for Piedmont Vegetables and Herbs* ([growingsmallfarms.ces.ncsu.edu/wp-content/uploads/2012/08/plantharvestguide20081.pdf?fwd=no](http://growingsmallfarms.ces.ncsu.edu/wp-content/uploads/2012/08/plantharvestguide20081.pdf?fwd=no))

## 2. Estimating costs of production

Developing realistic costs of production is perhaps the most important task for the financial success of a market garden. Many production cost categories have already been addressed in this publication. This section provides a summary and overview of the major market garden cost categories.

There are two cost categories for a market garden: variable and fixed. Variable costs change with the amount of production. Common pre-harvest variable costs include seeds and plants; fuel; fertilizer; mulching, plasticulture, and irrigation supplies; weeding; and pest control products. For example, it will take more seeds to grow a 100-foot row of squash than it will to plant a 10×3-foot raised bed of squash. Labor is another important variable cost, especially if the market gardener will use hired labor to help with planting, weeding, and harvest.

Fixed costs do not change with the amount produced. Fencing supplies are a good example of a fixed cost for market gardens. Posts, fences, and electric fencing supplies are purchased once but will be used for many different crops across multiple seasons. Other common fixed costs are machinery, equipment (for example, tillers, sprayers, and cultivation mechanisms), and irrigation infrastructure.

Look at Table 10, which illustrates an estimated production cost for a 100-foot row of tomatoes, staked and irrigated. Although the production cost estimate looks favorable compared to the production revenue, some costs aren't represented. For example, the fixed costs will need to be allocated for this crop. Depending on the size of the market garden and the amount of

equipment purchased, these fixed costs could easily range from \$25 to \$250 per year—for only a 100-foot row. Fixed costs are frequently underestimated; in addition, a cost will be incurred for getting the crop to market and selling it to the customer.

### 3. Marketing costs

Market gardeners often underestimate the costs of marketing. Marketing costs can be roughly divided into four categories:

1. Packaging (variable cost)
2. Transportation to market (variable cost)
3. Vendor labor (variable cost)
4. Marketing equipment and memberships (fixed or variable cost)

*Packaging costs* include boxes and crates used to transport the crop to market as well as bags and boxes provided to the customer. A market gardener who is supplying a CSA may need to buy containers for delivering member shares to a delivery point.

*Transportation costs* include fuel used to get crops to market and the fixed cost of the vehicle. The North Carolina Farm School budgets assume the purchase of a \$5,000 used pickup truck to haul produce.

*Vendor labor* is often underestimated. If a farmers market is open for three hours, for example, someone not only has to be there to assist customers during those hours but also must set up and break down the market stand and drive to and from the market. The extended time needed to sell at a farmers market is one reason market gardeners may seek alternative outlets.

*Marketing equipment and memberships* are fixed costs. Many farmers markets require membership fees; these may be modest but add up. Other one-time costs can

include equipment like tables, crates, and coverings used at a market stand. Advertising, including printing and mailing costs for cards and flyers, are potential marketing expenses that can fit into both variable and fixed cost categories.

### 4. Labor requirements

Labor needs for a market garden will vary by crop. Understanding how much labor you will need—and if any of it must be hired labor—is important. Table 8 shows labor in hours per 100-foot row for seven types of produce.

The North Carolina Farm School estimates 1,724 labor hours for a 1-acre market garden growing a typical market garden crop mix during a 40-week period—more than 40 hours per week. Even if a market gardener hired half that labor, as the North Carolina Farm School budget assumes, the owner would need to work more than 20 hours per week during a 40-week period. Labor needs are not likely to scale down in proportion to market garden size; in other words, it will likely require more than 172 hours to produce and market a one-tenth acre garden during a season. Market gardens are highly labor intensive, and potential market gardeners should not underestimate the labor requirements.

### 5. Example Break-Even and Profit Levels

Every farm will have different production systems and costs and generate different profits. However, the sample returns listed in Tables 9 and 10 illustrate the wide variety in profitability for garden crops commonly sold in local markets. Successful market gardeners must use careful planning and good management—likely along with lots of trial and error—to arrive at a profitable crop mix for the particular farm or garden and the local market.

**Table 8. Labor in Hours per 100-foot Row.**

Labor Type	Tomatoes	Peppers	Cucumbers	Salad Mix	Green Beans	Cantaloupe	Watermelon
Pre-Harvest	14	5	3	2	2	2	2
Harvest	20	4	4	3	8	1	1
Post-Harvest	14	1	1	13	0	0	0
Post-Season	1	1	1	1	0.5	1	1
<b>Total Labor Hours per 100' Row</b>	<b>49</b>	<b>11</b>	<b>9</b>	<b>19</b>	<b>11</b>	<b>4</b>	<b>4</b>



**Table 9. Pricing and Yields by Vegetable Crop.**

Prices and Yields	Type	Tomatoes	Peppers	Cucumbers	Salad Mix	Green Beans	Cantaloupe	Watermelon
Yield	# of Plants per Row	50	66	100	N/A	300	50	50
	<b>Total Yield per 100' Row in lb</b>	<b>602</b>	<b>364</b>	<b>173</b>	<b>160</b>	<b>80</b>	<b>160</b>	<b>46</b>
Price per lb	Retail 60%	<b>\$2.00</b>	<b>\$2.00</b>	<b>\$2.00</b>	<b>\$8.00</b>	<b>\$3.00</b>	<b>\$3.00</b>	<b>\$5.00</b>
	Wholesale 40%	<b>\$1.00</b>	<b>\$1.00</b>	<b>\$1.00</b>	<b>\$1.50</b>	<b>\$3.00</b>	<b>\$3.00</b>	<b>\$5.00</b>

**Table 10. Vegetable Crop Budget Comparison.**

Budget Category	Budget Item	Tomatoes	Peppers	Cucumbers	Salad Mix	Green Beans	Cantaloupe	Watermelon
Gross Income per 100' Row	Retail	\$722.40	\$436.80	\$207.60	\$768.00	\$144.00	\$288.00	\$138.00
	Wholesale	\$240.80	\$145.60	\$69.20	\$96.00	\$96.00	\$192.00	\$92.00
	<b>Total per 100' Row</b>	<b>\$963.20</b>	<b>\$582.40</b>	<b>\$276.80</b>	<b>\$864.00</b>	<b>\$240.00</b>	<b>\$480.00</b>	<b>\$230.00</b>
Variable Cost per 100' Row	Purchased Transplants	\$7.29	\$6.85	\$12.06	\$0.00	\$0.00	\$13.98	\$24.45
	Seed	\$0.00	\$0.00	\$0.00	\$17.31	\$3.07	\$0.00	\$0.00
	Stake Replacement	\$3.33	\$13.20	\$4.00	\$0.00	\$0.00	\$0.00	\$0.00
	String	\$0.68	\$0.68	\$0.91	\$0.00	\$0.00	\$0.00	\$0.00
	Insecticide	\$3.20	\$0.00	\$2.18	\$0.05	\$0.29	\$2.18	\$2.18
	Herbicide	\$2.05	\$2.05	\$2.05	\$0.00	\$1.02	\$2.05	\$2.05
	Fungicide	\$9.13	\$0.00	\$0.71	\$0.49	\$0.20	\$0.71	\$0.71
	Lime (pro-rated)	\$0.41	\$0.41	\$0.41	\$0.41	\$0.41	\$0.41	\$0.41
	Fertilizer	\$6.06	\$5.80	\$4.60	\$3.64	\$1.60	\$4.60	\$4.60
	Black Plastic w/ Drip Irrigation	\$12.00	\$12.00	\$12.00	\$0.00	\$0.00	\$12.00	\$12.00
	Drip Irrigation Only	\$0.00	\$0.00	\$0.00	\$4.00	\$4.00	\$0.00	\$0.00
	Annual Rye Cover	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
	Sales Containers	\$98.73	\$3.07	\$3.07	\$24.55	\$3.07	\$2.73	\$3.18
	Total Labor Cost @ \$12 per hour	\$586.57	\$132.55	\$103.64	\$228.00	\$126.00	\$48.00	\$48.00
	Marketing Cost at 8% of Gross Revenue	\$57.82	\$29.09	\$12.96	\$61.44	\$19.20	\$36.36	\$36.36
	Capital Variable Cost	\$34.96	\$45.60	\$47.13	\$34.82	\$40.40	\$34.83	\$34.83
	<b>Total Variable Cost per 100' Row</b>	<b>\$822.23</b>	<b>\$251.29</b>	<b>\$205.71</b>	<b>\$374.71</b>	<b>\$199.26</b>	<b>\$157.85</b>	<b>\$168.77</b>
<b>Returns Over Variable Cost per 100' Row</b>	<b>\$140.97</b>	<b>\$331.11</b>	<b>\$71.09</b>	<b>\$489.29</b>	<b>\$40.74</b>	<b>\$322.15</b>	<b>\$61.23</b>	
Fixed Cost per 100' Row	Capital Fixed Cost	\$44.88	\$35.00	\$47.13	\$45.47	\$34.70	\$43.19	\$43.19
<b>Total Cost per 100' Row</b>		<b>\$867.11</b>	<b>\$286.29</b>	<b>\$252.84</b>	<b>\$420.18</b>	<b>\$233.96</b>	<b>\$201.04</b>	<b>\$211.96</b>
<b>Returns to Land, Capital per 100' Row</b>		<b>\$96.09</b>	<b>\$296.11</b>	<b>\$23.96</b>	<b>\$443.82</b>	<b>\$6.04</b>	<b>\$278.96</b>	<b>\$18.04</b>
<b>Breakeven \$/lb</b>		<b>\$1.44</b>	<b>\$0.79</b>	<b>\$1.46</b>	<b>\$2.63</b>	<b>\$2.92</b>	<b>\$1.26</b>	<b>\$4.61</b>

This budget was assembled by Derek Washburn, NC Farm School, NC State University, in collaboration with Gary Bullen, N.C. Cooperative Extension agents across North Carolina, and small farms in North Carolina. For more detail regarding this budget, visit [ncfarmschool.ces.ncsu.edu](http://ncfarmschool.ces.ncsu.edu).

## Summary

A market garden can be a profitable venture for a small farm in North Carolina. The possibility of profitability is increased with production planning, market research and development, and development of a working plan for maintaining soil health and controlling pests during the enterprise. This publication has highlighted some of the relevant resources for planning a market garden in North Carolina.

## Additional Resources

### Market Garden Costs and Returns

*Budgeting for Agricultural Decision Making* (PennState Extension)  
[extension.psu.edu/budgeting-for-agricultural-decision-making](http://extension.psu.edu/budgeting-for-agricultural-decision-making)

*Vegetable and Melon Budgets: Small Scale* (University of Kentucky Cooperative Extension Service)  
[www.uky.edu/ccd/tools/budgets](http://www.uky.edu/ccd/tools/budgets)

### Market Garden Design

*How to Organize the Garden* (The North Carolina Extension Gardener Handbook)  
[content.ces.ncsu.edu/extension-gardener-handbook/16-vegetable-gardening#section-heading\\_7966](http://content.ces.ncsu.edu/extension-gardener-handbook/16-vegetable-gardening#section-heading_7966)

### Planting Dates for North Carolina Regions

Eastern North Carolina Planting Calendar for Annual Vegetables, Fruits, and Herbs  
[content.ces.ncsu.edu/eastern-north-carolina-planting-calendar-for-annual-vegetables-fruits-and-herbs](http://content.ces.ncsu.edu/eastern-north-carolina-planting-calendar-for-annual-vegetables-fruits-and-herbs)

Central North Carolina Planting Calendar for Annual Vegetables, Fruits, and Herbs  
[content.ces.ncsu.edu/central-north-carolina-planting-calendar-for-annual-vegetables-fruits-and-herbs](http://content.ces.ncsu.edu/central-north-carolina-planting-calendar-for-annual-vegetables-fruits-and-herbs)

Western North Carolina Planting Calendar for Annual Vegetables, Fruits, and Herbs

[content.ces.ncsu.edu/western-north-carolina-planting-calendar-for-annual-vegetables-fruits-and-herbs](http://content.ces.ncsu.edu/western-north-carolina-planting-calendar-for-annual-vegetables-fruits-and-herbs)

### Season Extension and High Tunnels

*Growing Small Farms* (NC State Extension)  
[growingsmallfarms.ces.ncsu.edu/growingsmallfarms-seasonextlinks/](http://growingsmallfarms.ces.ncsu.edu/growingsmallfarms-seasonextlinks/)

### Selecting a Site

*North Carolina Extension Gardener Handbook*, Chapter 16, "Vegetable Gardening"  
[content.ces.ncsu.edu/extension-gardener-handbook/1-soils-and-plant-nutrients](http://content.ces.ncsu.edu/extension-gardener-handbook/1-soils-and-plant-nutrients)

### Soils and Plant Nutrients

*North Carolina Extension Gardener Handbook*, Chapter 1, "Soils and Plant Nutrients"  
[content.ces.ncsu.edu/extension-gardener-handbook/1-soils-and-plant-nutrients](http://content.ces.ncsu.edu/extension-gardener-handbook/1-soils-and-plant-nutrients)

*Managing Soil Health: Concepts and Practices* (Penn State Extension)  
[extension.psu.edu/managing-soil-health-concepts-and-practices](http://extension.psu.edu/managing-soil-health-concepts-and-practices)

*Soil Health: Healthy Soil for Life* (USDA Natural Resources Conservation Service).  
[www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health](http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health)

### Start-up

*Got to Be NC* (Search North Carolina Farmers Markets)  
[gottobenc.com/find-local/farmers-markets](http://gottobenc.com/find-local/farmers-markets)

*Market Gardening: A Start Up Guide* (ATTRA: National Sustainable Agriculture Information Service)  
[douglas.extension.wisc.edu/files/2010/05/Market-Gardening-Getting-Started-ATTRA.pdf](http://douglas.extension.wisc.edu/files/2010/05/Market-Gardening-Getting-Started-ATTRA.pdf)



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