



Farming for a Sustainable Community

A Training Manual

By Patrick W. Staib and the American Friends Service Committee



**American Friends
Service Committee**

Produced by
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American Friends Service Committee

American Friends Service Committee

Founded in 1917, the American Friends Service Committee (AFSC) is a Quaker organization including people of various faiths who are committed to social justice, peace and humanitarian service. Co-recipient of the 1947 Nobel Peace Prize on behalf of Quakers worldwide, AFSC today carries out programs of service, development, justice and peace throughout the United States, Central and South America, the Caribbean, Africa, the Middle East, and Asia.

AFSC's New Mexico Program

Farming requires water, and in New Mexico, there is a long-standing conflict over land and water rights. The displacement of traditional agricultural communities, along with appropriation of land and water resources by government and corporations, creates major obstacles for land-based communities to engage in sustainable agriculture that generates enough income to support their families and communities. These conditions conspire to create a food-insecure state and puts New Mexico children and future generations at risk.

Since 1976, the American Friends Service Committee's New Mexico program has identified with the struggles of local people to empower themselves, with particular attention to water and land use, and the need to support traditional ways of life. Like many marginalized communities within the U.S., the Hispanic and Native American population of New Mexico seeks self-determination, economic growth and cultural dignity. The Service Committee works with local people and organizations to regain control over the current and future use of traditional water systems, utilize and manage local resources, and preserve their traditional ways of life.

The New Mexico program provides hands-on, farmer-to-farmer training to land-based people so they can have economic security from their land and water. We facilitate the creation of farmer networks for marketing and sales, and advocate for policies that support small sustainable farms and help connect low-income people to resources to support their work. Our long-term goal is to help revitalize sustainable farming in New Mexico, thereby protecting culture, land, water and jobs, and improving the health of the communities—especially children.

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Introduction to Northern New Mexico Sustainable Agriculture

by Don Bustos, Director, New Mexico Program

For generations New Mexicans have survived using the natural resources the earth has provided. We have an enduring connection with the land and water that is at the heart of our culture and heritage. We are blessed with a resilience that defies easy explanation. Historically, our people and communities have been challenged by weather, successive government intrusions and bad policies, and economic forces threatening our livelihood—livelihoods that are linked to that land and water whose wise use is our responsibility and our independence and freedom.

The New Mexico Office of the American Friends Service Committee has created a farmer-to-farmer training program so that people of the land can increase their income by using the land, water and sun in a sustainable manner and so that future generations can continue to raise their children and grandkids on the land. This training program is also an important way we have chosen to save our water from commodification. We believe that everyone and everything has a divine right to fresh, healthy, free water. We also know that growing organic, healthy food, and making it available to those who need it, is an essential piece of a sustainable food system in our state.

People of the land abide by the principle inherent in the question: “How much is enough?” We are not trying to save the world, but this business philosophy considers how much is necessary to feed the family, pay the bills and save a little bit for a rainy day. This training is focused on small acreages that allow a family to make enough money to sustain themselves and save our land and water for agricultural activity that benefits local communities.

Food System Approach to Agriculture: Local vs. Centralized

Our current food supply is based on a centralized model of agriculture that does not provide the vital needs for sustaining vibrant communities. Impoverished sectors of our communities have limited access to fresh, nutritious foods, even though there is the potential to have enough healthy food for everyone. Presently, it is difficult for small-scale organic farmers to compete for market access. This AFSC project and farmer training program strengthens small farmer access to the local food system by encouraging growers to collaboratively market to area institutions and the local food service industry. Locally grown produce has the potential to benefit consumers while reducing New Mexico's dependence on external sources of food.

AFSC's farmer-to-farmer training program offers unique skills acquisition as well as opportunities for personal growth and entrepreneurial expertise. Our training emphasizes the formation of a

network of regional food processing hubs that connect community-based growers to new produce markets. We have several approaches for development of these networks, and no two are alike.

Given land, water and sun, the next vital link in the food chain is the producer/farmer/business person. That is why we have a year-round training program that teaches how to grow food 12 months a year using nothing but natural resources and locally available inputs. Our training manual includes business and farm planning, soil and site assessments, and crop selection and planting dates. One of the main training areas is market development and how to access farmers markets—and the more complex task of how to break into the market of large institutional buyers such as schools and hospitals.

This manual is based on the American Friends Service Committee's New Mexico farmer-to-farmer training program that was piloted in the South Valley of Albuquerque, New Mexico, made possible by a USDA National Institute of Food and Agriculture grant and collaboration with strong community partners. The manual presents models for land selection, soil preparation, crop planning, cultivation, handling, marketing and season extension with point-by-point instruction, case studies, illustrations and descriptions. It includes the experiences of the trainers and farmers in forming the Agri-Cultura Network, a grower-owned, South Valley-based local produce brokerage, which is a result of this three-year training and collaboration.. In defense of ancestral water rights, three South Valley organizations that make up the membership of the Agri-Cultura Network—e-merging communities, La Plazita Institute and Valle Encantado—have collaborated to implement small-scale, low-impact, economically viable models for small-scale vegetable production. These models are based on the lifetime experience and knowledge of my family, which has farmed in the Española Valley for centuries.



This training program guides farmer-to-farmer training in organic vegetable and fruit production for the local market. We grow our crops according to the seasons and lunar cycles using appropriate technology such as cold frames with layering that lets us harvest salad and greens in the middle of the winter using the sun as our energy source. Then, knowing how to market year-round produce will allow for profitable small farm business.

These indications and recommendations are by no means an absolute recipe for success in small-scale agriculture. This model strictly relies on timely and consistent manual labor and keeping a close eye on crops as they grow. It requires thorough business planning and competent business and labor management. Thanks to those who are drawn to this document for the purpose of increasing food security, reducing hunger and malnutrition, and maintaining arable land in diverse produce production for their local markets.

Don's Tip

There is no single recipe for success in community-based organic farming. This manual offers my specific approach to reduce risk and increase revenue from year-round farm production, but I stand firm with my grampa's statement, "cada chango su columpio" (every monkey, his own swing), to affirm that everyone will have their own way of doing things. These are guideposts along the way.



Part One: Land and Water

Selecting the Appropriate Farm Site

Introduction

It is important to consider several factors when choosing where to invest time, energy, money and other resources into the farm. Albuquerque's South Valley is rich in arable land, and most of it is in alfalfa production. Several organizations have taken interest in the issue of unfarmed or mono-cropped land as it relates to landless individuals. This manual is intended for those looking to rent or operate in land-use arrangements with existing landowners. However, landowning new farmers are welcome to adopt these recommendations and indications for field site selection and preparation. This section will guide you through the processes of site selection and field orientation, access and security, soil quality and testing, water sources and irrigation, land use arrangements and memoranda of understanding.

Initial Considerations

So you are interested in farming organically and selling to the local market. Before selecting seeds and tilling your land, there are several considerations to keep in mind. Here is a list of the major factors in determining a growing site:

- Is there a consistent water source for the entire growing season?
- You must evaluate where you will situate your planting beds/rows in relation to the sun. It is important to maximize the southern exposure from the sun. Evaluate the potential shade from trees and buildings at different times of the year and different times of day. Consider how to orient your growing area along the north-south axis in order to maximize even sun exposure. Consider pruning or removing trees from the southern side of your grow site.
- Consider your growing area. How long should your beds/rows be? How wide will you make your growing area? If using drip tape (see below), you must limit your length of bed in accordance with the psi (water pressure per square inch) of your drip tape so that there is enough pressure in the line to emit water and not so much that the pressure would blow out the lines.
- How secure is the area where you plan to grow? Is there a fence? Is it intact and secure? Is there a locked door/gate that keeps people, pets and wildlife out of the fields? Are there any visible risks to employees or produce on this site?
- At what hours is this land accessible? What are the access times when the landowner permits activity on the field? Who has access to this area? Are any risks evident?
- Soil health is an important factor in determining a growing site. A basic soil test will give you an idea of the health of the soil. Please refer to the section on soil building later in the manual.

- Much arable land in the South Valley has been planted in alfalfa or generally abandoned. There are also many prime sites where junk cars are left to sit and where potentially harmful compounds may exist. It is useful for both organic certification and for general soil well-being to obtain a statement of land use for at least three years prior to planting in vegetable production. This historical statement serves to validate the hard work that you, the grower, will invest to maintain clean and productive topsoil and ensure the safety of the food you plan to grow.

Land use agreements

Farmers must enter into land use arrangements with a note of caution. You could be displaced and lose your investment in soil and seed if proper measures are not in place to defend your interests and if you do not have enough time to achieve your goals. This allows the farmer to recuperate the costs put into the land. Using the land for less than 3 years can mean a loss for the farmer considering how much s/he invests and how much they are able to produce and sell.

Memorandum of Understanding (MOU): This is a non-binding document that lists the parties involved, the intentions, parameters, expectations and compensation, if any, in a land use scenario. Farmers need not own the land on which they produce, but they need protections and assurances for their hard work and soil building activity on another person's land. This document differs from any contractual land rent or lease because it details the activities conducted once the land is accessible (see Appendix D for a template MOU)

Land Rent: This differs from an MOU in that it is solely the compensation for accessing another's land. Not all land arrangements require rent, but private landowners may. The current rate (mid-2012) for a rented acre of arable land in the South Valley is approximately \$250–\$500 per acre annually. Keep in mind that your efforts to clean, organize and amend land that has not been in production adds value to the landowner's property. Thus, you are providing a service through the mere land management aspect of your work. Other considerations are profit sharing or harvest sharing with the landowner. These factors can have a bearing on the amount of rent paid.

Factors to Consider in a Land Use MOU

This is a list of issues or concerns that pertain to the use of agricultural land by an individual who does not already have a contractual relationship (lease, rental agreement, etc.) with the landowner. Feel free to amend or alter this working document as you see fit.

Land Use Rental: Presumably, agriculturalists will rent arable land for approximately \$250-\$500 per year. A percentage of profits could return to the landowner as well, if desired. (To date, a landowner has not imposed a rental fee on farmers that we have worked with.)

Land Maintenance: The landowner could benefit from Agri-Cultura Network efforts to make land orderly, clear overgrown areas, and prune excess brush or plants. Installing a cold frame on one's land will require tending to soil composition and general cleanliness of the area.

Water Rights Maintenance: The active farming use of agricultural land is the best way to preserve one's water rights. The preservation of ancestral water rights and the acequia (irrigation ditch)

system (described below) is important in combating the increasing desire of commercial or residential developers to “dry up” the South Valley water rights for the benefit of a privileged few. Use the water and you won’t lose it.

Infrastructural Benefit: The semi-permanent structure, a cold frame, would possibly belong to the landowner at the end of the land use agreement. Otherwise, land renters may take this item with them when they vacate the land. This needs to be clarified.

Access to Land Area: It is important to clearly define the land use parameters for hours of usage, people permitted on land and liability of people working on land. Clear definitions will help to avert any complications down the road.

Long-term Benefits of Agricultural Activity on Land: Land management through organic agricultural production can preserve valuable topsoil, build more soils, and foster ecological diversity of beneficial plants and insects. This will keep water rights active as well as add value to unused or underutilized tracts of arable land.

Well Use and Maintenance

Introduction: As mentioned before, start by informing yourself about the conditions, frequency and quality of the water you intend to use for irrigation and for produce washing. Irrigation water need not be potable, but produce washing water must be potable. This section reviews the considerations and processes for using or refurbishing a well, considerations and instructions for installing a drip irrigation system, and considerations and suggestions for water from the acequia (irrigation ditch).

Considerations for Existing Well and Pump: If a well is already on the property, you need only ensure that the energy source and the well pump are in clean and safe working order. A pump that has not been in use will require general maintenance. Be sure to prime the pump by filling it with water before turning it on, or else it will burn out. Take the time to secure your pump with a pump house that locks. Also, drain the pump after use during cold months so it doesn't freeze during the winter, requiring costly repairs or replacement. Lastly, regulate the water pressure coming out of the pump to work well with drip irrigation systems. You may consider contracting a well specialist to inspect the quality of your well and conduct a quality test on a water sample. The simplest and most valuable water quality test is to ensure that there are no nitrates in your water source. Nitrate test kits can be purchased at plumbing supply and hardware stores.

Considerations for Installation: The installation of a new well on a grow site will require a series of authorizations through the state engineer's office and the county assessor's office. You must declare or obtain water rights for your well. You must indicate whether it is a domestic use or agricultural use well (domestic allowance is 1 acre-foot per annum; agricultural is 3 acre-feet per annum). Several local companies will drill a well for a significant fee. Since the water table in the Middle Rio Grande Valley is shallow, many people have installed their own "driven" wells by hand.

Water Testing and Well Registration

According to the Bernalillo County Environmental Health Department, historically there have been many septic systems in the valley that could contaminate water sources. For this reason, water quality should be tested on a regular basis. Test for traces of nitrates and other contaminants in your well through a field test kit, or contract a water quality technician. The New Mexico Rural Water Association (nmrwa.org) will assist with this.

Well registration is required in order to operate a licensed business in Bernalillo County of the City of Albuquerque. First, you must declare your water rights to the county and the state engineer (The South Valley Regional Association of Acequias can assist in these processes). You must then have your well inspected and pinpointed on a GIS map. If your farm site has its pre-1907 water rights intact, then there should be no issue. If your water source (surface or well) was established prior to the date when Bernalillo County and the Middle Rio Grande Conservancy District (MRGCD) took over the distribution and allocation of water rights in your area, you can reclaim or declare rights and register with the county. If there is no water right, or no water sources that existed prior to MRGCD control, then you must obtain a costly and limitedly available water right from the New Mexico State Engineer and the MRGCD in order to register your operation and obtain a business license.

Installation of Drip Irrigation Systems

This section will detail the materials needed and the proposed design for installing and utilizing a low-flow drip irrigation system. The rationale for implementing drip irrigation is to conserve water and to maximize the amount of water that irrigates the area directly around the plant and root area.

Note: Drip irrigation is the suggested method for watering off a well into a year-round cold frame structure.

Materials for Irrigation Installation

Drip Tape

This is made of nylon polymer. It is light, comes in a roll and lays flat. The top is marked with a blue line or fold and has emitter slits. Under the appropriate water pressure (4–15 psi) water will tear and drip from the slits. T-Tape comes in a roll of several hundred feet. It is also rated for length and is available with varying distance between drip emitter slits. For example, 15 mil drip tape emits 0.42 gallons per minute for every 100' stretch. T-Tape with a $\frac{5}{8}$ " diameter and 12" spaced drip outlets typically comes on rolls of 5,000 linear feet.



Use a drip tape that is rated for 100' maximum lengths with 12" spacing between emitter slits. The 12" spacing allows for a soaking radius of 6" to connect the area between emitter slits as well as irrigate 6" on either side of the drip tape. This also allows for rounded calculation of space needed for the planting area in cold frames and outdoors. Also, purchasing a longer roll will reduce the overall price per foot of the drip tape. Lastly, the effectiveness of drip tape depends on the mineral content of your water.

Of course, there are some drawbacks to relying on drip tape for irrigation. High pressure will rupture the drip tape, and patching the drip lines can be costly. Mending a ruptured line requires purchasing two mending couplers for the section that you need to replace. These couplers resemble the threaded end of the valve that connects the tape to the irrigation tubing. They have a threaded nozzle and securing cap to tighten the coupler onto the drip tape. Dirt, debris and mineral deposits will clog the emitters and prevent water secretion. Running vinegar through drip lines can help to reduce this problem. Many farmers also use sand filters on their wells to prevent clogged drip lines. The last

drawback is the regular investment in this necessary item. The benefits of using drip irrigation far outweigh the drawbacks, and that is why its use is encouraged in this region.

Another consideration is that drip tape must be anchored or set in place for waters. When empty, the tapes tend to gather up and eventually catch in the wind. In the case of dense plantings, the tape is held in place by the plants. But be sure to secure or anchor during germination and sprouting phases in seed beds by using 2" x 6" staples or a rubber cord tied to a stake to put tension on the line.

Orchard Tubing

Orchard tubing is rigid and ideal for installation with PVC to irrigate fruit trees or berry patches. It is rated for longer durability, but performs a similar function as the flat drip tape. Note that this is a more expensive approach

Irrigation Tubing

Two-inch polyethylene (poly) tubing is ideal for connecting to a drip system. This should be connected to the well pump with a compatible valve and pressure reducer.

Flow Control Valves and Valve Punch

Flow control valves allow you to shut off certain sections that do not need water while watering others along the same line. They also prevent return flow of water in the T-Tape line. Flow control valves are inserted into the point at which the T-Tape will intersect with the 2" poly tubing. Select the appropriate diameter to adapt with your T-tape. A 5/8" valve with a 1/4" barb will adapt well with 2" poly tubing. Purchasing in bulk from Rainflo or Irrigation Direct (www.irrigationdirect.com) will reduce unit price for valves.



Attaching Valve to Drip Tape

Once you have attached 2" poly tubing to the well pump, unroll, lay flat and secure with stakes or wire hoops. Allow the kinks to work out for 12–24 hours so that the 2" poly tubing lies completely flat.

There is a trick to successfully attaching the valve to the T-tape. First, use downward force with a slight wrist rotation to punch or perforate the side of 2" poly tubing. Make sure that the punched-out section of tubing comes free from the valve punch. Next, insert the ¼" barbed end of the flow control valve and make sure that it is snug. Now for the trick: Make sure that once you have connected the line from the well and inserted all of the valves, all of the valves are in the closed position (perpendicular to the valve itself, so you'll know if it's left open). Then, with another person's help, cut lengths of drip tape that match the length of your growing beds or rows. Leave 2" extra at the end of each line of drip tape. Then, secure the far ends of the drip tape by trimming off a 4" section of the end, and then folding 4" over itself at least three times. Insert the folded section into the trimmed 4" section. Repeat for all lines along this row. Lastly, unthread the emitter end of all of the valves. Turn on the well pump. Take the end of the drip tape and open it. Slide the end over the emitter end of the valve. Slightly open the valve just as you insert the emitter into the tape. Simultaneously slide the tape further onto the valve. Thread the emitter end over the tape tightly. Repeat for all lines of drip tape. Check for any tears in the drip tape lines. Also, any valves that are not secured to tape will likely leak or separate under pressure. Try to get the tape as far up the valve emitter as possible to prevent this.



Pressure Reducer (optional)

A pressure reducer is necessary between the well pump and 2" poly tubing to ensure that the psi of irrigation remains between 4 and 16 psi, but ideally remains at 10 psi along the entire drip system. Also, a standard faucet valve can be used to regulate pressure in your lines. Plus, the valves on the irrigation system are useful for controlling flow. Make sure that the system emits water evenly by checking it periodically during watering.



Acequia Systems

Acequias are an intricate system of diversion ditches that transport surface (river) water to land for irrigation. This system has existed in New Mexico for centuries and is under threat from the demand to store water rights for non-agricultural use. So it is important to consider whether your land is adjacent to or uses an acequia for irrigation. Also consider what state your acequia is in, if you have surface water rights in the first place, and who the governing body of this acequia is. Many resources on the history, legacy and practice of acequia irrigation can be obtained at the New Mexico Acequia Association, www.lasacequias.org.

Access

Individuals or families that belong to an acequia are typically known as acequia parciantes. The acequia season is usually from late March to early November, depending on the winter season snow pack and the rate of alluvial flows, or runoff. Acequia irrigators tend to belong to an association or, literally, belong to a certain ditch, to which they must commit a certain number of hours, likely 40, to springtime clearing and cleaning of the ditch. This is a traditional method of natural resource distribution that kept growers along a ditch in constant contact. It also reflects a community hierarchy, as downstream parciantes tend to defer to those upstream to ensure that all receive equal access to water.

Season

Check with your acequia mayordomo (or ditch rider, in the case of the Middle Rio Grande Conservancy District in and around Albuquerque) for the schedule of when your ditch will flow. It tends to be one to two days per week. In scarce years, acequias will only fill once a week and require parciantes to irrigate at odd hours throughout the night.

Pumping from the Ditch

Some growers may have land alongside a ditch, but no headgate from which to access the ditch. The lack of a headgate will not prevent accessing the water. In many cases, we have rigged a drip system off the ditch by simply obtaining a submersible 1 hp (maximum) water pump. Connect the water outlet from the pump to irrigation tubing and design a drip system as explained in the previous section. One concern is that there is a lot of debris and dirt in the ditch that can clog lines and pump. A mesh filter around the pump itself can help with that. **Note: This activity may not be legally permissible in all areas. Consult with your local acequia manager or mayordomo before proceeding.**

Ditch Water Retention

Dig a retention pond for ditch water where you can store water and submerge the water pump. Daming side laterals with a folded tarp will allow water to gather for retention purposes for use with a drip irrigation system.

Flood Irrigation Practices

Assuming you have access to a headgate and are on a water schedule for acequia water, you can consider flooding your field. There are several precautions and contrasts to the above-mentioned approaches when considering this approach to irrigation. They are listed below:

Three-foot growing beds are not ideal for flood irrigation. Flooding will irrigate plants at their roots; thus for plant propagation you will need to design farm layout in furrowed rows and work the floodwaters in between rows with a shovel, mud and rocks to make sure that too much water does not overflow your rows.

Flood irrigation is well suited for broadcast-seeded field crops, such as alfalfa and grain. Flood irrigation has been used for millennia and has its advantages, but it is not ideal for small-scale organic production in an arid region such as the Rio Grande Valley. Broadcast seeding is throwing or spreading seed to disperse over a large area and then passing through with a rake or a grader to cover seeds. This is the ideal mode for cover cropping and growing grain that is harvested with a combine. The land must be level, with a low-grade incline, in order to properly and efficiently flood irrigate.

There is a lot of weed seed and debris in the ditch. There are also other detectable toxins, pharmaceutical residue and trash in ditch water. Weeds that have seeded along the banks of the river and the ditch will contaminate the ditch water with seeds. Always check the water for the presence of trash and debris. Never leave the flood area, and check the flow at the compuerta (headgate) with regularity.

The floodwaters can get out of control quickly. Open the headgate slowly. It is better to err on the side of “not enough” rather than “too much.” The flood can be too much in a short period. Essentially, by the time your entire field is covered, you should be ready to cease the flow. Also, make sure that all the burms surrounding your intended field are intact. Frequently, floodwaters break out of intended areas, taking you away from watching the flow from the compuerta or in the furrows.

Soil Health

Soil Composition

Healthy soil hosts thousands of living organisms that exist in balance. Worms and insects, fungi, bacteria and protozoa constantly nourish and replenish soil health. Soil is separated in strata. At the bottom is bedrock, then mineral soil, and topsoil on the surface. Industrial farming has left 5% of the original topsoil intact in North America. Intensive tillage can have negative impacts on topsoil erosion. The preferred method of AFSC's New Mexico program features a minimal till approach, regular monitoring of soil characteristics and incorporation of soil amendments. The 3'-wide by 100'-long growing bed is optimal for reducing compaction on the growing area and accessing plants for weeding, pruning and harvesting.

South Valley farmer Lorenzo Candelaria told us that in New Mexico “we have plenty of dirt, but we have to work to make soil.” The mountainous regions benefit from the foliage and ground cover, which add organic matter to the ground. In contrast, the Rio Grande Valley has a more mineral soil, as opposed to organic soil, composed of silt (sand deposits from river flows) and clay (caliche is the specific type of sedimentary rock—calcium carbonate—and hard clay that can be used in adobes and ceramic).

Organic soil is defined as having at least 20%–30% organic matter along with clay, sand and silt. Clay maintains moisture for roots to absorb. Sand and silt allow for filtration and drainage. Organic matter provides nutrients and nitrogen from decomposition of organic matter. Compost from plant waste and animal manures are an ideal way to amend soil and add necessary nitrogen.

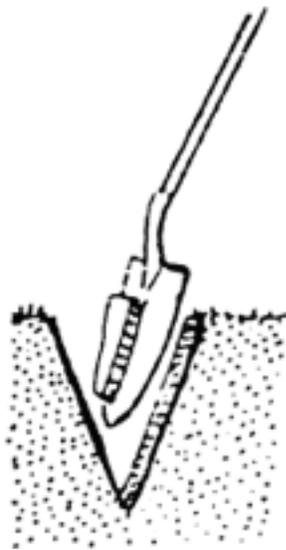
Especially in the Rio Grande Valley, but also in most areas, it is important to budget for added organic compost and nutrients to our soil before every planting. As discussed in Part Two, fruiting plants and leafy greens tend to drain soils of valuable nutrients. Replenishing between plantings, planting and turning-in cover crops, and leaving fields fallow are important methods in maintaining good tilth. Soil with good tilth is nutrient-rich and has an even balance of organic matter, clay and sand that prevents severe compaction.

Soil testing

Sending a soil test to a laboratory for analysis will assist growers in determining what nutrients are lacking in the soil and what specific crops can succeed in this soil. Most land in the South Valley is rich in clay and silt (river sand), but lacking in organic matter. Our small farmers are active soil builders as well as vegetable growers. Through their efforts in maintaining topsoil and replenishing soil nutrients, they strive to improve the arable quality of our soils while providing fresh, organic, locally grown produce to our community. New Mexico State University (NMSU) Cooperative Extension Service provides forms (see Appendix A) and instructions for conducting a soil test. You must obtain a soil auger or conduct a shovel test (see below) in order to obtain a representative sample of your field plot. You will blend six to eight samples from throughout the field and place them all in a single sealable plastic bag.

Sampling: Seasonal soil testing will provide a good base of information about the nutrients that may be lacking, and you'll need to amend the soil in order to maximize growing potential for annual crops. Make sure to test soil for perennial planting sites and amend accordingly. Work with your local county cooperative extension office to test your soil and get assistance interpreting.

Auger vs. shovel sampling: NMSU Cooperative Extension has loaned us their soil auger in the past. (Soil augers are quite expensive for retail sale.) Augurs are made of ½" steel tubing with a beveled tip. The handle is perpendicular to the tube, and the tube has a winder space that runs the length of the auger (see image below). Shovel sampling requires the use of a shovel to obtain a representative sample of the soil in your field (see diagram below; for a complete description of soil sampling and submission procedures, see http://aces.nmsu.edu/pubs/_a/a-114.html). This process requires digging a 6" hole and then obtaining a slice of soil 1" thick and 6" long from several spots on your field.



Above figure courtesy of NMSU Cooperative Extension.

Interpreting Results

Amending Soil

AFSC recommends using blood meal, bone meal, compost and animal manure to increase nutrients and biological activity in the soil. Nitrogen, potassium and phosphorus are the three most desirable and important nutrients for soil fertility and plant vigor. Blood meal and bone meal are effective ways to add these nutrients to the soil. Between plantings, replenish growing beds with blood meal and bone meal (2:1 ratio). Make sure it is evenly dispersed when there is no wind. Turn into bed instantly. Always follow the manufacturer's handling instructions on the package.

You can create your own inexpensive soil amendment by making compost. Composting is an active process of turning and watering compost piles so that they get air and do not become anaerobic.

Compost from plant matter or animal manures will add organic matter and slowly release nitrogen into the soil. Composting is also a good way to dispose of plant waste, kitchen scraps, dry leaves and other decomposable materials. Make sure that manure from chickens, goats, horses or cows is composted for 90 days before application to above-ground crops and 180 days for below-ground crops or crops that touch the ground (such as squash fruit). See Appendix B for examples of composting practices.

Don's Tip

Premix blood and bone meal in a wheelbarrow or a bucket before spreading directly on beds. Apply directly to the planting surface of garden beds. This way, you aren't wasting valuable nutrient on your paths. Blending reduces total passes through while spreading nutrients.



Cover Crops – Nitrogen Fixation

Cover cropping is an important practice for allowing soil to rest and restore valuable nitrogen. One consideration is that cover crops do consume significant water during the growing season. Make sure to select a nitrogen-fixing legume. Hairy vetch, cowpeas and yellow clover are good for low season cover cropping and turning in to the growing area before the spring planting takes place. Keep in mind that nitrogen-fixing varieties must be mowed down once they are at approximately 10% flowering. The flowering absorbs the soil-borne nitrogen, so mowing will prevent reabsorbing of vital nutrients.

Tractor Work and Tillage

To till or not to till...is that the question? Many theorists of agriculture ponder whether tillage causes more harm than good in that it causes increased depletion of micronutrients and bacteria in the soil and requires synthetic additives for the plants in tilled areas to thrive. Permaculture is a field of food production that works to practice beneficial companion cropping and no-till practice. Biodynamic farming is based in the notion of resourcing as much as possible of the nutrients and additives for a farm from that very farm. AFSC's New Mexico program's approach is a low-impact approach that controls for compaction and overproduction while working to keep the land productive. This section addresses the tools and techniques for keeping soil productive without over-depleting it.

Digging Out and Prepping Growing Beds

Use stakes and rope to measure the dimensions of the growing area. Measure $3' \times 100'$ for the growing area and $1' \times 100'$ for the path. Run the string the entire length of the growing bed and on either side of the path.



Use a shovel blade as your guide and make sure to work with a spade (pointed and sharp at the tip). The shovel blade is approximately $8'' \times 8''$. Dig the path in reverse, using your weight to drive the shovel into the ground and then leaning backwards to lift the soil. Deposit this soil onto an adjacent bed. Make the path about $8''$ deep from the original ground level. Also, designate which side of the path the dugout soil will go to and make sure everyone is clear on this. This activity works within the topsoil layer, but inverts much of the underneath layers in order to enrich them with nutrients.

The directions above are for the first time you break ground to grow on a site. If you have been producing on growing beds already and are digging out before the season, there are some additional considerations. Watering the growing beds creates compaction. Use a broadfork or shovel to loosen the soil in the bed if it has become hard and compact.

Use an iron rake or an aluminum landscaping rake to break up big chunks of dirt, to remove rocks, and to flatten and level the surface of the growing bed. Then add in composted organic matter or manure and blood and bone meal, and make a couple of passes with the rototiller.

Broadfork

A broadfork (or a deep spader) is much larger and heavier than a pitchfork, and its use is much more specific. The broadfork is simply for loosening soil manually. It usually has a series of tines and a substantial handle. There are several designs on the market, but the best have been made from iron or steel throughout. Wooden handles and attachments will break.

The broadfork extends deeper than a shovel and can move more volume of soil. It is a great tool for aerating the soil, which allows more oxygen to get to the roots of the plants, and loosening hard, compact soil. It can be useful for harvesting root crops as well.



Rototiller

Rototillers are important for efficiently prepping beds, integrating nutrients and softening soil into a fertile and rich tilth. They must be maintained and handled with care. Regular oil changes and filter changes are important for the long life and durability of these machines.

The preferred model of rototiller for AFSC's New Mexico program is a walk-behind, with 12" till depth and wide spacing for tilling tines. We have recommended the Honda FRC800AC adjustable speed, walk-behind rototiller. It has a 240cc engine, three forward speeds and one reverse. It also has counter-rotating tines that turn against the forward direction of the machine.



Make sure to have engine oil and gasoline on hand when using a rototiller. Check that the oil level is sufficient. Set the throttle at $\frac{3}{4}$ full (or set the choke, if the tiller has one) and pull the start cord. Be sure to walk behind or alongside the tiller. When tilling garden beds, do not walk directly behind the tiller, as that will compact the soil that you worked so hard to loosen.

Tractor Work

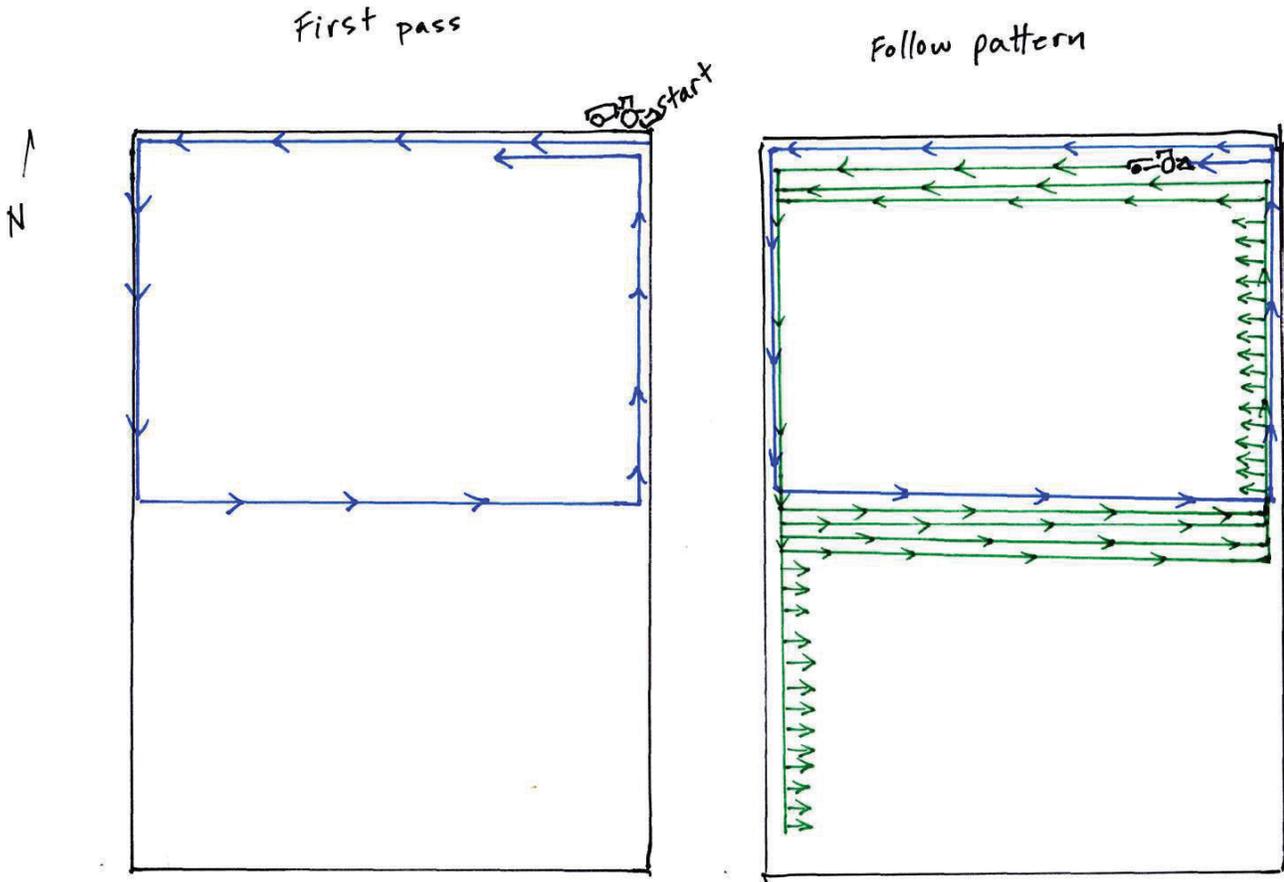
Tractors are ideal for major jobs like prepping a field for the first time or removing trees and stumps. For AFSC's New Mexico program, farmers are trained on where to access tractors for rent and what specifics to look for. It is also important to be skillful in tractor operation and light maintenance.

The Kubota B3000 Diesel Tractor is an ideal model for the work that we do on small farms. It should have a front loader and bucket as well as a three-point hitch and a hydraulic powered take-off (PTO) on the rear (a PTO is an easily attached rotary drive shaft that provides power to an attachment or farm implement).

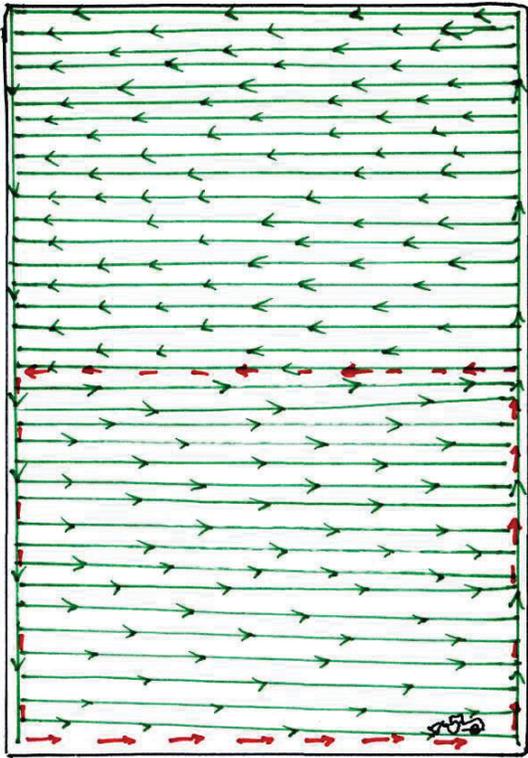
This type of tractor is useful for removing large debris, plowing soil, tilling soil, and using a disc to dig furrows, or planting rows. You will need a powerful tractor—18–32 hp—in order to break through some of the typically compacted soils in the region. Make sure you have access to a tiller, plow, disk and harrow in order to adequately turn soil and add amendments while doing tractor work.

Plowing and Tilling Patterns

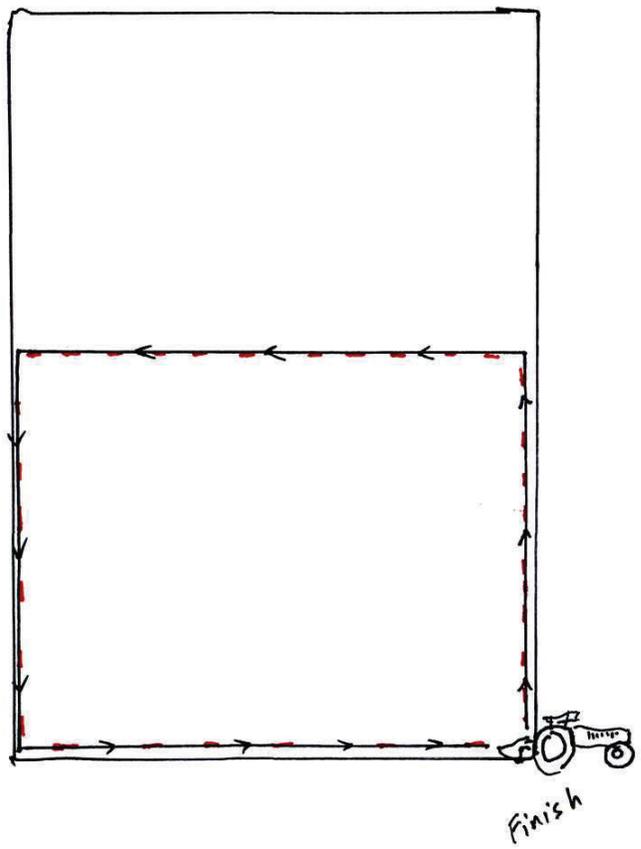
Depending on compaction of the soil and the amount of hardpan or clay, you will consider whether to do a deep plow to turn the soil or a light 4-6" till to fluff and loosen the soil. The pattern for plowing is similar to mowing patterns for fields. The idea is to minimize compaction caused by tractor tires. So, depending on the type of plow or tiller you have available, keep tires on previous tracks and try not to go over the same section more than once. The diagram below details the ideal tractor-plowing pattern for a sample plot that is rectangular and smaller in area. This pattern is based on the use of a single-side plow.



complete pattern



Last pass



Part Two: Crops and Productive Practices

Introduction

As much as managing labor and budget, crop selection and proper care are integral to any farming operation. The model that Don Bustos and AFSC have selected for appropriate small-scale production is based on the year-round rotation of 10 annual crops and two premier, high-value perennial crops: leafy greens, root crops, nightshades, squashes and cucumbers, legumes, blackberries and asparagus.

The AFSC farmer-to-farmer training model is based on the selection of high-value crops that are both appropriate for the growing conditions in New Mexico and have a reliable market value. Also, in selecting varieties, it is important to distinguish what segment of your farm plan you will devote to wholesale and retail production. This means selecting staple varieties in order to appeal to larger wholesale markets (institutions, grocery or food service) and reserving specialty varieties for domestic consumption or direct sales (more in Part Six).

The rationale for detailing selection and handling instructions for the crop varieties below is that they are a blend of traditionally produced foods (squashes, tomatoes and chiles) and specialty, high-demand items (leafy greens and salad mix) that can tolerate the mild wintertime climate in most of New Mexico. Of course, there are multiple resources to determine what varieties are most likely to yield well and sell well, but make sure to consider the weed control and pest management issues related to growing certain crops organically. Most of the varieties discussed below have been selected based on their relative manageability in the small-scale organic model. It is important to note that leafy greens can be hosts to water-borne disease and illness, so careful handling is of utmost importance when growing, harvesting, cleaning and packaging these products. (See Appendix C for information about post-harvest handling.) Lastly, if you are or plan to be certified organic, you must obtain certified organic seed or provide documentation of unsuccessful searches for certain varieties to be available organically.

Don's Tip

Grampa always said that if it doesn't freeze twice after you plant, then you planted too late!



Annual Crops

Leafy Greens (Compositae)

Salad Mix

Crop Summary: Salad mix, the premier product of AFSC's farmer-to-farmer training program, is often referred to as mesclun (French for "mixed") greens. It is high value, manageable and marketable. It can also be grown year-round. Seed companies offer blends of salad varieties, or you can select the varieties that you would like to grow (see Appendix D). For example, Johnny's Selected Seeds company offers the following varieties in their Encore Organic Salad Mix: Lolla Rossa, Parris Island, Outredgeous, Tango, Black Spotted Simpson, Green Leaf, Red Leaf.



Planting Details: To reduce seed waste and the labor needed to thin plants, use a seeder. We recommend two types of seeders, the Earthway or the pinpoint precision seeder. Select the correct disc on an Earthway Seeder, or adjust a pinpoint seeder appropriately. Plant four rows, 6" apart, on a 3' bed, with three runs of T-tape in between the four seeded rows (see the diagram below). Also, you may plant by digging a 2" trench and spreading and covering seed along the bottom less efficiently, yet equally effectively.



Productive Practice: Water upon planting. Water for at least four to six hours off the drip system. Seed will germinate within a few days. Use an iron rake to thin the spouts. Remove weeds by hand or with a hoe. Watch for insects such as aphids and control with Safe Soap. Salad mix will be ready for harvest in 28 days (longer during colder months with shorter daylight hours).

Harvest and Handling: Harvest the salad leaving two inches of the plant so that it can continue to

produce. Use a sharp knife, scissors or trimmers and transfer cut leaves directly into a harvest container. Sort the lettuce by spreading a single layer across a large surface. Remove any debris, wilted or yellow leaves, stems, or insects and snails. Clean the salad in small batches in cool potable water. In a series of deep sinks. Add a capful of food grade bleach or vinegar to the first sink., Submerge the salad and gently rotate it with your hands, being careful not to bruise the leaves. (Do not over fill the sink with salad as the weight can break the leaves.) The second sink should have only clean potable water. Lift the salad from the first sink and submerge it in the second sink and rotate with your hands. If snails become prevalent, you may consider adding another sink before the final rinse with sea salt to dislodge the snails from the leaves. Spin dry in a commercial-grade salad spinner or a repurposed washing machine on spin cycle. Make sure that the leaves dry completely to prevent molding. Store in latex-free plastic bags or food-grade bags in three-pound increments. Leave some air in the bag to protect the lettuce. Keep in cool at 45 degrees or lower. Salad mix should stay fresh for approximately one week.

Note: Clean out broken, brown or wilted leaves in between the rows after harvesting salad. This will reduce the incidence of molding and inspire strong regrowth. Salad mix can be cut up to three times for marketable quality. The grower can then decide, based on flavor and texture, whether to continue harvesting a certain bed. Some Agri-Cultura growers leave the lettuce to grow into full heads and sell them at the farmers' market.

Spinach

Crop Summary: Spinach (*Spinacia oleracea*) is a hardy cold weather crop. Seed selection should be based on preference for flat leaf or savoy (ruffled) leaf. Tye (F1) is an organic hybrid flat leaf variety that responds well to Middle Rio Grande growing conditions. Spinach germinates best in cool soil. Sowing in soil above 85°F will worsen germination.



Planting Details: Spinach is direct seeded.

Plant seeds ½" deep using a seeder or by hand. Sow seeds in three to four rows on a 3'-wide growing bed. Space the rows 6" apart. Set drip lines between seeded rows. Depending on soil texture, irrigate for 4–6 hours immediately after sowing seed. Spinach takes approximately 28 days to harvest as baby spinach.

Productive Practice: Spinach will sprout within seven days. Make sure to thin sprouts and pay close attention to weed and pest infestation. For bunching and full size: Sow 10 seeds per foot, ½" deep, rows 12–18" apart. Harvest spinach full size but before bolting, cut just below root attachment for "rooted spinach," or cut higher for "clipped spinach." For baby leaf: Sow in a 2–4" wide band, ¾" apart, about 40 seeds per foot. Clip small leaves in 3–5 weeks, depending on time of year and speed of growth.

Harvest and Handling: Harvest spinach with a knife, scissors or trimmers, or simply pluck each leaf by hand. Some will gather the entire plant and chop off all leaves at once. Sort harvested spinach

on a flat. Clean surface. Remove debris and wilted, yellow or dry leaves. Wash spinach in a deep sink with hypochlorite or other approved sanitizing solution following product instructions. Rinse with fresh water and spin dry. Store in latex-free plastic bags and leave air in the bags to buffer the spinach. Keep at 32°F with 95% humidity for 7–10 days.

Arugula

Crop Summary: Arugula or roquette (*Eruca sativa*) is known for its sharp, peppery flavor. Its leaves are lobed and grow in a bunch similar to spinach. Arugula grows well during colder months and can winter-over in many climates. The market demand is not as great as for spinach and lettuce, but it requires minimal tending and is very hardy. Full-grown arugula tends to sell in bunches, while smaller arugula sells well loose. The flower is edible, but sharper in flavor.



Planting Details: Direct seed with a planter or by hand in ¼"-deep rows that are about 2–4" apart. Four rows per 3' bed are ideal. Place three lines of T-Tape in between seeded rows. Water for 4–6 hours immediately after sowing seed.

Productive Practice: Arugula takes about five days to sprout. Thin the seedlings with an iron rake. Baby leaves will be ready in 28 days and full-grown leaves by 40 days. Flea beetle and aphids can be a concern, especially when arugula is planted indoors. Floating row cover can assist in controlling flea beetle.

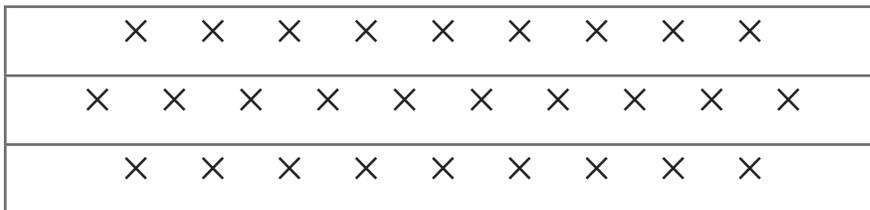
Harvest and Handling: For preparation as loose arugula, cut by hand with a knife, scissors or trimmers and keep in a harvest vessel. Cut leaves no larger than 6". Exclude thick stem or woody parts. Larger leaves (8–10" and larger) Should be sold in ½ lb to ¾ lb bunches. Cut the full-grown leaves low to the ground and use the stems to gather and tie together. Sort harvested arugula on a flat, clean surface. Remove debris and wilted, yellow or dry leaves. Wash arugula in a deep sink with a capful of food grade bleach. Rinse with fresh water and spin dry. Store in latex-free plastic bags and leave air in the bags to buffer the arugula. Keep at 32°F with 95% humidity for 7–10 days.

Mustard Greens, Collard Greens and Kale



Crop Summary: Mustard greens (*Brassica juncea*), collard greens and kale (*Brassica oleracea*) are in the *Acephala* group of the cabbage family. Unlike traditional cabbage, these do not form a head, but rather are sought for their hardy, flavorful leaves that will increase in eating quality into late fall and will be harvestable through the winter in most areas. The plants thrive in cold frames through the winter. Red Giant and Green Wave are the best-known varieties of mustard greens this area. They are known for sharp, spicy flavor. The preferred kales in this region are Red Russian (pictured above left) and Lacinto or Dino Kale, a tight savoy leaf. These tend to struggle in the mid-summer temperatures and drought conditions in the Middle Río Grande.

Planting Details: Sow three seeds every 6", ¼" to ½" deep, in rows 12–18" apart. Stagger the row so that no two plants are side-by-side (see diagram below). Thin to one plant per group. Plant two to three rows per 3' planting bed. Plants will be full grown in 60 days. Harvest the larger, outer leaves. Water immediately after planting.



Collard, kale and chard planting pattern

Productive Practice: Seeds should sprout within 10 days. Thin the sprouts, leaving 4–6" between plants. Weed and aerate the soil around the growing bed. Control flea beetles with floating row cover. Control aphids with Safer insecticidal soap.

Harvest and Handling: Only harvest leaves from the outside of the plant. Use a sharp knife to cut leaves low at the stem. Harvesting leaf by leaf allows for field grading. Sort leaves on a flat surface and remove any debris. Wash in a deep sink with diluted sanitizer (chlorine or vinegar). Rinse in fresh water. Spin or towel dry. Smaller leaves can be packaged loosely. Larger leaves should be bunched in ½ lb to ¾ lb bunches.



*Above: Lacinto kale
Below: Red Giant mustard greens*



Chard

Crop Summary: Chard (*Beta vulgaris*), also referred to as swiss chard, is in the beet family, and its tall, firm leaves have a very rich, almost spinach-like flavor. It is a very hardy and popular-selling leafy green for both direct sale and wholesale venues. It produces continually for several months after a single planting. Chard produces a large green leaf with differently colored rib/stem. The rib resembles a celery stalk and is useful in cooking applications with the large leaf. Chard comes in several varieties and seed blends. The most common are Rhubarb Chard, Ruby Red, Fordhook, Bright Yellow and the most attractive, Bright Lights. These leaves can be harvested small (2–3") for salad mixes or braising mixes, or medium to large (8–12") for bunching.



Bright Lights full-size swiss chard bunches

Planting Details: Plant chard by direct seeding into cool soil at a pH over 6.0 (closer to neutral soil). Use a seeder or sow by hand. Sow about 6 seeds per foot, ½" deep, rows 18–24" apart. Thin to 4–6" apart for larger leaves and stronger plants. Cut for bunching at any stage from the leaves at the perimeter. New leaves will sprout and mature. Make sure to stagger the planting along your growing bed. Two rows per 3' bed are ideal for irrigating and harvesting.

Productive Practice: Control flea beetle with floating row cover. Control aphids with Safer insecticidal soap. Powdery mildew can damage leaves and cause early leaf drop. The ideal conditions for powdery mildew are poor ventilation with a temperature between 60 and 80°F. The powdery mildew spores overwinter in diseased plant parts and begin asexual production of new spores once the weather warms. Selecting mildew-resistant varieties can help prevent this. Applying a baking soda and water solution or diluted neem oil via spray bottle can control mildew at early stages. Severely affected plants should be uprooted and destroyed to prevent spreading of mildew.

Harvest and Handling: Harvest larger leaves around the perimeter to ensure constant new growth. Use a knife or scissors to cut leaves low at the stem. Sort leaves on a clean, flat surface. Remove any debris, insects, or wilted and dry leaves. Wash by immersing in a deep sink with a sanitizing solution that contains either chlorine bleach or vinegar solution. Rinse in fresh water. Spin dry with a commercial salad spinner, and make sure that there is no moisture on the leaves. Gather small leaves loosely for sale as loose greens. Package larger leaves by the bunch and tie at stem. Weigh bunch to ½ lb to ¾ lb for wholesale or retail sale. Store packaged in latex-free plastic inside a wax box. Keep in cold storage (under 45 F) for 7–10 days.

Leafy Greens Summary

Leafy greens are ideal for extending the growing season through the winter months in the Middle Río Grande Valley. They can be difficult in midsummer in locations where the microclimate gets severely hot or where there is full sun exposure in the summer months. Shaded or cooler sections of the farm are more suited for leafy greens production in the summer months. The varieties listed above are those that have had demonstrated success in the AFSC farmer-to-farmer training program and the development of tiered markets for the Agri-Cultura Network. Many other varieties exist that will have success in this region. Some to consider are Asian greens such as tatsoi, mizuna and bok choy.

Root Crops



The following section is based on production of root crop for both direct sale and wholesale. Many of the root crops below have handling and cultural practices that resemble those of the leafy greens, especially chard, which is in the beet family. In contrast, however, harvest root crop eliminates the entire plant from your bed. Thus, sequential plantings are the way to ensure a constant supply. These products are beneficial in that they store well, are relatively easily handled and are appealing to the eye, and they are widely consumed in our regional market.

Don's Tip

Plant radish and carrot seeds simultaneously in the same bed. The radishes will be ready in 28 days. Once harvested, the radishes leave space for the carrots to grow and thicken. Make sure to thin sprouts upon germination with an iron rake to leave 1" between sprout bunches.



Duration to maturity is an important concern. Radishes tend to take 28 days, and carrots take 90 days. Plan accordingly in the spring months, but most of these varieties can be sown in a cold frame during colder months. They are also well suited for outdoor production with floating row cover for pest control in warm months and warmth in the cold months.

Radishes

Crop Summary: Radishes (*Raphanus sativus*) grow quickly and are very marketable in direct sale and wholesale venues. The bulb is known for its sharp flavor and crunchy texture. The leaves are nutrient-rich and full flavored. The preferred varieties of the AFSC farmer-to-farmer training program are red rover (pictured above); Easter egg, a blend of colorful seed varieties; and ping pong, white round bulbs. Other varieties have been mentioned as potentially attracting chefs and restaurant buyers: French breakfast or D'Avignon, an elongated, red-tipped and white bulb; and icicle radish, a white, carrot-shaped variety.



Planting Details: Radishes remain in prime condition for only a few days and then they get too big, the skin splits, and they get pithy or woody. So timing is important with this crop. We recommend adhering to a rigid sequence in order to reduce product loss.

Productive Practice: Plant with a seeder or by hand. Plant in rows with T-Tape in between each pair of rows. Plant up to six rows per 3' growing bed. Sow at any time during the season, beginning in early spring. Use 2-3" wide bands, seeds about ¾" to 1" apart and ½" deep, and rows 1' apart. Dense planting will eliminate unplanted ground to discourage weeds. Radishes are adversely affected by hot, dry weather. They remain in prime condition only a few days and should be grown rapidly with plenty of moisture to be mild, tender and attractive. If overgrown, roots become tough, pithy and too spicy. Control flea beetle with floating row cover. Radishes mature in 28 to 35 days.

Harvest and Handling: Harvest radish once the bulb is at its prime readiness, 1" to 1½" in diameter, with the skin intact. Check bulb readiness by clearing soil away from the base of the stem. Gently tug and wiggle at the base of the leaves. Take care not to pull leaves from the bulb. Loosen soil around the bulb if needed. Remove any yellow or wilted leaves. Remove dirt from the bulb. Rinse in fresh water. Tie at least five bulbs in a ½ lb to ¾ lb bunch.

Beets

Crop Summary: Beets (*Beta vulgaris*) are valued for their sweet, tender root and hardy, flavorful leaves. Red ace is the most commonly known variety. Badger gold has a mild, sweet flavor and light gold color. Choggia beets look like a bull's-eye when sliced. These grow well in cooler climates and can be harvested as baby-sized—less than 1" in diameter bulb—or full-sized—2½" diameter bulb. Beets mature in 45 days to baby size, 60 days to full grown.

Planting Details: Begin early plantings when soil has warmed to 45°F. Sow up to four rows per 3' bed. Plant 10 seeds per foot in a single row ½" deep and rows 6–12" apart. Thinning is not necessary. For a continuous supply of greens and small tender beets, sow seed at 2-week intervals until 8 weeks before regular heavy frosts are expected.



Productive Practice: Loose and loamy soils are ideal for root production. Cool temperatures favor brighter skin colors. Make sure to aerate surrounding soils and to thin sprouts after germination. Clear weeds by pulling them by hand or with a hoe. Acute temperature fluctuations may cause zoning, or discolored rings on the root. Thin medium-size plants so roots can grow to full size. Also, rotate to prevent *Cercospora* leaf spot. Keep well irrigated to prevent scabbing, raised brown spots on roots.

Harvest and Handling: Determine ripeness once the leaves have grown beyond 6". Clear the soil around the root to verify size. Fork or undermine in hard soil. Tug gently on the leaves just above the root in loose soil. The smaller, thinning bulbs can be bunched at ¾ lb with a tie just above the root. The full-size bulbs should have at least three plants per bunch. Remove any yellow or wilted leaves. Remove dirt from the bulb. Rinse in fresh water. Tie at least five bulbs in a ½ lb to ¾ lb bunch.

Turnips

Crop Summary: Turnips (*Brassica rapa*) grow well for most of the year, from early spring to late fall. Purple top, red stem and hakurai, a Japanese variety, are the most popular in this region. The hakurai is well liked because of its mild, sweet flavor, and it can be consumed raw. Red stem and purple top have an earthier flavor and require cooking to be eaten in most contexts. Radish-sized

turnips mature in 30 days; full size turnips mature in 45–50 days. Skin is smooth when radishes are small.

Planting Details: Sow in early spring to late summer in rows $\frac{1}{4}$ " to $\frac{1}{2}$ " deep. Use a seeder or place seeds 1" apart, approximately 35 seeds per foot by hand. Sequence planting in order to ensure a constant supply. Plant at least four rows in a 3' growing bed.

Productive Practice: Thin the sprouts after germination. Pull weeds and keep well irrigated. Control flea beetles and root maggots with floating row cover.

Harvest and Handling: Hakurai are ideal for harvesting small, with a 2"-diameter bulb. They are ready in 40 days. Other varieties can grow larger, since they are not ideal for eating raw. Pull small roots by gently tugging at the base of the plant. Larger bulbs may require digging. Remove any yellow or wilted leaves. Remove dirt from the bulb. Rinse in fresh water. Tie at least 5 bulbs in a $\frac{1}{2}$ lb to $\frac{3}{4}$ lb bunch.

Carrots

Crop Summary: Carrots (*Daucus carota v. sativus*) come in many colors. Orange has predominated as the typical carrot color since the 17th century when growers in Holland selected for the bright orange color in celebration of their leader and liberator, William of Orange. Multicolored carrots are thought to have been effectively eliminated in a single generation during that era. Carrots take about 75 days to reach maturity, so a clear cropping plan that anticipates the wait on carrots is important, but the market demand makes it worth the wait. The domesticated or garden-variety carrot has been bred from its wild origin for sweetness and softer texture. Carrots were originally cultivated for their aromatic seeds. They are related to cumin, dill, fennel and parsley. Left to flower, carrots are attractive to parasitic wasps and beneficial pollinators. The most eye-catching varieties do best at farmers' markets, while the more staple colors, such as orange and yellow, do better for wholesale. Purple haze and rainbow have been successful varieties for South Valley growers.

Planting Details: Use a planter to sow seed $\frac{1}{2}$ " deep in loose soil that is free from rocks. Plant from early spring to mid-July for fall harvest. Plant about 30 seeds per foot. Space rows 4–6" apart.



Productive Practice: Carrots grow best in full sun, but will tolerate shade. Do not allow the soil to crust prior to the emergence of seedlings. Thin the young sprouts to 1' between sprouts, with an iron rake or by hand. Sequential plantings will ensure a constant supply.

Harvest and Handling: Clear dirt at the base of the leaves to determine appropriate harvest size.

Pulling a sample carrot works too. Baby carrots are under 4" in length. Full size are 6" or larger. Undermine or dig out with a pitchfork, shovel or broadfork. Remove as much dirt and soil from the roots as possible. Remove any yellow or wilted leaves. Wash in fresh water and scrub off mud and dirt. Rinse in fresh water. Towel or drip dry. Tie at least 5 carrots in a ½ lb to ¾ lb bunch. Store carrots without moisture below 45°F.

Nightshades

Nightshades include a diverse group of plants such as tomatoes, peppers, eggplant, potatoes, gooseberries and tobacco. Tomatoes and eggplants are very marketable, but require special handling post harvest. Peppers are more durable in the New Mexico climate. There are several regionally developed strains such as the New Mexico green chile pepper. Peppers are not susceptible to disease and are a much more durable fruit. Early season plant starts allow the grower to maximize fruit production during warmer months. So get your starts going by mid-February and expect to transplant by early to mid-May (in fact, in 2012 the last frost was one month early, in mid-April, so paying attention to weather predictions and the *Farmers' Almanac* helps for early season extension). The following section contains details on tomato, pepper and eggplant production and handling specifications.

Tomatoes

Crop Summary: Tomatoes (*Solanum lycopersicum*) are excellent sellers. But once they are in season, the market becomes saturated and prices drop significantly. In selecting what varieties to plant there are several considerations regarding cultural practice and handling. First, consider the distinction between determinate and indeterminate varieties. Determinate varieties flower and fruit at the same time. Yellow taxi is a determinate variety that produces early in the cold frame and draws a good price early in the season. Sequencing determinate tomatoes requires successive germination and transplanting. They do not require pruning or high trellis, since they grow into a bush and cease putting on vegetation once the flowering takes place.



By contrast, indeterminate varieties continue to grow vegetation and flow throughout the warmer months and into the fall in a cold frame. They benefit from trellis and climbing lines. Heirloom varieties such as Black Prince, Moscovich, Green Zebra and Brandywine are more delicate

and don't have a uniform fruit size or shape. Moscovich is the most like a red slicer, but it is thin-skinned light most heirlooms. Other indeterminates that do well in the Middle Río Grande are New Girl and most cherry tomato varieties: yellow pear, grape, black cherry. Note that these developed seed varieties are list as F1 hybrid seeds. F1 means that the fruit is a hybrid that has been selected for certain traits. An F1 variety will not replicate the same desired traits into the next generation. So farmers cannot save seed of F1 hybrids and expect similar size, shape, flavor, texture, color or growth.

Planting Details: Do not start these too early. The plants will become root bound, meaning that the roots will grow into a tight ball. Once plants are root bound, flowers are likely to open. If transplanted once there are open flowers, the plant is likely to be stunted and will struggle to produce fruit.

It is important to start tomatoes in a heated and ventilated greenhouse with soil-less peat-based starting mix and seeding trays 6–8 weeks prior to the last frost—by mid-March for the South Valley. Start the seeds by planting them in trays or flats with 72 cells. The starting mix must be kept 75–90°F to maximize the germination rate. Tomato seeds germinate and develop slower in cooler soil. Once the first true leaves emerge (not the seed leaves or cotyledons that appear upon initial sprouting), transfer seedlings into 24 plug flats. Grow seedlings at 60–70°F. Water enough only to keep from drying. Fertilize with diluted fish emulsion or an OMRI (Organic Materials Review Institute)–listed seedling fertilizer.

Transplant after six weeks into medium nutrient-rich soil (not too much nitrogen and not too little; this can be achieved with the proper quantities of compost, blood meal and bone meal). Transplant 12" apart with two rows per 3' bed and two lines of T-Tape. Plant root bulb and stalk up to the first pair of leaves into the bed. Design trellis or caging for indeterminate plants. Water plant starts with a high-phosphate fertilizer solution upon transplanting.

Productive Practice: Do not smoke or handle tobacco if you are going to touch tomato plants. Tobacco carries a virus that can eliminate your entire planting. Prune indeterminate varieties at the suckers and train plants upwards. Determinate varieties need no pruning and can grow into a bush. Pruning blossoms and suckering will inspire greater growth.

Harvest and Handling: Harvest vine-ripened fruit for direct, same-day sale. Pick less ripe for next day or long-distance delivery. Pick with the last node of the stem intact. Store fruits on flats with the stem facing downward. Take care not to let fruits roll into each other or puncture each other in transit. Store firm, ripe fruit for 4–7 days at 45–60°F.

Don's Tip

Trellis tomato plants once they are 2 feet tall. Use cages, twine and rebar, or barbless wire with T-posts and zip strips, or hang guidelines of twine from the rafters. Send at least two rows of trellis to keep tomato plants growing upwards. This will reduce exhaustion of having to bend over and lift plants to find fruit.



Peppers (*Capsicum annuum*)

Crop Summary: Several varieties of peppers will thrive with the arid growing conditions of New Mexico. Of course, New Mexico is renowned for its special variety of green chile. There are several locally adapted and landrace, almost appellation strains like Chimayo and Hatch as well as commercially developed strains such as Big Jim and Sandia Hot.



The New Mexican climate is ideal for pepper production of many varieties, but hot, Mexican chiles tend to grow very well in this area. The regional yellow hot pepper produces nicely as well. Both hot and sweet peppers need to be started at the same time as tomatoes. They prefer well-drained soils and high summer heat. “Chile does not like soggy feet,” many growers have shared. Others insist that the heat stress and sudden flood and drain of water are what intensify chile heat and flavor.

Planting Details: Plan to germinate and start seeds 8 weeks prior to the last frost (early to mid-March to plant starts in New Mexico). Plant seeds in shallow flats, 4 seeds per inch, or in 72-cell flats. Plant ¼” deep in soil with abundant phosphorus and calcium. Maintain soil temperatures at 80–90°F. Once the first leaves emerge, transplant to 2” apart or 24-cell flats. This helps the development of better root systems. Grow seedlings between 60 and 70°F until after the last frost. Set transplants 12–18” apart in two staggered rows 12–18” apart. Transplants with buds but no open flowers are ideal.

Productive Practice: Water peppers abundantly once a week; depending on temperatures more watering may be necessary. Use row cover to protect from cold. Drip irrigation prevents bacterial spots. Sunscald is the result of insufficient plant foliage. Excessive nitrogen inspires increased plant growth and reduced fruit production. Make sure that soil nutrients are balanced and the phosphorus levels are adequate. Common ailments include fruit drop from excessive heat or watering and blossom end rot from lack of nitrogen.

Harvest and Handling: Pick peppers by hand as soon as they are full grown to encourage further fruit set. Take care to wear gloves for hot chile pepper varieties. Do not wash. Wipe dirt away. Store in a ventilated container free from moisture. Do not package in sealed plastic for too long, as this will inspire mold. Peppers turn from green to red as they ripen. Certain varieties are desirable in the green stage and others in the red, ripe stage. Also, with regard to jalapeños, hardened veins on the exterior indicate how hot the pepper will be. The more dried veins, the hotter it is.

Eggplant

Crop Summary: Eggplant (*Solanum melongena*) is dark, light or bright purple or white. It is a bell-shaped annual with a dense pulp and rich texture. Known for its absorption of flavors, eggplant is preferred with hardy recipes. Well-known varieties are traviatta, the large Italian, dark fruit; ichiban, or Japanese eggplant, which is narrower and lighter-colored than the traditional styles;

and zebra, which is striped purple and white and produces a medium-sized fruit. This product does well under the same conditions as its relatives, tomatoes and peppers. Unlike with tomatoes and peppers, fruit growth increases exponentially with water. So you will likely have a generous surplus if you experience a lot of rain during the growing season. Also, eggplant keeps well in a dry, dark and cool place. Its marketability has a short window for wholesale and retail, since the skin gets wrinkly and loose as soon as one day after harvest.

Planting Details: Start seeds indoors about 8 weeks before the last frost—mid-March for the Middle Rio Grande region. Use a rich, balanced potting soil in a 72-cell flat or tray. Maintain soil temperature at 85–90°F. Once the first true leaves emerge, transplant into 2–4" pots, 2–4" spaces on a tray or a 24-cell flat. Grow seedlings at 60–70°F. Water enough so that the seedlings do not dry out. Transplant after the last frost once the weather has settled, about mid-May in this region. Cold hardening will benefit the overall well-being of plants, but they are tender, and cold will affect eggplant. Use floating row cover to protect against cold spells. Transplant in two rows on a 3' bed. Plant in a staggered fashion with 12–18" between plants.

Productive Practice: Clear weeds with a hoe between rows and between plants. Be mindful of over-fertility, when there is too much nitrogen in the soil and the plants produce big, bushy branches and not much fruit. Balance this by adding phosphorus (in the form of bone meal or rock phosphate) to soil. Like tomatoes, eggplants can be pruned and staked to keep fruit facing downwards. Eggplants suffer from curly top and leaf wilt like their relatives. Be sure to not smoke or handle tobacco when working with eggplant. Use floating row cover to protect recent transplants from flea beetle and Colorado potato beetles. Frequently check the underside of leaves for orange clusters of Colorado potato beetle eggs. Crush them upon discovery.

Harvest and Handling: Use shears to cut fruit with stem. Harvest directly into boxes and transfer to shade to remove field heat. Full-grown fruit is close to 6" for traditional varieties. Baby eggplant fruit should be harvested if ripe. Harvest frequently to encourage further fruit set. Do not wash. Wipe fruit clean. Lay on a flat, single-layer cardboard or plastic container. Make sure that your storage area is neither too cold nor too hot. Warmer post-harvest storage will loosen skin, and colder areas will soften flesh. Many claim that same-day harvest and delivery is ideal to ensure premium market quality.

Legumes

Legumes include a wide variety of plants that tend to produce seeds in a pod that are valued for their high protein content. Beans and peas are the most commonly known legumes, but soy, lentils, chickpeas/garbanzos, peanuts, cowpeas, clover and mesquite are all legumes. The distinction within this group is whether the plant is a grain legume that produces the desirable seed/pod at the end of branches, such as soybeans and string beans, or a forage legume that tends to produce edible pods along or under the ground, such as peanuts. Legumes also have a special characteristic of capturing atmospheric nitrogen and fixing it into the soil. Nitrogen fixation, as it is known, is an important aspect of building fertile soil (as mentioned in Part One). Recall that nitrogen stimulates fruit production and phosphorus inspires vegetation, but there needs to be a good balance of the two, with some potassium as well. Corn, tomatoes, lettuce and peppers absorb nitrogen from the soil. Legumes can play a beneficial role in replacing nitrogen in the soil. However, there is a catch. The legume fixes

nitrogen during the vegetative stage, but once in flowering, it transitions to nitrogen absorption. So when cover cropping with legumes such as cowpea or hairy vetch, one must mow or turn in the plants prior to the flowering stage.

This section reviews the planting and cultural practices for snow peas and snap peas as well as string beans and wax beans. Both of these crops are well suited for New Mexico growing conditions and offer good options for early and late-season extension. It is important, as with all crops, to pay special attention to planting dates and growing season for legumes, as some varieties will struggle under the midsummer temperatures in central New Mexico.

Snow Peas and Snap Peas

Crop Summary: Snow peas and snap peas (*Pisum sativa*) are good cold weather crops. They can be sown in the cooler months in anticipation of harvest before the daytime temperature high reaches 70°F. These varieties differ in that snap peas produce a thicker pod with round peas, and snow peas produce a flat pod and flat peas. Also, many varieties grow in a vine, so plan to trellis upon planting.

Planting Details: Direct seed peas at a depth of ½" to 1", 1" to 1½" apart in a 3"-wide band. Plant rows 12" apart with two to three rows per 3' growing bed. In New Mexico, many practice direct seeding with a jab planter and follow the rule of three—that is, three seeds per hole, "*una para mi, una para vos, y una para los animalitos de Dios.*" Plant as early in the spring as the soil can be worked. This is usually in early February for the Middle Rio Grande Valley.

Productive Practice: Pea seeds require inoculant in order to encourage the formation of nitrogen-producing nodules on the plant roots. This enriches the soil, results in larger plants and increases yield. Purchase legume inoculant from a seed supplier. The inoculant is a fine, soil-like powder. Either apply inoculant in a slurry and submerge seeds to coat, or mix dry inoculant with seeds in a bucket or plastic bag just prior to direct seeding. Prior to planting, design a trellis system upon which the peas can climb. You can use cages, or stakes with barbless wire that hang directly over the seeded row. Shorter varieties do not require trellis, as they will crawl along the ground. Peas can absorb soil moisture, so there is no need to water upon planting, but make sure that the soil stays moist, and be sure to water one or two times per week depending on precipitation. Guide taller plants through trellis during growth. Decide whether to plant bush vs. vine varieties. Bushes will need minor trellis for support. Vines will need a fence, rope, pole or other climbing structure to grow on. Choose mildew-resistant varieties to avoid powdery mildew. Plant in well-drained soil and rotate crop after three plantings to control for pea root rot that causes browning and drying of leaves and branches from the ground up. Plant 60 days before the first frost for fall harvest.

Harvest and Handling: Expect to harvest 60 days after planting. Pick frequently to encourage further pod set. Peas are ready for harvest when the pod comes loose from the plant with minimal effort. Gently pluck pods from the ends of the branch, taking care not to damage the plant. Take care not to cut the branch either. Pick pod above the small leaves connected to the pod. Transfer into a clean harvest container. Do not submerge, rinse or wipe pods clean of dirt and debris. Remove any stems or leaves on the pods. Package and store in a sealed container that is free from moisture.

String Beans

Crop Summary: String beans (*Phaseolus vulgaris*) differ in lengths, shape, color and plant growth.

Bush bean varieties develop a broad, bushy plant that reaches 2–3' from the ground, does not require support and tends to produce bean pods over the same period. Pole beans grow in a vine and climb on supports such as trellis, cages or beanpoles. They tend to produce for a longer period, as their vegetative growth is continuous through the growing season. Plain old green beans—or *haricot vert*, as they are known in French—or filet beans are more tender and have no string; they are a very popular staple product for direct sale and wholesale. Their handling is minimal after initial planting, and in times of high yield it can be a challenge to harvest the pods before they become tough or hard.

Planting Details: Direct seed in prepped garden beds with well-drained soil. Plant after the last frost, around mid-May, or use floating row cover if planted prior to the last frost. Sow 1" deep at a distance of 2" apart. Plant two to three rows per 3' growing bed. Inoculate seeds to encourage better germination and growth. Direct seed when the soil temperature is at least 60°F. Dark-colored seeds germinate better in cool soils than light-colored seeds. For consistent supply, plant successively every 2–3 weeks through mid-summer.

Productive Practice: Bush beans do not need support. Pole beans will need a trellis or climbing support upon planting. Keep the area clear of weeds and be sure to keep soil moist, watering up to three times per week during warmer months. Control Mexican bean beetle with pyrethrum. Plow under or compost bean straw in the fall to destruct disease organisms. Practice three-year crop rotation.

Harvest and Handling: Filet beans (*haricot vert*) are valued for their tenderness, so pick on the smaller side (about 1/8" to 1/4" in diameter). Harvest regularly to encourage pod set. Three days of hot weather and five days of cool weather between harvests should suffice to avoid overgrown, tough bean pods. String beans, like the Fresh Pick or Provider varieties, can endure longer between harvests, but err on the early side to avoid tough beans. Clean the dirt from the skin of the beans. Pick beans by hand during the cool part of the day. Overgrown and tough beans should not be included in premium sale. You may submerge beans, but be sure to spin dry completely before packaging and storing green beans. Wiping them off to clean dust off the beans is all they need.

Squash and Cucumbers (Cucurbits)

Cucurbits or *Cucurbitaceae* is a plant family that includes many well-known crops: squash, melons, gourds, cucumber, pumpkins and watermelon. These plants are annual vines. Their stems are hairy and pentangular. Tendrils lead out from the leaves and guide the plant as it crawls and climbs. Consider three important things when including this family of plants in your farm plan. The first consideration is spatial dimensions; consider in what proximity you expect to sow your cucurbit seeds. These varieties are closely related and can cross-pollinate and produce undesirable characteristics; for instance, a zucchini can taste like a melon or a melon can taste like a cucumber. The second consideration is pest control. The squash bug is very prevalent along the Rio Grande Valley. Although some insist that strong soil fertility and timely pest management will help to control or eliminate these pests from your fields, there tends to be a point when the bugs have overrun the plants and you need

to move on. The key date around which you should plan is July 4, Independence Day. Time your planting to either be finished harvest by July 4 or plan to plant after that date for a late-season fall harvest. Also, plan to get fall and winter squashes in the ground by mid-July as well. The last consideration was an unforeseen one for Agri-Cultura Network. The market for organic squash is usually flooded by the late part of the summer. It is hard to get a reasonable price for all the hard work that goes into growing and harvesting it. This is when Agri-Cultura Network began to market squash blossoms as a specialty item to restaurants. The squash blossom, as will be detailed below, is highly delicate, but can draw more per weight price than the fruit. Along with this same consideration is whether you want to pickle a portion of your harvest for sale as a vertically integrated unit (this means that your end product is something beyond what you grew and harvested). Lastly, pay close attention to market specificities for size and appearance of cucurbits. They can become too large in a short period, and then you will either have to adjust pricing to accommodate or consume internally. All squashes and cucurbits in general will have two types of flowers, male and female. The male pollinates the female through wind, bees or gravity. Male flowers will not bear fruit, but females will. The male flowers can be used for sale as squash blossoms, since they have no other market value.

Cucumbers

Crop Summary: These are very popular, with great marketability at farmers' markets and wholesale. One caution is to pick frequently to encourage new fruit set and to prevent overgrowth, which can happen over the course of a few hours. Some of the preferred varieties of the growers in the valley are American slicing varieties (General Lee and Marketmore); pickling varieties (Northern Pickler and Adam Gherkin); and specialty varieties (lemon cucumber and Armenian seedless). These varieties do not present susceptibility to most common illness. They will be vulnerable to squash bugs, but those tend to prefer squashes and pumpkins.



Planting Details: Cucumbers can be direct seeded or started indoors and transplanted after the last frost. Cucumbers prefer a warm, nutrient-rich, limey soil, but any well-drained fertile soil is sufficient. There are two designations to consider when purchasing seed: parthenocarpic and gynoecious. The first means that plants will set fruit without pollination. The second means that the plant will only produce female flowers and potentially increase yield.

Plant indoors about 4–5 weeks before the last frost into 2" plug trays. Plant three seeds per plug. Keep temperature between 70°F in the daytime and 60°F at night. Transplant 12" apart in rows that are 6–8" apart. Take care not to disturb roots while transplanting.

Direct seed once the soil is warm, a couple weeks after the last frost. Direct seeding before the last frost is risky, since cucumbers cannot handle frost. Floating row cover can help for seeding near the last frost. Make sure that the soil is at least 70°F. Sow seeds ½" deep, 2" apart, spacing rows 6–8" apart. Thin to 8" between plants.

Productive Practice: Floating row cover is ideal for cucumbers, especially when planting early in the season or extending the late season. Row cover will also protect against pests such as

cucumber beetles. They can be controlled more aggressively with pyrethrum. Cucumbers can be trellised or allowed to crawl.

Harvest and Handling: Fruit will bear within 45 days from planting. Pick as soon as fruit bears to encourage fruit set. Harvest directly into a wax box or a clean bin. Wipe each cucumber clean and rub off the small thorns on the skin. Clear any dried flower from the end. Store below 50°F in a single or double layer in a wax box lined with plastic for up to 2 weeks. Do not seal the plastic.

Yellow Summer Squash and Zucchini

Crop Summary: Zucchini and summer squash are very popular items and grow extremely well in our climate. They have soft skin and must be handled delicately, but you can harvest daily when in full production. Summer squashes come in a few varieties: yellow summer, yellow crookneck and yellow sunburst. Other squashes that require the same handling and have the same marketable time frame are 8-ball, Mexican Grey and Zephyr (yellow crookneck with a green base). Zucchini varieties that have worked well are Raven and Dunja. They both yield well and produce a very marketable fruit.



Planting Details: Plant in late spring, well after any risk of frost. Make sure that the soil temperature is at least 62°F. As mentioned for cucumbers, plan to plant for a harvest prior to the July 4 cutoff, and then plan to plant for a fall harvest by July 15. The rationale for this is to minimize plant illness and crop loss from the squash bugs that tend to peak their infestation in late June to early July.

Direct seed 12" apart in a row with three seeds per hole. Plant at a depth of 1½" to 2". Water upon planting. Use row cover to protect seedlings. Space rows 18" apart, or two rows per 3' growing bed. Planting under a thicker-grade floating row cover will provide four degrees of frost protection.

Productive Practice: Fruit will emerge within 30–40 days. Sow every 2–3 weeks during growing season to ensure consistent supply. Manually control squash bugs by eliminating bugs on the plant. Grab them and squish them, or vacuum them. Look for orange-colored egg clusters under the spines on the underside of the leaves.

Harvest and Handling: Expect to begin harvesting within 40 days. Twist or clip fruit from vine. Take care not to scratch the skin, as it will scab and scar and impair quality. Also, harvest at least 3–4 times per week, especially after watering or rainstorms, as squash and zucchini tend to enlarge quickly. Make sure to harvest squash and zucchini at around 6" in length. Any larger or longer, and the seeds get hard and the flesh of the squash gets bitter. Overgrown squashes may be sold at farmers' markets for use in baking, soups or stuffing, but be sure to sell them by the individual unit and not by the pound. Harvest squash directly into a cardboard flat or wax box. You may stack squashes and zucchinis on top of each other. Do not pack more than 40 lb in a box at a time.

Perennial Crops

AFSC's New Mexico program has implemented a farmer-to-farmer training program that focuses on selecting 10 high-value annual crops and two high-value perennial crops. These high-value crops make it easier to obtain a specialty price that will ideally cover the costs of production. So in this section we will review the rootstock source, planting techniques, cultural practices, growing season, and harvest and handling processes, as well as marketing options, for both blackberries and asparagus. These two crops were selected as ideal perennials for their marketability and their relative ease of harvest and handling. Both blackberries and asparagus have defined growing seasons that reach their peak prior to or after the intense growing and harvest period of annual crops.

Blackberries

Crop Summary: Blackberries are perennial plants with biennial stems or canes. After rootstock is planted, the first cane to shoot up is the primocane. It does not produce fruit, only large palmate leaves. It can grow up to 10' long. The canes in following years, called floricanes, do produce fruit. Blackberries need 3 years after planting to yield a significant harvest. The preferred variety in this region is Triple Crown Thornless. AFSC's New Mexico program purchases second-year rootstock from Nourse Farms (www.noursefarms.com) These plants must be trellised and pruned back every off-season, during cold months while the plant is dormant.



Land and soil preparation and considerations: After conducting a soil test to determine the nutrient content of the field, remove all stumps, trees and debris before plowing. Integrating compost during the plowing period will help to introduce organic matter into the soil prior to planting. Consider whether you will plow the entire field or just the rows in which you will be planting the blackberry rootstock. Use a furrower or a disk implement to dig trenches with a tractor, or simply use a shovel to dig trench rows for planting rootstock. Conduct soil tests and leaf sample tests annually to ensure that the proper nutrients are getting to plants.

Planting: Make sure that your growing site is tilled and weed-free by the time of planting. Also, use level or slightly sloped land to reduce water pooling or still water that can encourage plant disease. Dig trenches for planting rootstock to 12" in depth. Space rows 8" apart to allow for plant growth between rows. Use ground cover around the 2–3' on either side of the plants after they have been established.

Companion Crops: White clover or any nitrogen-fixing cover crop is ideal for outcompeting nutrient-draining weeds as well as building soil in nutrients. Remember to mow clover once 10% has flowered. Clover and other legumes fix atmospheric nitrogen into the soil only to reabsorb it once they begin to flower and fruit.

Irrigation System and Watering Cycle: Use 2" PVC pipe from the well pump and run along one end of the rows. Then connect orchard tubing to the PVC pipe and run along the blackberry row. Water the blackberry field weekly during hot months, or more during the peak heat of Albuquerque summer months. Water enough to keep the soil moist during the colder months, 1–2 times per month. The irrigation system leaves space in between rows for a subsoil sprinkler system made of ½" PVC tubing with emitters every 15'.

Trellis and Weed Control: There is no need to trellis in the first growing season. In fact, it helps to leave the plants to crawl in the first summer and then prune and trellis in the following dormant phase (ideally, the winter after the one when you planted the rootstock). Trellis with a combination of barbless wire, T-posts and galvanized steel tubes. There are several variations on how to trellis these plants, but the main idea is to keep pathways clear and make the fruit as accessible as possible for harvest. Blackberries tend to create a bramble that is difficult to harvest. Trellis will keep some order to the plant growth and development.

Trellis once these begin to grow in the spring. This will require more than one person. Build the trellis by pounding 2" galvanized tubes at a 45-degree angle at the far ends of the blackberry rows. Bore holes with a power drill through which you will anchor the wire. Stake in the T-posts about every 25'. Secure barbless wire at one end of the row and run the wire to the other end. Make sure to tie wire around the T-posts and hook so that the T-post will support weight. Tighten at the far end and tighten further between sections of the end pipe and T-post with a come-along. Send two runs of wire, one at 2' and one at 4' from the ground. Once the trellis is complete, select the strongest three vertical canes and secure them to the trellis with Zip Strips or wire ties.

Water once or twice per month during the dormant, cold season, depending on rains. Irrigate weekly during the growing season. In the spring the cane shoots will emerge. These must be trellised to prevent re-rooting during the growth and fruiting stage, so that the plant's energy and nutrients do not go to growth and fruit. Control unwanted weeds and grasses with porous ground cover cloth between plants and alongside the rows. If watered, the clover should outcompete many weeds in the path, but this too must be hand weeded and mowed every 8–10 weeks through the first few seasons.

Pruning and Dormancy: Prune back the dried stems/canes during the winter, well before the last frost. Trellis and retain the three healthiest canes on each plant, and prune the rest to the base. Use Zip Strips to tie to the wire. Trim away all dried sections. Cut re-rooted canes 18" from the ground to repot and use for rootstock. Trim long canes to 6' and leave side shoots at 18" from the main canes. Tie to trellis and clear base area of weeds and debris.

Harvest and Handling: Expect a 4- to 6-week fruiting harvest in late summer. The trellising work is partially done for ease of harvest and access. These plants would grow into a bramble, making it difficult to carry cases of freshly picked fruit. Instead, the plants can be trained and trimmed to stay along the row and climb the trellis. Harvest is in the late summer–fall. Fruit must be harvested directly into pint baskets lined along a tray or a box. Do not pick up fruit from the ground for market sale. Pick ripe (or just under-ripe) fruit by gently tugging the fruit from stems. If the fruit resists, it is probably not ripe. Harvest in full sun, so that you can see if there is any shade of pink or red on the berry, in which case, then it is not ripe. Never wash the fruit.

Precooling: This term refers to removing the field heat from your harvest within the first hour of pick. Blackberries are a relatively perishable fruit, so harvest just under full ripeness. Also, bring coolers with sealed ice and lined with newspaper or paper towels to store blackberry flats while harvesting in the field.

Store blackberries in baskets and flats in a well-ventilated area. Store below 45°F to maintain freshness. Take care to bring cooled storage if you are vending at late-day markets.

Price: \$4.00/half pint basket retail or \$3.00/half pint wholesale

Asparagus

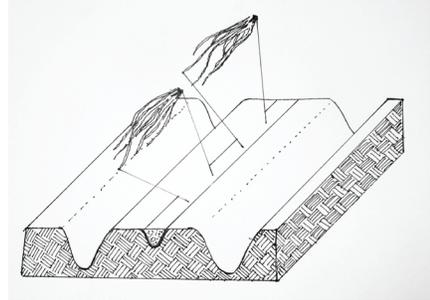
Asparagus (*Asparagus officinalis*) is an early spring perennial that has up to 15 years of productivity. It produces approximately ½ to 1 lb per plant when in full production. Asparagus is a relative of onions and garlic (alliums). Its fruit is poisonous to humans and the leaves are actually extensions of stems. That is why this plant is referred to as a fern. This is well-renowned vegetable the world over. Its flavorful shoots begin to emerge in early April. Asparagus sprouts in early spring and continues for 4–6 weeks. It is important to harvest asparagus spears regularly, as they grow rapidly and get woody and overgrown. Although it is possible to propagate asparagus from seed, AFSC's New Mexico program recommends purchasing second-year crowns from a reputable, inspected nursery supplier. Crowns are essentially the root head from which the sprouts emerge. They resemble a mop head or squid with long tentacle-like roots.

Land and soil preparation and considerations: Asparagus is a perennial vegetable and for that reason it is important to choose an ideal growing site. Asparagus will not tolerate wet, soggy soils. Like most vegetables, it requires well-drained, loamy soil where water will not pool. Sandy, light-textured soils—like those in the Middle Rio Grande Valley—are ideal. Conduct a standard soil test to ensure that there is a significant amount of organic matter in the soil. If necessary, amend with compost prior to planting. Dig furrows or trenches, 8–10" deep, in which the crowns will be planted.

Rootstock: Jersey Knight second-year crowns, from Nourse Farms (www.noursefarms.com), come in refrigerated shipping and must be stored in a refrigerated space. The crowns will begin to sprout if left out of refrigeration. Therefore, it is important to stage your planting around shipping and land preparation.



Planting: Plant in early to mid-spring. Do not add any concentrated fertilizers or fish emulsion until a year after planting. Lay the roots flat in the same direction along the trench. Use soil that was dug out from the trench to angle the crowns upwards out of the soil. They should be upright, as the roots turn and lay flat (see diagram below). Plant in parallel rows with 3–5' between rows. The closer the crowns are planted, the narrower the shoots will be once they emerge. So plant at 8" apart for slim spears or at 14" apart for thick spears.



Refill the trench and cover crowns under 1–2" of soil. Eventually you will mound the soil up around the asparagus crowns, but in the first year it is important to irrigate in the growing season and keep weed-free in the rows and in the paths.

Irrigation System: Ideally irrigate from a well pump and use 2" irrigation tubing that runs the length of one end of the planting rows and then connect with T-tape emitters. T-tape is rated for 100' lengths, so keep that in mind when designing rows and planting layout. Bury T-tape under a superficial layer of soil and run it along the entire row of asparagus plants.

Weed Control: Use a lawnmower and a hoe to clear weeds from the paths. Hand weed or use a trowel to clear weeds from between plants. Make sure to clear weeds regularly, or they can quickly overwhelm a first-year planting. Planting densely will help to shade the area and control weeds, but in the first few years it is important to keep weeds back, as they pose a direct risk to the newly planted crowns.

Pruning and Dormancy: Planted in spring, asparagus will shoot in the first summer season. Allow these shoots to develop into complete ferns. Hay, straw or leaf mulch can be added in mid-summer to control weeds. Ferns that grow will feed the roots. This will allow photosynthesis to occur, and the plant will establish firm rooting and stability for ensuing years. At the end of that first summer, the ferns should be 4–6" in height. Wait until they dry and "die" naturally in the fall. Gather up drip tape lines. Trim or mow back the ferns, as well as any overgrown weeds or plants, and remove the fern straw and burn or discard it to discourage any plant-borne disease. Using shears or pruners, trim plants back to the crown height and ground level, and mound dirt and soil above the crown. Irrigate regularly during the dormant months. Water frequently during the growing season, at least weekly when there has been no rainfall.

Harvest and Handling: The first spring after planting will yield a modest harvest. Expect a full harvest every mid to late spring in each subsequent year. Harvest daily as the weather warms, to maintain crop quality. If the spear is thicker than a pencil in diameter, it is ready for harvest. If thinner than a pencil, do not cut; allow it to develop into a full fern. Bend a spear until it snaps or cut 1" below the soil. Harvest in the cooler part of the day and submerge in water as a form of hydrocooling or precooling while completing harvest duties in the field. Asparagus can be stored at 32–45°F for 2–3 weeks.

Yield and Grading: All-male hybrids, such as Jersey Knight, will increase their productive yield with each year. The yield is directly tied to the previous year's fern growth. Each plant should provide approximately ½ to 1 lb in full harvest. Spears of ⅜" in diameter or greater are graded as "large." Spears of ¼–⅜" in diameter are graded as "small." Spears less than ¼" in diameter should be left

to grow into complete ferns. Package spears in uniform lengths in ½ lb or 1 lb bunches. Use elastic or a natural tie to bundle/bunch the spears. Uniform diameter is important in bunching. Also, consider what portion of your harvest will go to wholesale and what you will sell directly. Some growers have all of their asparagus sold before it even comes up. Others may have to consider multiple outlets to take advantage of this high-value crop. Sale price can vary between \$3.00/lb for wholesale and \$5.00/lb for retail.

General Planting Techniques

Crop Rotation

This practice is important for the preservation of soil nutrients and to prevent disease. Essentially, this is the practice of changing the variety and the frequency of plantings at a certain site. Small plots with a diversity of plants are ideal for attracting beneficial pollinators and controlling pests.

Polycropping

This is a practice of spacing planting of varieties to control for pest infestations and overplanting of a single crop in a certain area. A wide variety of crops protects the grower; the idea is that if a certain variety does not thrive, another will.

Companion Cropping

Companion planting is growing crops together that repel pests, attract pollinators or support vigor and health of each other. The Three Sisters technique of planting corn, beans and squash together is the most well known companion planting method in New Mexico. The cornstalks serve as poles for the beans to climb; the beans provide nitrogen and break the soil; and the squashes' large leaves shade the ground to keep soil cool and reduce weed growth.

The following plant combinations will repel common pests:

- Marigolds are commonly known for companion planting near tomatoes. Marigold will repel bean beetles, squash bugs, thrips, tomato hornworms and whiteflies. They will also repel root knot nematodes—microscopic white worm that naturally occurs in soil—that attack tomatoes, potatoes and berries. Turn marigolds under soil to introduce a nematode repellent from marigold roots.
- Garlic discourages aphids, fleas, Japanese beetles and spider mites.
- Perennial chives repel aphids and spider mites.



- Basil repels flies and mosquitoes.
- Borage deters tomato hornworm.
- Nasturtium repels Colorado potato bugs, squash bugs and whiteflies.
- Rosemary and sage repel cabbage moths, bean beetles and carrot flies.
- Peppermint repels ants, white cabbage moths, aphids and flea beetles.

Predatory insects

Perennial yarrow, dill or carrot will attract predatory insects (ladybugs, damselfly, lacewing, Tricogramma wasp and praying mantis) that feed on the harmful, undesirable ones (aphids, mealy bugs and mites).

Other beneficial combinations

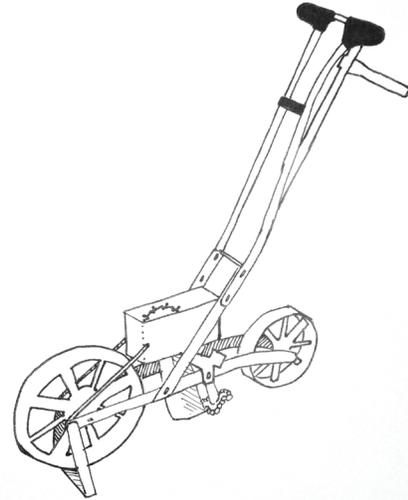
- Beans like cucumbers, corn and squash, but dislike onions and fennel.
- Beets are compatible with bush beans, lettuce, onions and cabbages.
- Cabbage, dill, onions and potatoes are good companions.
- Carrots, lettuce, radish, onions and tomatoes are good companions—keep dill away.
- Cucumber combines well with sweet corn, peas, radishes, beans and sunflower. Keep apart from aromatic herbs and potatoes.
- Lettuce grows well with onions, carrots and cucumbers.
- Onions should be kept away from peas and beans.
- Tomatoes, carrots, onions and parsley are good companions.

Seeders

Precision Seeder: The four row precision seeder allows for planting four rows of seed simultaneously. This seeder is only about 12” in width and is used with a wooden handle. This tool is ideal for planting small areas such as a greenhouse or cold frame. It requires finely-worked uniform soil in order to get good seed to soil contact. The main benefit of this product is the precise spacing between rows and the maximization of growing space in smaller areas.



Single Row Earthway Seeder: This seeder plants a single row at a time, but it accommodates a wide variety of seed sizes. Its seeder uses exchangeable plates with holes for different-seed sizes. The front wheel is geared with the plate as it drops seed down an adjustable planter spade. A small chain follows the spade to cover the seed with dirt (see diagram below). The seeder works well with small seeds such as lettuce, radish and carrot seed. The planter works with larger beet or squash seed, but many claim that too much seed is wasted and prefer to direct seed by hand.



Planting Cycles and Seasons

AFSC's New Mexico program suggests paying close attention to lunar cycles and daylight hours in order to ensure the best germination, growth and yields for year-round production. Also, a good understanding of the seasonality of certain crops is important for planning and operational purposes. Farmers' Almanac is a great resource for keeping track of lunar cycles and dawn and dusk hours. Indications on seed information will detail ideal planting dates and conditions.

Lunar Cycles

Traditional land-based people have always planted by the cycles of the moon and present day farmers find that this often leads to increased crop yields. The gravitational pull of the moon affects plant germination and growth as well as the tides. Observe when the moon is full and when it is new. Plant root crops after the full moon, as the moon is waning or decreasing toward new. Plant above-ground crops after the new moon as the moon is waxing, or increasing toward full.



Daylight Hours

The number of hours in the day with sunlight makes a major difference in the ability to successfully germinate and grow vegetables. Plants germinate and grow best with ten or more hours of daylight. When there is less than 10 hours of daylight germination is more difficult and plant growth slows significantly.

Sample Monthly Planting Guide (Based on the middle Rio Grande valley; this will vary by region):

January: After mid-month, plant leafy greens and radishes under row cover and in cold frames.

February: By mid-month, plant peas (snap peas and snow peas). Start tomatoes for early season planting in cold frames.

March: Plant leafy greens and radishes under row cover and in cold frames. Plant early season starts for outdoor production of nightshade varieties: tomato, peppers, eggplant. Start herbs indoors.

April: Plant leafy greens and radishes under row cover and in cold frames. Transplant early season tomatoes into cold frames. Trellis and prune tomatoes. Direct plant root crops.

May (last frost by mid-month): Transplant nightshades outdoors. Direct plant cucurbits, beans and root crops for outdoor production. Plant leafy greens and radishes for outdoor production.

June: This is the end of the leafy green planting cycle through the hot months. Weed, aerate and thin plantings of warm-season crops. Cover crop cold frames.

July: This is the end of early squash season. Replant squash for fall harvest. Replant the outdoor production area in root crops, legumes and leafy greens for fall harvest. Continue harvest of nightshades.

August: Plant hard-skinned winter crop.

September: Plant late-season pea crop. Plant late fall crop of leafy greens for winter production.

October: Harvest winter squash. Turn under summer plants. Harvest leafy greens. Cover crop the outdoor production area.

November: Coldframe/infrastructure construction, maintenance, and winterizing

December: Harvest winter leafy green crops.

Pest and Weed Control

An organic farm cannot depend on synthetic pesticides or herbicides for all of the hard work in controlling weeds and pests for the farmer. Synthetics include toxic compounds that are expensive and harmful to water sources, soils and habitat. Organic farms pride their ability to produce an abundant variety of products by only using manual techniques and investing in low-impact approaches to pest and weed control.

This section will explain the identification and management practices for both weed and pest control. It will address approaches to weed and pest control from the least costly/laborious management practice to more intensive approaches to control these undesirable plant and insect varieties on your fields.

Weed Control

Weeds pop up in beds and rows as soon as you begin to irrigate, especially when cultivating land for the first time. Dormant weed seeds in the soil can withstand years. These will take time to hand weed

out of your growing area in the first few seasons, but eventually with good soil-building practices and a consistent cropping plan, weed infestations should reduce. With several products, such as lettuce and salad mix, the desired plant can outcompete the weeds that germinate in the soil.

The approach to weed control depends on the stage of your fields/beds/rows and the stage to which the weed has developed. A new field requires a general cleaning, unlike cultivated space that needs routine weeding. Obviously, removing weeds at an early phase is ideal and much easier than having to deal with them once their roots and stalks grow. Do what it takes to till, mow or pull weeds before they go to seed, creating a worse problem. But it is difficult for small farmers to address every single weed that is on their field. So take a realistic approach to what can be weeded efficiently while conserving a saleable crop. Also, there are distinct weeding considerations for annual and perennial crops, as detailed below.

Common Nuisance Weeds in Middle Rio Grande Valley:

Johnson grass, blue grama: Planned weed management is necessary.

Thistles, knapweed, bursage: Pull young, before too thorny, or use gloves or burn when dry.

Kochia: Pull young or burn in winter.

Crabgrass, prickly lettuce: Pull young or burn dry.

Bindweed, morning glory: Till, pull vines, dig out rhizomes up to 2–3" under the soil.

Siberian elm: Pull young or risk a nutrient-sapping, firmly rooted invader in the way.

Puncture vine or goatheads*: This nasty carrier seed is a sharp, thorny, round seed that resembles a horned animal's head. The plant crawls along the ground and is best controlled by hand or with a hoe.

Verdolaga or purslane*: These succulent plants crawl along the ground and are best controlled by hand or with a hoe.

Quelites or lamb's quarters*: Pull by hand or use a hoe.

Pigweed or amaranth*: Hoe or pull early with gloves; these tend to root firmly.

*Note: These are edible plants.

Ideal weed control tools:

- 5-gallon propane tank and torch
- Hula (or stirrup) hoe
- Traditional pull hoe
- Long-handle and hand-held cultivating fork
- Hand-held gas or 3/1 powered weed trimmer
- 240cc 3-speed, walk-behind rototiller
- Machete
- Iron rake, aluminum Rake



Hula hoe

New Field Mass Weeding

In many cases, especially in the South Valley, you will be recovering land that has been in pasture grass, alfalfa or left fallow (bare or only has weeds). There may be overgrown weeds and grasses. The ideal approach is to clear the field and remove debris in the winter. A large tractor may be needed to pull up tree stumps and stubborn weed-infested sections. Use machetes, hoe, dig or mow to cut down overgrown weeds. Rake into piles and burn with a torch. Turn the soil with a plow.

Pasture grass is difficult to disrupt. Even turning it under leaves the rhizomes in the soil, and they will sprout with water. A good approach to planning to cultivate a pasture grass field is to use ground cover or sheet mulch to kill the grass from lack of sunlight. Otherwise, expect to need to sort grasses out of salad mixes and to clear weeds from between plants in the row and between rows throughout the growing season.

Don's Tip

Make sure to save your back by setting early the practice of weeding when weeds first sprout and aerating the soil simultaneously. A very sharp 2" hula hoe is ideal for this. It can remove weed sprouts and loosed hard topsoil with short push-and-pull motions.



Cultivated Annual Growing Area

The activities of annual planting, harvest and sequential planting in annually planted rows and beds will likely disrupt the weed pressure. Weeds will persist in your beds and rows nonetheless. Depending on the intensity of weed pressure, the grower can decide how to address weed issues. Densely planted beds of salad mix, arugula or beets tend to be difficult to weed with a tool without harming plants. Hand weeding is preferred. Squash and cucumber tend to cast shade and outcompete weeds in close proximity. Peppers, tomatoes, eggplants and beans have enough space between plants to weed with a hula hoe. Run the hula hoe underneath $\frac{1}{2}$ –1" of the soil surface in a back and forth motion. Move the double-edged hoe blade about 4–6" back and forth. Take care not to damage the plant stem. Outdoor rows can be weeded the same way. Paths between rows can be mowed and tilled to reduce weed pressure.

Cultivated Perennial Growing Area

Perennial fields are prepped and planted only once, and plants are tended over several years. These fields require periodic attention in order to prevent weeds from overtaking the plants and harming development, especially in the early years of planting a perennial field of asparagus or blackberries as in AFSC's New Mexico program. Using ground cover cloth around the base of the plants and in between plants will reduce the amount of weeding that is necessary later on. Also, planting a cover crop of white clover will fix nitrogen and outcompete other weeds in the paths. Clear paths with a mower, rake and tiller. Use a hoe or weed by hand between plants in the row, taking care not to damage the plants or the root structure.

Pest Control

Management practices for pest infestation take many forms on an organic, small-acre farm. It is important to properly identify nuisance pests before they infest to unmanageable levels. This section will review commonly encountered pests on the small-acreage, organic farm operations that AFSC's New Mexico program works with in the Middle Rio Grande Valley and present approaches for control or management. One important aspect to note is that the diversity of crops and consistent soil-building practices should help in preemptively establishing pest control measures.

Basic tools for pest control: Rototiller, backpack sprayer or hand-held sprayer, 5-gallon buckets, masks, gloves and eye protection.

Parasitic and beneficial insects: These species of insects feed on the nuisance insects in your fields. These can be purchased or attracted with certain flowering plants in the carrot and dill family: ladybugs, lacewings, damsel bugs and Tricogramma wasps.

Repellents

Organic farms must use insect repellents that are approved by OMRI (Organic Materials Review Institute, www.omri.org). South Valley growers have a few homegrown methods, but manufactured compounds must be registered as safe under organic certification. They are:

Neem oil: This is derived from the seed of the neem tree, an evergreen endemic to India that has numerous cleansing and astringent properties. Dilute neem oil prior to application.

Organic tobacco, chile powder or detergent: These should be all natural (don't break up a cigarette or use laundry detergent from your cupboard). Dilute 1 cup of solids in a 5-gallon spray pump or backpack sprayer.

Organic Insecticides

Synthetic pesticides (such as DDT) are extremely harmful. The following is a description of natural or organically approved insecticides that will help to control infestations. Practice extreme caution even when applying these products, as some are still toxic to a certain degree. Gloves, masks and eye protection are standard practice when applying these products.

Pyrethrum: This is an organic compound made from a certain species of chrysanthemum. It is originally developed from powdered, dry flowers. Pyrethrum is unstable in sunlight and preferably applied early in the day. Take precautions when applying this powder. Use gloves and a mask, since the dust can be irritating. Also, make sure the pyrethrum product you purchase is OMRI certified and do not confuse it with synthetic permethrin, which is manufactured to resemble the chemical composition of natural pyrethrum.

Diatomaceous earth: This off-white powder is naturally occurring sedimentary rock that is crumbled into a powder for insecticidal application. The product is made of fossilized remains of diatoms, a type of hard-shelled algae. Diatomaceous earth kills pests by absorbing lipids through the insect exoskeleton, causing it to dehydrate.

Safer Brand: This is a brand that produces an array of OMRI registered repellents and pesticides. These natural compounds are short-lived and will break down in the sun, so apply early in the day.

Insecticidal soap: OMRI listed insecticidal soap attacks a broad spectrum of pests.

Spinosad: This is a synthetic reproduction of a naturally occurring chemical in the soil. It controls pests through a fermentation process that kills in 1–2 days.

Bt: *Bacillus thuringiensis* is a naturally occurring soil bacterium that when propagated and concentrated is toxic to pests. It is applied in powder form and is useful in controlling all types of pest infestation. Corn producers will need to apply diluted Bt to the silk on corn husks as the grain head opens and matures in order to control corn moth caterpillar.

Common pests

Aphids: These are small white or black insects that thrive on the base of lettuces and leafy plants, especially in greenhouses during cold months. These bugs feed on the sap of tender leaves and if left unchecked can damage tissue structure, stunt development or alter fruit production. You may control these pests by purchasing or attracting beneficial predatory insects such as ladybugs, lacewings, parasitic wasps or damsel bugs. Also, spray leaves while in the soil with a high-pressure hose to remove aphids. Insecticidal soap will control aphids if applied early. Lastly, if infestation is minimal, aphids will wash off leaves during the wash and rinse of produce. The “honeydew” secretion from these and other pests can transmit disease

Thrips: The first sign of these pests is pale yellow spots on leaf surfaces, and eventually a silver film develops. There are many colors and sizes of this pest. They are known for their jagged wings, but some claim they look like worms with legs. Their fecal matter and telltale scraping and rasping on leaf surfaces are easier to discover than the insect itself. Also, they are fast moving and will cover a large area quickly. They have wings in the adult stage and will fly to reach more area. Address these insects upon discovery to control them in the larval phase. Apply insecticidal soap or OMRI registered repellent. Dilutions of tobacco, chile powder, and detergent or neem oil are known to be useful in this case. These can be controlled with parasitic wasps, ladybugs, damsel bugs and lacewings.

Whiteflies: These bugs multiply rapidly. They are easy to detect, as they burst into a snowy cloud when their plant host is moved from watering or wind. These insects attack the leaves, buds and stems of host plants. Without control, infested plants yellow, wilt and eventually die. .

Flea beetles: These black, hard-shelled beetles prefer cole or brassica crops such as broccoli, cauliflower, cabbage, kale, collard greens, radishes, beets, arugula and turnips. Their characteristic “shotholes” leave punctures that resemble a shotgun blast through the leaves. Heavy incidence will reduce the marketable quality of produce. Control with diatomaceous earth, neem oil, insecticidal soap, or most effectively with floating row cover during the sprouting phase of direct plantings.

Tomato hornworm: These caterpillars will cause significant damage before they are found, due to their camouflaged color. These reach 3–4” in length as caterpillars and have a large wingspan as moths. Their larvae burrow in the soil and pass through the pupae stage, and then emerge as moths in the early spring. Adult moths mate and deposit eggs underneath plant leaves. Pupae mature in 3–4 weeks and work their way onto tomato, eggplant, pepper and tobacco plants. These are best controlled by hand and dropped in a bucket of soapy water. Short-lived, botanical pesticides will control large infestations. Ladybugs, lacewings and Tricogramma wasp feed on the hornworm eggs. These can be mechanically controlled with floating row cover or planting in cold frames. Rototilling after harvest will destroy overwintering pupae at the top of the soil.

Squash bug: Squash bugs will take over squash plants and sap them dry. They overwinter in the soil and mate in the late spring. They impact zucchini, summer squash and pumpkins significantly. Their eggs are orange and laid in a cluster on the underside of squash plants at the vein intersection. In the Middle Rio Grande region, planning to pull spring plantings of squash plants by July 4 and replanting after that date is a general rule of thumb for addressing squash bug pressure. We have found in working with development of the Agri-Cultura Network that the market value of

squash is not cost effective for broadcast application of natural pesticides. It is more worthwhile to sacrifice whatever goes to the squash bugs and replant for a fall harvest. In some cases, the squash bugs do not have a very severe impact, but in severe infestations manual removal or a low-powered vacuum will rid the pests from your plants.

Integrated Pest Management (IPM) vs. Pest Control

Pest control is the method used to respond to an infestation. These control practices must be documented and declared to organic certifiers. Integrated pest management (IPM) involves a preventative approach to controlling pests by poly-cropping, planting trap-crops, tending soil health and planting companion crops that attract beneficial insects. Thus, IPM is a long-term, systemic approach to achieving ecological and biological balance on your farm. Pest control is a short-term response to threats to crops in the ground.

According to the U.S. Environmental Protection Agency, IPM “is an effective and environmentally sensitive approach to pest management that relies on a combination of common-sense practices. IPM programs use current, comprehensive information on the life cycles of pests and their interaction with the environment. This information, in combination with available pest control methods, is used to manage pest damage by the most economical means, and with the least possible hazard to people, property, and the environment” (www.epa.gov/pesticides/factsheets/ipm.htm).

Don’s Tip

Manage your farm by walking it. Walk through beds and rows on a daily basis. Get on the level of the plants to assess the impact of pests and weeds. Consider plant health by documenting leaf, stem and fruit characteristics. This should be a daily practice, and it will keep you up to date with the harvest, nutrient, weed control and pest management aspects of your farm operation.

Part Three: Farm Budget Planning

Introduction

The farm budget includes two important and interrelated elements: the business plan and the crop plan. A business plan is a broad estimate of costs and investments over a certain period of time required to harvest and market a crop. The crop plan is a season description and diagram of what crops will be sown in the given season, in what arrangement and in what intervals. These two planning documents will inform one another and also give the farmer a clear understanding of costs vs. expenses as business operations are under way.

This section describes the necessary elements for both a business plan and a crop plan. It will also offer templates for entering your own data and determining the start-up and annual costs to operate an organic farm on 1 to 3 acres. Above all, maintaining a clear record and schedule of activities will keep labor working efficiently, and business records will help to achieve business viability by allowing you to understand which enterprises operate at a loss and which provide a gain.

Many have heard that most small businesses take 3–5 years before turning a profit. This is true of small farms as well. However, it is important to factor in whether you will receive a salary as the farmer or whether you will not collect a salary and allow those funds to return into general operating costs. Participating in community-based development projects, working with microfinance organizations, or obtaining pre-harvest funds through a CSA or sales account are ways to defray the initial start-up costs for a thriving, year-round farming operation. Ideally shoot for a 20% return in net revenue (after all expenses are paid) from farm sales by the third year, which is a strong indicator of success. Remember, most operations take 3–5 years to merely break even. A last word of advice is to keep timely records on a regular basis. It is no fun to leave it all until the end of the month or the growing season to add everything up. Do yourself a favor and stay on top of it.

Don's Tip

Grow 10 high-value annual crops and two high value perennial crops per year. Make it a goal to sell \$100 of each crop every week



Business Plan

A comprehensive business plan should be designed prior to engaging in farm activity and investing time, energy and resources in the land. Also, developing a budget is a lot of work at the outset, but in subsequent years it should be adapted and refined to suit the farmer's year-round need for transparency in business operations and documentation. Bernalillo County Cooperative Extension Service helped us in developing budgets for Agri-Cultura farms. Their advice was to know your market before investing in land, labor, and seeds. Essentially, estimate what you plan to sell, how much you plan to sell, and how much you expect to earn from sales. Part Five discusses marketing produce to multiple venues and budgeting around a broad range of price points, but for now, this section will detail the important things to consider when figuring out what it costs to get produce to market and how to reduce business expenses.

Keeping Clear and Consistent Records

Obtain a receipt for every service or material input on your farm, even wages for on-farm labor. File these receipts, because you will be able to deduct these expenses as business expenses from your gross revenue. However, before beginning to make purchases you will need to estimate what it will cost to operate your farm. Here the necessary items to estimate and then record:

Seasonal expenses

Budgeting for different parts of the growing season will require some experience before a grower will hone what to invest in farm production compared with what the market can bear. This is a cost vs. benefit analysis of the total sum of investments in a certain crop vs. the revenue generated from the sale of that crop.

For example, a cold frame with eight 100' × 3' beds will yield approximately 600 lb of salad mix planted in four rows along a 3' growing bed. That comes to \$3000.00 worth of salad mix in the first harvest (it could be harvested two more times, but the yield diminishes each time). There are two sets of expenses to consider in this scenario: first, the one-time cost of a cold frame, the investment in drip tape, and harvesting buckets and bags; and second, labor cost in tilling, prepping, amending, planting, watering and weeding the eight 100' × 3' beds.

Costs (excluding infrastructural investment of rototiller, rakes, shovels, cold frames and harvest tools):

1000' drip tape (1/5 of total roll) one-time	\$50.00
50' poly tubing one-time	\$35.00
24 valves (3/bed) one-time	\$48.00
1/12 of annual expenses (in relation to total production)	\$500.00
Harvest labor (12 hr/bed × 8 beds = 96 hr) @\$8.00/hr major cost	\$768.00
Prep labor (\$8.00/hour × 32 hours) per planting	\$256.00
Seeds (1 oz/bed × 8 beds = 8 oz)	\$85.00
Total cost of production:	\$1742.00

Seeds: The cost of seeds can be offset by organizing a CSA where shareholders invest in your production prior to the growing season. Otherwise, revenues from the previous season will go to investment in seed purchase. Purchase seed based on records of what did well and what did poorly the previous season. Also, evaluate the amount that will be required to get through the growing season without having to acquire more seed mid-season.

Amendments and nutrients: Blood meal and bone meal; organic compost.

Origins: Document where you purchased seed. Also, detail the cost and labor to start certain crops indoors for early season production.

Labor: You will require paid labor at every step along the way. From soil amendment, to planting, weeding, harvesting, washing, prepping and packaging, the more you grow, the more you sell, the more labor you will need. Track planting cycles with dates, sequence and general time to complete task.

Annual expenses or fixed costs

These are expenses that should be consistent from year to year. Conservatively budget around these fixed expenses first before considering expansions, infrastructural investments or operational modifications.

Water, irrigation: A well pump should be a single expense, but maintenance and care will come at a cost. Drip irrigation supplies: drip tape, valves, poly-tubing and tube punch.

Fuel, electricity: Energy expenses for indoor grow lighting, cold storage and well pump will add up through the year. Keep a record of this monthly expense to project how to cover this on an annual basis.

Rent: Monthly costs for rented properties or storage. Also, factor in rental equipment—tractors, tillers, etc. It is a good idea to obtain insurance coverage for damage to rented properties to cover your back.

Permits: There are fees associated with operating under a city or county business license. Also, health permits and organic certifications come at a cost.

Insurances: Third-party liability insurance is the coverage you need to be protected from any claims that your food harmed an individual. Look to obtain a policy that covers damages up to \$1 million. The general cost for this type of policy is about \$500.00 per year.

Structures: Structural investments tend to be a single expense, but maintaining requires a reserve fund to cover repairs and upkeep. Figure the general cost for this activity and factor it into the annual budget.

On-farm necessities: Shovels (spades and transfer), iron rakes, broadfork, rototiller, landscape rake, Pull Hoe, Hoop Hoe

Estimated Revenue

Sales estimates: This may be difficult for growers who have yet to market produce. Part Two of this manual gives price estimates as a point of departure. Make a conservative estimate of your potential sales based on estimated yields. This estimation tends to become more accurate with each year of productive experience.

Annual Budget:

Market projections should be based on clear and consistent record keeping. This is literally a mechanism for limiting your expenditures. Don't spend more than you can be sure you'll earn! The farm budget details the total costs and earnings over the entire year. You should make an effort to stay within your projected budget so as not to get overextended or in debt in order to produce on the land. Keep things within obtainable goals. Four out of five small businesses fail because they were not able to stay within their budget in the first years of operations.

Profit margins: A general rule of thumb is to aim for 20% in earned revenue (net) after covering expenses, labor, and your own salary as the grower. This 20% profit should be used to reinvest in infrastructure and expansion of varieties or technologies for farm production. Or use it on a vacation; you probably earned it if you were able to achieve that target revenue.

Sales projections: These are difficult to estimate in the first year of production. There are many factors to consider, but it is helpful to obtain clear market values for the produce that you plan to sell. Go to a few specialty grocers and take note of the retail price for items that you can grow and sell. Also, talk to extension agents or produce brokers to get an idea of the pricing along wholesale vs. direct sale opportunities.

Crop Plan

A crop plan is an essential tool for determining crops to grow and planning seeding, transplanting and harvesting to meet marketing goals. To make a crop plan, collect the following information about your growing area:

- Approximate dates of the outdoor summer growing season, the fall outdoor season, the cold (indoor growing) season, and the late winter/early spring planting season
- Growing area size and shape (Measure and sketch the growing area, taking note of any relevant features like shady or badly-drained areas.)

Use this information to decide which crops you can grow, devise a growing and harvesting schedule, and make a map showing where each crop will be grown. (AFSC's New Mexico program recommends planting ten annual and two perennial crops in a year-round plan.) Keep in mind that the crop yields will fluctuate in volume over the year, and your revenue will follow those fluctuations. (See the Farm Plan Draft in Appendix D for more on this kind of planning.)

Part Four: Season Extension

Introduction

In order to be economically viable, farmers need to generate revenue year round through season extension. Revenue is highest during the harvest season, when there are farmers' markets and high demand for locally grown, seasonal produce. But while farmers markets increase opportunities for direct sales, the high volume of produce drives down prices and increases competition. One way to increase revenue is to offer high-demand seasonal items (tomatoes, chiles, squash) before or after the other farmers through season extension.

This section presents four viable and accessible methods for season extension that small-acreage farmers can afford and manage. These infrastructural investments can be cost prohibitive for small farmers and new farmers, so they are presented in order of most affordable to most expensive: early season plant starts, floating row cover, high tunnel/hoop house construction and heavy-duty cold frame structures.

Early Season Plant Starts

This activity entails germinating nightshade varieties indoors with seeding flats and heating mats. The rationale behind this approach is that nightshades (tomatoes, chiles and eggplants) will not germinate in cold soil. So direct seeding only works well after the late frost. However, starting seedlings early and tending to them indoors will give the grower a head start once the last frost passes in the spring. In fact, many growers sell seedlings at farmers' markets in the early growing season as a marketable item. There are two options for engaging in this activity: invest in your own heated, indoor production, or pay an established nursery or greenhouse operator to provide the service for you. In 2011, Agri-Cultura farmers paid ARCA Organics \$18.00 per 24-plug flat or 6-week-old nightshade varieties. ARCA reports that this was the actual cost without profit margin for these flats. Here's what you'll need if you plan to do it yourself:

- A well-lit, southern-facing, heated structure (sun room, plastic tent, or greenhouse)
- Full spectrum fluorescent light fixtures
- Shelving or a high flat surface
- 244-cell flats
- 72-cell flats
- 24-plug flats (for 6-pack flats)
- A soil-less growing medium (usually peat moss with vermiculite, greensand and gypsum)
- Watering cans

How to Prep Plant Starts

This process could be done by leaving flats in the warmth of the sun in a window or a passive solar cold frame and then bringing them into the heated house at night. It all depends on what you have at your disposal and what you are willing to do. Plant in the 244-cell flat after the new moon. Fill cells $\frac{3}{4}$ full with soil-less growing medium. Set one seed per cell. Fill cells completely. Water with low pressure (a water can with spray works well). Water flats only to keep from drying out. After the first true leaves emerge, transfer seedlings to the next size up of cell flat. Add the necessary amount of soil-less medium. Make sure to time this accurately. Starting too early will cause tomatoes to get root-bound and struggle to develop and fruit. Plan to initiate starts 4–6 weeks before the last frost in May.

Floating Row Cover



This practice is useful for insulating cold-hardy plants, extending the growing season and protecting from pests. In the colder months, these plants will survive under row cover or in cold frames to temperatures just below freezing, however, the growth will be slower, since the plants must devote energy to surviving the cold. The type of row cover used depends on the time of year for which it is intended. Heavy grades are ideal for additional soil warmth during winter months. Light grades work well as a pest barrier in the summer months. Also, consider what type of support you will use for the row cover. AFSC's New Mexico program recommends 60-gauge wire for cutting into 6' lengths, bending into bows and staking into the ground. Bend the 6' sections into an arch, leaving the ends somewhat straight for inserting into the soil. Place a support bow every 5–6" along the growing bed. The bows should not stand more than 2" off the ground. Trim row cover to the correct length to extend over your growing area. In many cases, the roll of cloth is 8–10" wide. In this case, you can cover two rows at a time. Use rocks to weigh down the cover cloth. Shovel dirt along the edge to create a seal. In times of frost, this seal will protect frost from contacting your crops, as the frozen soil will bind the cloth to the ground and dew will freeze on the cloth and not on your crops.

High Tunnel/Hoop House Construction



This is a cost-effective approach to designing a structure that will protect crops from the wind and cold of the winter months, but can be erected and maintained with minimal effort or investment. This design requires leveling the field area and squaring the corners of the structure. Use two-by-fours to construct the framing for the baseboard, the end walls and the corners. Use 1" PVC tubing for the overall frame, rafters and perpendicular supports (Use 1 ½" PVC if you expect snows greater than 6"). Ideally, a structure of this type will allow an adult to enter without crouching and allow for digging out beds and paths for year-round production. Combine this with a heavy-grade cover cloth in the cold months to protect leafy greens and radishes.

Heavy-Duty Cold Frame Construction

A cold frame is a semi-permanent structure used to shield crops from wind and cold night temperatures during the winter. It uses a simple solar design to keep crops warm in the winter. These cold frames are integral to seasonal extension and winter production of salad mix as well as hardy leafy greens and radishes.

Tool List:

String line
Measuring tape
Sledge hammer
Post cap
Level
Drills: 1/4", 1/8" bits esp.
Drivers: #2Phillips, hex, socket
deep sockets & wrenches: esp. 1/2" and 7/16"
Ladders (at least two 10')
wood saw
metal saw
channel locks/vises grips

**Coldframe Material List**

For 30'x96':

2"x6"x12': 38 pieces
2"x4"x12': 36 pieces
16' rebar
240' chain link fence top rail
30' of 1 1/4" PVC
3/4" Tek screws: about 150
3" Wood screws: 5lbs.
1" Drywall screws: 2lbs.
1/4" eye screws: 8
1/4" eye bolts, washers, nuts: 36
300' of 3/8" rope

Don's Tip

Here are a few good ideas when assembling a cold frame made of galvanized steel tubing. First, have three to five ladders on hand of various heights; second, have two or three complete sets of drills, ratchets and multiple battery packs charged; third, consider assembling the arches (or rafters) on the ground and then hoisting into place with two to four people; fourth, square and plumb in sections of four arches (rafters) at a time.



Farm tools

- Four flat shovels
- Four round shovels
- Four hoes
- Four hula hoes

Toolkit

- 18-volt battery-powered drill
- Sawzall reciprocating saw
- Circular saw
- Extra battery

Additional

- 5-gallon water cooler
- 60-gauge wire—3000'

Rental List

- 8" auger

Shared List

- Shovels
- Wheelbarrow
- Hose
- Ladder
- 55-gallon drums



Constructing a Heavy-Duty Cold Frame

1. Identify site based on accessible area, water access and sunlight.
2. Square the area based on the dimensions of the structure.
 - a. Identify the corners of the structure
3. Set up the batter boards approximately 8' from the projected end wall area.
 - a. Drive two metal stakes into the ground with a sledgehammer. Nail 4' two-by-fours to the two stakes. The batter boards meet at 90 degrees.
4. Use two two-by-four boards at the corners of each intersecting wall for a total of 8 boards.
5. Use the Pythagorean theorem to square the building. $A^2 + B^2 = C^2$.
6. Use a dry line that is tied across the batter boards to determine the building dimensions and exact corner points.
7. Use an 8" motorized auger to dig holes 12" deep along the length of the side walls. The holes should be spaced to meet engineering specifications (approximately 5–6' apart).
 - a. Determine the amount of concrete needed per hole. Mix concrete and set poles level in the ground.
8. Assemble bows and start to place them atop the poles and begin to assemble the building.
9. Frame in end walls with doors and openings. Assemble the frame on the ground based on measurements of the opening to frame. Then hoist the frame and secure it with many helpers on hand.
 - a. Determine whether to use galvanized steel, treated wood or aluminum. Also, end walls are secured to 6" × 8", 16" pumice (cinder) block that will be buried halfway along the length of the end wall.
10. Skin it—put plastic in place and secure with spring-loaded tie-downs.
 - a. Use 3/8" rope to "pull" the plastic sheet over the frame of the structure.
11. Prepare beds for planting and seeding.

Part Five: Tiered Marketing

Introduction

It is important to have various marketing options throughout the year. Marketing options differ according to what is in season and to market demand for certain items. There will be times of year that you cannot give zucchini away, especially in August, but if you can bring zucchini to market, or offer it to your restaurant buyers, before the rest of the regional growers do, then you can fetch a better price. Given this logic, it is important to factor in the fluctuations in market price when budgeting to grow a certain crop.

The marketing sections below are focused on direct sales, restaurant sales, institutional sales and grocery wholesale. These sections will detail the material and operational necessities for vending produce at certain markets. This is a general overview of what you need and how to produce to meet a certain demand. Keep in mind that the marketing options that AFSC's New Mexico program has nurtured are focused on high-value crops for sale in direct-sale venues or to wholesale restaurant and institutional accounts.

Direct Sales

The term “direct sale” means that the grower (or representative) is selling produce directly to the consumer. There is no intermediary that usually charges a fee. This way, the farmer can ask a retail price for the product and retain a high percentage of profits from sales. The ideal venue for this is setting up a farm stand. One could set up shop anywhere, but there are a lot of regulations and legalities involved in selling fresh produce to the public, especially when you are doing it on public or government-owned land. That is why it is preferable to establish oneself at one of the many New Mexico Farmers' Marketing Association sanctioned markets (www.farmersmarketsnm.org).

Things to consider when vending at a farmers' market include the time of day that the market takes place, the duration of the market, and how much you need to earn to make that market worthwhile—a make or break point. Also, just as growers are required to put up funds in the off-season for seed, amendment and supplies, they are also required to pay market fees in the spring. Some markets will accept week-by-week fee payment, but you will not have a guaranteed location at the market. Location is important because market patrons tend to follow a routine when they come to shop. If they cannot find you, they will not buy from you.

Basic supplies for setting up a farmers' market stand

- 8' folding tables (at least two)
- Large baskets for loose greens
- Small baskets and trays for fruit and root crop
- Crates to add levels

- Price stands with signs
- Dry erase board
- Tablecloths
- Dual-display digital scale that reads to the 100th decimal point
- Produce bags
- Paper bags
- Ice chests/coolers
- Hand wash station (bucket, hand sanitizer, fresh water, liquid soap)
- Tongs for loose greens
- Cash box with \$100.00 bank—2 tens, 10 fives, 20 ones, 40 quarters
- Ground cover
- Shade umbrella or tent with sand bags or weights (no staking allowed)

Don's Tip

Always keep your market stand looking full and abundant. As the saying goes, “pile it high, watch it fly.” As inventory is reduced, continuously restock, rotate, and replenish. Break down tables as you sell out if items keeping remaining tables looking full.



Community Supported Agriculture (CSA)

A CSA operation entails selling “shares” of projected yield prior to the growing season. Shareholders receive a standard quantity of produce on a periodic basis. There is inherent risk for the grower and of course for the shareholder/investor. There will be times in the early or late season that all you’ll have to offer shareholders is cold hardy greens. Your shareholders should be educated, likely by the farmer, to understand the seasonality of produce availability.

The logistics and customer service of this model can be challenging. Santa Cruz Organic Farm suggests that CSA shareholders pick up their weekly produce share at the growers’ market stand. Other CSAs put boxes together for shareholders.

AFSC’s New Mexico program cautions that the CSA model requires a level of consistent production that is not feasible for most beginning farmers.

Wholesale Markets

The reality of wholesale in the context of small-acreage organic growers is that it is difficult for a single grower to satisfy the demand of a grower or a larger restaurant. Some smaller businesses will make the effort to design their menu around the diversity of crops and harvest that come from the small farm. But if small-acreage growers want to compete with large-scale food distributors, they need to aggregate crop under certain quality and handling standards. This approach suggests that small farmers cannot sustain the demand for large volume at a lower price that is inherent in wholesale production, but in cooperation, if growers agree to share market options, they can gain access to broader marketing options.



In the case of the South Valley, AFSC's New Mexico program worked with three community-based organizations to form a local produce wholesale brokerage, the Agri-Cultura Network. ACN formed initially as a limited liability corporation (LLC) in order to obtain vendor status at institutional markets in 2010. Currently, ACN specializes in placing growers' produce in wholesale markets as well as institutional markets such as the Albuquerque Public Schools. The three community-based organizations had worked in various aspects of community-based agricultural production for several years. However, neither could supply a high-volume account like the Albuquerque Public Schools on their own. In collaboration they can sequence plantings of produce for school lunch to grow throughout the colder months.

An important consideration is that once the food you've grown leaves your possession for sale through another venue there will be fees assessed by the intermediaries, and permits and certifications as safeguards for certain handling and safety issues. The beauty of the farmers' market association is that they advocate for the right of farmers to sell produce directly without needing to invest in prohibitive costs and administratively cumbersome insurances and health permits. So a part of farmers' identity and ability to talk about their produce is lost in this arrangement. That is why it is important to consider who you want to represent you in the marketplace and follow up on their progress. Go check on how your salad looks that the broker sold to La Montañita, for example.

Lastly, this approach is based on the understanding that farmers have enough work to do to keep farmland healthy and productive. Should farmers need to leave the farm to create, attend to and deliver to restaurant accounts, they will do so by sacrificing important on-site farm work time. These high-value, low-volume accounts do not do much on an individual level to make a major difference for growers, but in aggregate they will support small farmers through the lean months and work with growers to obtain the volume and quality desired. Also, for this model to run smoothly, there needs

to be a standardized operational procedure with which all growers comply. This can be as simple as packaging and labeling standards or as complex as harvest, handling, processing and selection standards—it all depends on what the market requires.

Restaurant Wholesale

Restaurants will pay closer to retail price because they want the farmers' market freshness without having to go to market. Individual growers can bring samples of their product to the potential buyers and negotiate arrangements. A broker will work to bring samples, establish sales accounts, invoice, and manage payments, inventory and supply in order to keep the chefs content and ordering and keep the farmers secure with timely payment and consistent communication.

Restaurants will detail what regulatory compliance they require in order to buy from you. Some, mostly small businesses, will not request anything, and others, likely bigger restaurants, will require obtaining vendor status and providing documentation of health permits and tax IDs.

This is where Agri-Cultura is the ideal aggregation mechanism for farmers. ACN pays for and manages the permits in lieu of the grower. The grower in complying with ACN standards is inherently within the jurisdiction of ACN's permits and certifications. This restaurant market requires absolute premium in selection of crops.

Institutional Wholesale

This scenario allows growers to aggregate crop for a large-volume market. Larger volume tends to signify lower pricing, so be cautious and aware of the pricing window you have to work with. Institutions like schools, hospitals, universities and corporations have a large demand for food service items. These markets may not need the highest quality, since they will be processing the food items for cafeteria or food service settings. However, handling and safety tend to be major concerns for these markets, as they have overarching insurance policies that require that the foods they provide have been sanitized in a commercial kitchen, and that vendors have a health permit, business license and tax ID. These regulatory requirements are a challenge for a small-acreage producer to obtain, but for growers aggregated in a group this becomes accessible. The main challenge for accessing these markets is qualifying for and obtaining vendor status. Once that hurdle is cleared, then the grower group can figure out the logistics of providing a consistent quantity, quality and variety to satisfy the account.

Grocery Wholesale

Grocery wholesale can be one of the most challenging markets to satisfy. On the good side, the grocer will go with the flow if there should be shortages or some inconsistency in crop. On the bad side, they pay low and expect a long shelf life and premium quality. Ideally, this should be the last option before fulfilling the demand from the above listed wholesale accounts. Grocers will likely require obtaining vendor status, food handling and safety regulatory compliance, organic certification, and health permits. Then they will order what you have based on what they think they can resell.

Appendices

Appendix A: Soil Testing

Test Your Soil

Guide A-114

Revised by C.R. Glover, Extension Agronomist and R.D. Baker, Area Extension Agronomist

Cooperative Extension Service
College of Agriculture and
Home Economics



This publication is scheduled to be updated and reissued 4/05.

Soil tests provide a scientific basis for regulating available plant nutrients. Recommendations on kinds and amounts of fertilizer to apply and soil management practices are based on test results. Tests on a sample that does not accurately represent the area are likely to be misleading. The following directions can help you take a representative sample of the area you want tested.

Supplies

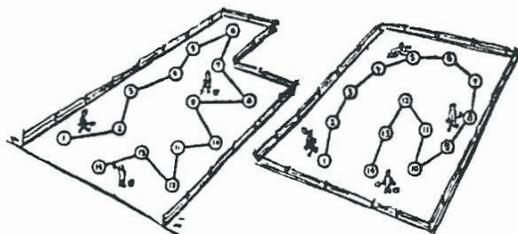
A soil auger, a soil tube, or a shovel and knife.
A clean bucket or other suitable container. Do not use a container made of metal.

A sample box and an information sheet, which you can get from your county agent or by writing to the Soil and Water Testing Laboratory, Box 3Q, New Mexico State University, Las Cruces, New Mexico 88003.

Where to Sample

Take a composite sample from each area or field, but as a rule, try to limit the sample area to no more than 40 acres. If you have large trouble spots or areas that differ extremely in appearance, slope, soil structure, productivity, drainage, or soil treatment, put a composite sample from each of these areas in separate sample boxes.

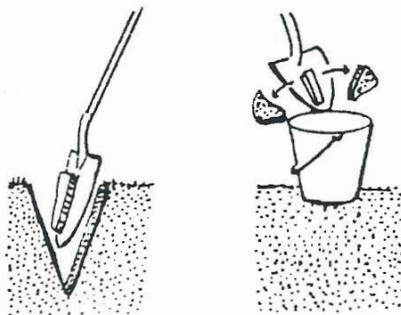
For a composite sample, take soil from at least five sites in a garden or lawn and up to 15 sites in a large field (as illustrated in the diagram). Avoid areas near a road, fence row, compost pile, fertilizer band, or other non-typical areas. *(Image not available. Please contact NMSU Agricultural Communications for a hard copy.)*



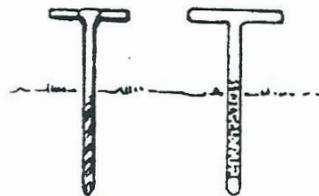
How to Sample

At each site remove any surface litter such as straw, leaves, and old stalks.

If you use a shovel and a knife, dig a hole about six inches deep. Take a slice of soil one-half inch thick and six inches deep and keep it on the shovel. From the center of this slice, cut a strip one-half inch wide from top to bottom and put it in the bucket. Repeat this at each site in the field.



If you use a soil auger or soil tube, take soil cores about six inches deep at each site and put in the bucket.



Mix the soil from all the sites in the same area. Place soil on a newspaper. Break any clods or lumps and let the sample dry at room temperature. Do not use heat for drying. Fill the sample box with the dry soil.

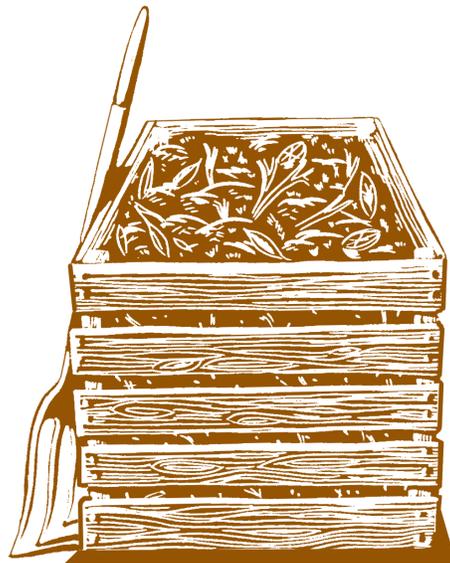
Appendix B: Composting



BACKYARD COMPOSTING MADE EASY

Call (505) 827-0197
for free brochures,
presentations, or workshops

BACKYARD COMPOSTING MADE EASY



New Mexico Environment Department
Solid Waste Bureau
1190 St. Francis Drive
P.O. Box 26110
Santa Fe, New Mexico 87502
(505) 827-0197
Call for free brochures, presentations,
or workshops



What is composting?

Composting is recycling organic materials such as lawn clippings, vegetable scraps, leaves and other wastes into a rich soil amendment/conditioner.

Why compost?

You can create your own inexpensive soil amendment and at the same time reduce disposal costs.



Your kitchen garbage will smell much better without kitchen food scraps.

Less food scraps go down the disposal where water is wasted and septic tanks are overworked.



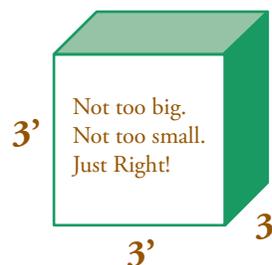
Your garden and landscaping plants will benefit from the nutrients in this soil amendment.

As opposed to most fertilizers, compost will release nitrogen over a longer time period.

Approximately 13% of the material in landfills is green waste and 12% is food waste, both segments of which are excellent for making compost. Instead of sending these wastes to the landfill, make them a gourmet delight for your garden or trees.



What is a good size for a compost pile?



Where should I put the compost pile?

Shaded or sunny areas are acceptable locations, however, always cover the pile with a carpet scrap or a large plastic garbage bag to seal in moisture. The reason for most compost failures in New Mexico is that they are too dry. A nearby water source (faucet or garden hose) is a good idea to ensure your pile stays moist.

Hint: Top off your kitchen scraps container with water each time you take it to the compost pile.

Will I need any special tools?

A shovel or a pitchfork are the only tools needed!



Some basic rules:

Turn the pile approximately every 2-3 weeks to speed up the breakdown of materials. When building, turning or transferring compost to a new bin, wet each successive layer (approximately every 6" layer). This ensures that the compost is also moist in the center of the pile. Squeeze compost in your hand to judge moisture content. If the material feels like a damp sponge, its moisture content is sufficient.



I know the materials in my pile will be mixed up eventually, but how do I add them at first?

Layers should be approximately 6". However, it may not be possible to have 6" of ingredients such as kitchen scraps. In that case, simply add as much as you can.



Water after adding each layer. It does not matter in what order layers are added, since they will eventually be mixed together anyway.



What can I put in the compost pile?



Add these:

Leaves, tree clippings (shredded), grass clippings, vegetable scraps, fruit wastes, coffee grounds (with filter), livestock manure (except pig), rabbit manure, paper, paper towels, *weeds.

Do not add these:

Meat, bones, diseased plants, fat, oils, pet manure (cat or dog), milk or cheese (dairy products), **wood ashes.

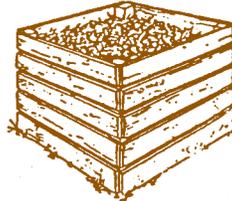
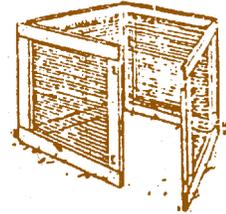
* If you are concerned about weed seeds, place the weeds in a black plastic bag in the sun for a day or two. The high temperature will kill the seeds. Composting will also decompose most weed seeds.

** Wood ashes are alkaline and increase the alkalinity of our already too alkaline soils.



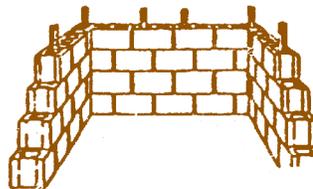
Easy materials to use for constructing your bin (if you choose not to buy a commercial bin):

Wood frame with hardware screen



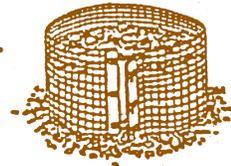
Four shipping pallets on end, wired together

Straw bales (no nails, no screws, no wire)



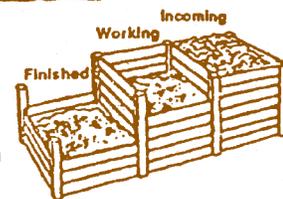
Concrete Blocks

Wire fencing - approx. 10 linear ft. for a 3' diameter



Compost heap

Slatted multi-bin



How do I troubleshoot if things are not perfect?

Concern	Possible Causes	Solution
The compost has a bad odor.	Not enough air, excess moisture and/or too compacted	Turn pile. Add dry material like leaves and wood chips if the pile is too wet.
The center is dry. (very common in New Mexico)	Not enough water.	Water each layer as you turn the pile. Cover pile with carpet scrap, plastic sheet, etc.
Low pile temperature.	Pile is too small. (less than 3'x3'x3')	Collect more materials & mix the new with the old. Insulate sides.
The heap is damp and sweet smelling, but doesn't heat up.*	Lack of nitrogen.	Add fresh grass clippings, manure, food scraps or nitrogen fertilizer.
The heap smells like ammonia.	Too much grass or other high nitrogen material.	Turn it to aerate, add dry leaves or wood chips.
Pests in the pile.	Rotting food wastes attract pests.	Dig hole and bury new food wastes deeper in compost pile. Turn pile more often.

* Heat generation is not necessary, especially if you are using composting redworms.



What is vermicomposting?

Adding compost “Redworms” speeds up the compost process about 2 times and requires less turning of the pile. (“Redworms” are generally not the variety sold for fishing, however they are inexpensive and readily available.) Redworm vendors/retailers can be located at www.nmenv.state.nm.us/swb/compostingmulch.htm

How long before I’ll have compost?

Frequently turning your compost pile can yield finished compost in several weeks. Piles turned less frequently may take as long as a year to produce finished compost, so get some exercise and turn your pile.

What does compost look like when it’s ready?

Finished compost usually settles toward the bottom of the pile and resembles a dark, rich, sweet smelling soil. Separate compost from the rest of the coarse material with a screen suitably sized for your needs.

How do I apply my compost?

Till in or top dress approximately 1” of the compost around garden or landscaping plants, bushes or trees. Apply as far out as the stems or branches extend. You can also mix it in with your house plant potting soils.

Although it is not a total solution to the solid waste problem, volume reduction clearly provides many opportunities to deal more efficiently and effectively with solid waste disposal. As existing landfill space is used up, disposal costs will climb. By reducing the volume of our waste through composting, we will conserve natural resources and at the same time reduce existing pressures on New Mexico’s landfill disposal capacity.

We would like to thank the following for their contributions:

Albuquerque Open Space Visitor Center

Bernalillo County
Cooperative Extension Service
New Mexico State University

Plant Science Department
Cooperative Extension Service
New Mexico State University



This brochure is printed on recycled paper, naturally.
2009

Appendix C: Post-Harvest Handling

Post-Harvest Handling Reference Guide

Produce is most susceptible to damage and hastened spoilage in the time immediately after harvest. The following handling procedures will help to reduce loss and damage and also increase the duration that produce is marketable. A few key points: sanitize all surfaces that produce will touch, anything that falls on the ground is a loss and all personnel handling produce must be trained and approved in proper handling and food safety procedures. Watering the night before harvest will increase weight and turgor (firmness and fullness) of crops.

Salad Mix (including baby greens such as spinach, mustards, kales and arugula)

Harvest: Cut leaves at 4-6". Cut in early morning. Keep away from direct sun at all times.

Storage: Keep cool in an ice chest with bagged ice and a cloth or paper barrier between ice and greens to protect from damage. Store at 32–45 F.

Preparation: Sort the lettuce by spreading a single layer across a large sanitized surface. Remove any debris, wilted or yellow leaves, stems, or insects and snails. Clean the salad in small batches in cool potable water in a series of deep sinks. Add a capful of food grade bleach to the first sink. Submerge the salad and gently rotate it with your hands, being careful to not bruise the leaves. (Do not over fill the sink with salad as the weight can break the leaves.) The second sink should have only clean potable water. Lift the salad from the first sink and submerge it in the second sink and rotate with your hands. If snails become prevalent, you may consider adding another sink before the final rinse with sea salt to dislodge the snails from the leaves. Spin dry in a commercial-grade salad spinner or a repurposed washing machine on spin cycle. Make sure that the leaves dry completely to prevent molding.

Units: Pack in food-grade plastic bags —a 13-gallon bag for 3 lb of greens for wholesale or ¼ lb and ½ lb amounts in produce bags. Direct sale price is \$8.00/lb and wholesale is \$5.00/lb.

Greens (full-grown collard greens, kale, chard, mustard greens)

Harvest: Use a knife or trimmers to cut leaves at the stem. Pick outer leaves that are 6"–10" in length. Use a large box, crate or bag. Take care not to crack leaves. Also, discard wilted, dry or brown leaves. Gently trim away any slight edge browning.

Storage: Pre-cool on-site in a cooler with ice. Store at 32–45 F in a sealed container.

Preparation: Follow the steps for cleaning salad mix (see above). Trim stems to even length. Tie at the stem with natural twine or wire twist tie. Leave stems in cold water until packaged for market. Package in plastic bags and wax boxes.

Units: Stack leaves to make a bunch that weighs $\frac{3}{4}$ lb. There should be at least eight leaves per bunch. Direct sale price is usually \$3.00/bunch and wholesale is \$2.00/bunch. Note: Loose baby greens from thinning plants should sell well at \$5.00/lb wholesale and \$8.00/lb direct. Blends of early season thinning sell well as a “braising mix.”

Tomatoes

Harvest: Hand-pick fruit with gloves on at the last branch node or at the flower leaves. Pick in the late morning to early evening, when the morning dew has evaporated from fruit surface. Place directly in a hard, flat storage container. Handle gently to avoid bruising or puncturing.

Storage: Store at 55–70 F in a dry area. Keep away from direct sunlight, but do not cool or ice.

Preparation: Dust off with a dry, soft cloth if necessary. Package in stackable cardboard flats; strawberry and tomato boxes are designed for stacking purposes. Pack in a single layer with stems facing downwards. Pack snug to prevent movement during transport. (Note: Pack cherry tomato varieties in pint baskets.)

Units: Use pint or quart baskets or sell by the pound out of flats. Direct sale and wholesale price will vary from \$2.00/lb to \$4.00/lb throughout the season.

Squash

Harvest: Pick in early morning. Select firm fruit with shiny skin. Cut or twist off at the fruit stem, with attention not to break the stem off. Zucchini and summer squash should not exceed 8” in length. Round squash should not exceed 4” in diameter.

Storage: Harvest into a flat container. Take care not to bruise fruit. Store at 50 F without ice or cooling.

Preparation: Wipe fruit clean if necessary with a damp cloth. Pack in a wax box with multiple layers in uniform direction. Take care not to damage the fruit at the bottom.

Units: Sell by the pound for small- to medium-sized fruits, by the individual unit if large-sized. Sale price is around \$2.00/lb in season.

Turnips

Harvest: Select for firm, solid root bulbs that are 2” in diameter. Pick in the early morning when the greens are upright and firm.

Storage: Harvest into a bucket or a box. Store in a cooler on ice.

Preparation: Wash dirt from entire plant and root. Drip dry and wipe each turnip dry. Package in bunches of at least three turnips per bunch.

Units: Weigh to $\frac{3}{4}$ lb bunches. Price for direct sale at \$3.00/lb and for wholesale at around \$2.00/lb.

Eggplant

Harvest: Use trimmers to cut the stem at least 1" from the fruit. Use a stable harvest container and do not stack eggplants. Keep from direct sun.

Storage: Pack snugly in a single layer upon harvest. Do not cool or ice. Store at around 60 F.

Preparation: Wipe away any dirt, and stack in single layers with stems downward. Pad box with newspaper if necessary to avoid bruising.

Units: Sell by the pound for smaller varieties like ichiban or zebra. Large purple beauties should sell by the unit; otherwise \$3.00/lb wholesale and \$4.00/lb direct sale.

Beets

Harvest: Pull beets in the early morning. Brush soil away to select firm roots that are 1.2–2" in diameter. Gently tug the leaves at the top of the root.

Storage: Place in a cooler with ice or in a shaded area. Store in sealed plastic bags and wax boxes. Cool to 32–45 F.

Preparation: Trim away any dry leaves. Submerge to wash away dirt and rinse clean. Dry off and bunch leaves together at the base.

Units: Bunch at least three beets together for a $\frac{3}{4}$ lb unit. Direct sale price is \$3.00/bunch; wholesale is \$2.00/bunch.

Carrots

Harvest: Once green carrot plants are at least 12" tall, check the base by clearing soil (or pulling a tasty test carrot). Pulling in hard soil can damage the carrot, so using a trowel, shovel or ideally a broadfork or a pitchfork will save time and yield. Harvest into a pail or crate.

Storage: Keep away from direct sunlight to prevent the greens from wilting. After washing and drying, store at 32–45 F in plastic bags and wax boxes or crates.

Preparation: Wash carrots in a submergible tank or sink to knock off dirt and soil clods. Gather greens at the base to bunch, or cut off greens to sell loose carrots. Loose carrots or bunches should be stacked neatly in plastic bags and wax boxes or crates.

Units: Bunch at least six carrots to make a $\frac{3}{4}$ lb unit. This sells direct at \$3.00/bunch or wholesale for \$3.00/lb. Note: Wholesale packaging for grocers will require bunching and a per bunch price. Restaurant buyers do not typically require bunching.

Radishes

Harvest: Pull radishes in the early morning when the greens are perky. Check at the base of the leaf for a root 1–1.5” in diameter. Pick radishes at first signs of cracking at the base of the leaves.

Storage: Keep away from direct sunlight to prevent the greens from wilting. Store in cooler with ice. After washing and drying, store at 32–45 F in plastic bags and wax boxes or crates.

Preparation: Wash radishes under water to remove dirt and debris. Bunch at least five radishes together at the base of the leaves. Loose radishes or bunches should be stacked neatly in plastic bags and wax boxes or crates.

Units: Gather at least five radishes to make $\frac{3}{4}$ lb. Use natural twine or wire twist ties. Direct sale price is \$2.00/bunch and wholesale around \$2.00/lb.

Cucumbers

Harvest: Harvest fruit at 5–8” with full dark color. Pick early in the day to maintain freshness. Gently pull and twist fruit off the vine, or trim off. Harvest into a sturdy container (bucket, crate or box). Pick regularly, as overgrowth cucumbers are unmarketable.

Storage: Keep out of direct sunlight after harvest. Do not cool. Store at 50–60 F.

Preparation: Wipe skin clean with a dry, soft cloth. This knocks away any spines on the cucumber skin.

Units: Sell by the pound at \$3.00/lb for direct sale and \$2.00/lb for wholesale.

Chiles

Harvest: Pick chiles by hand in the early morning when they are firm and shiny. The chile should be easy to tug and pick when it is ready. Chile can be picked green or ripe (fully orange or red). New Mexican red chile is left to ripen on the plant and dry on the plant before the entire plant is harvested, fruit and all.

Storage: Harvest into bags or buckets. Keep away from direct sunlight and store in a cool place at 45–50 F.

Preparation: Wipe clean if needed. Remove any fruit with sunscald or soft spots. Package in pint baskets for smaller-size chiles such as jalapeños and serranos. New Mexico green chile and other long chile can withstand loose storage in buckets, burlap sacks or boxes. Bell peppers should be boxed upright in an orderly fashion.

Units: Direct sale of yellow totes, jalapeños and serrano chiles varies from \$2.00–\$4.00/lb. New Mexico green varies from \$3.00–\$4.00/lb. Grocery wholesale pricing is closer to \$2.00/lb for all varieties. Restaurant wholesale will pay more, but buy less.

Blackberries

Harvest: The harvest begins in late summer and lasts 4–6 weeks. Pick regularly to encourage fruit set. Pick very gently by hand with a downward tug of the fruit off the plant. Blackberries are very easily damaged. If the fruit resists, it is probably not ripe. Harvest in full sun, so that you can see if there is any shade of pink or red on the berry, in which case, then it is not ripe. Gently place them directly into pre-placed pint baskets lined along a cardboard flat. Do not pick up any dropped fruit.

Storage: Store on-site in coolers with ice. Store at 32–45 F.

Preparation: Leave in pint basket until sale. Transfer pints of berries as little as possible.

Units: Sell pints at direct sale price of \$8.00/pint, wholesale at \$6.00/pint.

Asparagus

Harvest: Asparagus sends its first shoots in early spring. The shoots stay tender and harvestable for the next 4–6 weeks. Harvest spears that are 6–9” in length into a basket or bucket. Snap spears at the base or cut at a 45-degree angle at the base of the spear. Do not cut below the ground, as that will damage new spears. Keep bases in water upon harvest to ensure freshness, with an absorbent pad or a food-grade plastic bag set in a box with water in the bottom. Make repeat passes through asparagus rows.

Storage: Keep from direct sunlight. Store at 36–45 F in buckets, tubs or pans with a few inches of water to keep bases fresh.

Preparation: Trim spears to uniform length at the base. Submerge to wash in a diluted sanitizing solution and then rinse in fresh water. Drip and pat dry. Place upright in waterproof containers with water or pads at the bottom.

Units: Asparagus is categorized as small and large. Small is pencil thin, and large is the diameter of a dime. Harvest into ½ lb bundles and tie with elastic or natural twine. Sell bundles for \$4.00 each for direct sale; sell asparagus at \$5.00/lb wholesale.

Appendix D: Sample Forms

Sample Land Use Agreement

This Memorandum of Understanding (MOU) is a binding contract between the following two participants for the following services, duties and responsibilities.

Participants

Farmer Org.
555 Five Points Rd SW
Albuquerque, NM 55555

Landowner
Ms. D. Chavez
1111 Chavez Ln SW
Albuquerque, NM 88888

Farmer org. and landowners have agreed to the following terms.

Landowners are the legal landowner with clear title to two plots in the South Valley of Albuquerque, New Mexico. *Landowner name and farmer org.* have agreed to the following terms.

Memorandum of Understanding (MOU)

1. MOU is for five years upon signing.
2. Below date is the legal and effective date.
3. After five years this MOU can be renewed.
4. This MOU can be amended with 30 day written request from any participant.
5. This MOU can only be terminated by participants with 90 day written notice with a justifiable cause, as much investment has been put into the land.
6. All benefits of land improvements will be transferred to landowner after five year period. Any structures can be moved by *farmer organization* once the MOU is finished.

Farmer Org: service, labor and responsibility

Prepare, amend and cultivate soil for crops Provides one Farm manager, name of farmer, or mutually agreed upon replacement Provide well, pump, water, weed, harvest, and labor that applies to the farm Maintenance of irrigation Provide farm assistance with farm collaborative (additional farm labor) Provide administrative assistance to oversee the farm Maintain records of farm activity Procure contracts and sales of farm product Ensure that monthly rental for the property is paid timely and in full to the Landowner by the tenant/Farm manager according to the signed lease agreement and that all utility fees necessary for maintenance of this farming enterprise are kept current.

Landowners responsibility

Provide ½ acre of land Use of the existing electrical system to pump water Allow access to the farm Allow photos and information about the project to supporters and funders Allow tours of site for educational, support and funding purposes

Communication, Liability, Conflict Resolution etc.

Farmer organization, the Farm Manager, their guests, affiliates and agents agree to indemnify and hold harmless the Landowner for any liability, damage, loss, claim, cost or expense, including reasonable attorneys' fees, that is caused by any act or omission in connection with the use of or activities on the farm. All rights to make claims against the Landowners are hereby waived Farmer organization assumes full responsibility/liability for all activity it conducts, including personal injury, accidents, damage to property of any kind Farmer organization and its agents will conduct activity with due consideration for neighbors, including the Landowners, and maintain the farm accordingly Farmer organization, the Farm Manager and the Landowners will meet twice annually to review the status/progress of the project and to resolve conflicts Landowners reserve the right to control or deny access to individuals if conflicts arise Landowners reserve the right to make changes or exceptions to rules/policies where and when appropriate If warranted, all parties agree to share in hiring a professional mediator to assist in resolving conflicts.

Restrictions

24 hours verbal notice to Landowner prior to tours and/or photos Lock and keys handled only by the landowner and farmer organization farmer manager

5-year general farm project agreement and financial agreement

Farmer organization is the lead organization Farmer organization will handle all contracts Farmer organization will maintain all documentation for the farm project Farmer organization will maintain and keep all financial records Farmer organization will handle all accounts including payouts. Farmer organization will exchange ideas, discourse, and provide an information flow between participants American Friends Service Committee is a partner for the 1st three years of this project (see below).

For more information on American Friends Service Committee (AFSC) role, responsibilities and service see MOU between farmer organization and AFSC. This MOU can be provided upon request from AFSC.

PRINCIPAL CONTACTS:

Name	<i>Name</i> Executive Director of Org	<i>Name</i> Landowners
Contact	505-555-5555 email@email.com	505-888-8888 email@email.com

Date: _____

_____ Farmer Org.
signature

_____ Landowner
signature

Sample Business Plan

Sanchez Farm Plan

There are several locations we have looked at on the Sanchez farm and have for various reasons have chosen the center area on the west side of the large field and a hill top for the coldframe if funds are acquired. This rough plan is a first attempt to develop a small sustainable demonstration farm in this community. We are excited to work with all of the community and see the support this project has. This plan will reflect a marketing strategy that implies direct marketing (Farmers Markets).

Goal: Help start small farm at Sanchez Farm

- Create farm plan draft 12/12/07
- Create farm budget draft 12/19/07
- Create planting dates draft 12/19/07
- Implement farm plan 01/02/08

Specifications:

- The area we stepped off (because of a broken tape measure) is about 250 feet wide by 100 feet long. 25,000 sq ft (about half acre).
- Our beds will be 3 feet wide by 80 feet long with 2 ft. paths. We will use a raised bed system with soil amendments added as needed. Twenty beds.
- Our furrow farming system will be spaced between 2ft and 3ft depending on crops and rotation of crops. 50 furrows.
- We will use a drip irrigation system to conserve water, minimize salt build up in the soil and reduce weed pressure.
- We will extend our season production by using wire hoops and row covers.
- Winter production will be dependent on funding. We suggest the use of large cold frames 30ft by 96ft for production of commercial sales.

Crop Recommendations

Raised Beds

The first year we are focusing on farmer's market sales and small commercial accounts. Most of our plantings will be annuals, with a leaning to perennials for long term sustainability and product diversity. All raised bed crops reflect a quick turn around for maximum profit.

Recommendations; root crops:

- Carrots: 3 varieties yellow, orange, red 100 bunches per wk
- Radishes: 2 varieties pink beauty and Easter egg blend 100 bunches per wk
- Beets: 3 varieties red Detroit, golden, choggia 100 bunches per wk

Recommendations; leafy greens:

- Johnny's salad mix: baby salad greens, 50 lbs per week
- Tyee spinach: loose leaf (spring and fall), 10wk 25 lbs per week
- Arugula Rocket: bunched or baby greens 20 lbs per week
- Kale: red russian variety bunched 20 bunches per mkt
- Swiss Chard: rainbow mix 25 bunches per mkt
- Basil: Gevonnese loose leaf or bunched

*Row Crops***Recommendations; a mix of flowers and vegetables:**

We have about 50 furrows to plant

- Sugar Snap peas: plant mid February, 10 furrows, harvest by first mkt
- Potatoes: 6 furrows, varieties red chief, peruvian blues, Yukon golds
- Cucumbers: 2 furrows, varieties straight eight, lemon
- Eggplant: 2 furrows, varieties black beauty, ichibon, easter egg
- Jalapeños: 2 furrows
- Sweet Peppers

Flowers

Three Varieties easy to grow and make nice bouquets

- Cosmos: three furrows mixed colors
- Zinnias: three furrows mixed colors State Fair variety
- Marigold: three furrows

Perennials

These crops should be planted in early March, with the mind set that there will be no income for two

to three years and viewed as an investment for the future

- Blackberries: Varieties TBD by market demand fresh sales vs. added value 100 bare root or 1gal containers Nourse Supply Michigan
- Raspberries: bare root or containers Nourse supply

Supplies

Irrigation

- 2in header - 500ft roll, drip tape -10,000 ft roll, 100 inline valves, 100 3/8in couplings, pressure regulators, sand filter and other (see detail budget)
- Bags: farm produce bags small and large (13gal), t-shirt bags, and trash bags, gunny sacks.
- Twist ties or rubber bands.
- Scales
- Weight produce and soil amendments. Toledo scale weights 30 lbs for \$349 plus tax and shipping model # xRT-3710

Hand tools

- Shovels round and square tip
- Hoes hoop and traditional pull
- Johnny's pin point seeder
- One Earthway seeder with seed plates
- One hand held jab planter
- Rakes: garden and wide farm rake
- Scissors for harvest of salad greens
- Pruning shears small and large

Tractors

- Backhoe rented one day raised bed digging \$450
- Farm tractor for plowing disking, mowing, compost turning
- BCS
- Walk behind tractor 11 hp with till box, plow and sickle bar \$ 2,000
- Stihl trencher
- Weed mower hand held \$ 350

Other

- Weed burner and 5 gal propane tank
- 65 gallon Coolers for produce
- Wire hoops for row covers 30' × 1,000' 9oz Rainflo

Fertility

Compost, cotton seed meal, yum yum mix, 50 gal phyatmin 800 (peaceful valley) and chelated minerals a strong crop rotation with cover crops, hairy vetch, field peas, clovers and legumes.

Budget items for Sanchez Farm

Tools

Seeder Johnny's pin point	# 9269	\$ 169.00
Earthway seeder	# 9170	\$ 102.50
Flame weeder	# 9076	\$ 350.00
Solo 425 backpack sprayer	# 9411	\$ 105.00
Stirrup hoes (2 each, 3¼ in)	# 9489	\$ 77.00 (\$38.50 x 2)
Stirrup hoes (2 each, 5 in)	# 9500	\$ 81.00 (\$40.50 x 2)
Walk-behind tractor BCS	(see attachment)	\$ 2,500.00 (plus tax & shipping)

Fertility (Peaceful Valley)

Phyamin 801 55gal	\$ 209.00
Compost soil illusions organic	\$ 300.00 (\$30.00/yard x 10 yards)
Cover crops hairy vetch 50 lbs	\$ 120.00
Cotton seed meal 50 lb bag (5 lbs per sq ft needed)	\$ 179.90 (\$17.99/bag x 10 bags)
Alfalfa meal 50 lb bag (5 lbs per 100 sq ft needed)	\$ 209.90 (20.99/bag x 10 bags)
Yum yum mix	

Seeds

<p><i>Flowers:</i> Cosmos, zinnias, marigolds, sunflowers, bachelor buttons</p> <p><i>Veggies:</i> Eggplant, tomato, cucumber, squash, salad greens, kale, swiss chard, spinach, arugula, chile, radish, turnips</p>	\$ 500.00
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Winter/fall (Seasonal supplies)

Row covers: covertran 35 ft × 1000 ft	\$
Farm tractor rental: \$ ____ per day	\$
Weed trimmer (gas operated): Stihl	\$ 250.00 (plus tax)

Irrigation

Drip system

3 1/2 hp pump Honda \$650	\$ 650.00
Triton sand filters with backflow stop	\$ 850.00
Drip tape 10,000 ft row	\$ 172.00
2 inch main line 500 ft	\$ 150.00
Miscellaneous supplies (valves, coupling, goof-plugs, etc.)	\$ 300.00

Other

Farm applications and trade magazines	\$ 200.00
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Total budget

Total expense budget	\$ 8,369.50
20% add-on for price increase	\$ 1,000
Total	\$ 9,369.50

*All prices are subject to change***Budget for cold frame**

The recommendation is for two coldframes to meet the market demands and have a year-round income.

2 cold frames 30' × 96' = 5760 sq ft including covering of 5 year

6 mil poly and finishing strips	\$ 7,200.00
Cement for anchors	\$ 450.00 (\$150.00/yard x 3 yards)
Labor: two people for two 40-hour weeks	\$ 1,280.00 (\$8/hour x 160 hours)
Organic seeds purchased from Peaceful Valley Seed	\$ 320.00
Lumber for end wall and opening	\$ 520.00
Screws, nails and tips	\$ 230.00
Total Requested	\$ 10,000.00

Farm Plan Draft

Date: _____

Name of Farm _____

What is the size of the farm?

Size of the rows?

How many rows?

Vegetable						
Planting dates						
# of rows planted						
Est. date of harvest						
Est. Crop yield						
Est. income						

Name the markets for the crops:

Estimate expenses, including farm materials and labor costs.

Other notes:

Appendix E: Vendors

Cold Frame Suppliers

Jaderloon

800-258-7171
info@jaderloon.com
www.jaderloon.com

Farmtek

Sales: 1-800-farmtek (327-6835)
Customer service: 1-800-457-8887
www.farmtek.com

Floating Row Cover

Farmtek

Sales: 1-800-farmtek (327-6835)
Customer service: 1-800-457-8887
www.farmtek.com

Greenhouse and Garden Supply

3820 Midway Place NE
Albuquerque, NM 87109
505-345-6700
800-627-4769
gg@horticulturesupply.com
www.greenhouseandgarden.com

Rain-Flo Irrigation

929 Reading Rd.
East Earl, PA 17519
717-445-3000
sales@rainfloirrigation.com
www.rainfloirrigation.com

Irrigation Supplies

Rain-Flo Irrigation

929 Reading Rd.
East Earl, PA 17519
717-445-3000
sales@rainfloirrigation.com
www.rainfloirrigation.com

Sierra Irrigation Supply, Inc.

3101 Vassar Dr. NE
Albuquerque, NM 87107
1-800-590-TURF(8873)
support@sierrairrigation.com
www.sierrairrigation.com

Seed Suppliers

Johnny's Selected Seeds

1-877-564-6697
www.johnnyseeds.com

High Mowing Organic Seeds

802-472-6174
www.highmowingseeds.com

Peaceful Valley

888-784-1722
www.groworganic.com

Nutrient Vendors

Ranch-Way Feeds

546 Willow St.
Fort Collins, CO 80524
970-482-1662
www.ranch-way.com

Peaceful Valley

888-784-1722
www.groworganic.com

Johnny's Selected Seeds

1-877-564-6697
www.johnnyseeds.com

Rain-Flo Irrigation

929 Reading Rd.
East Earl, PA 17519
717-445-3000
sales@rainfloirrigation.com
www.rainfloirrigation.com

Appendix F: Organic Certification

New Mexico Department of Agriculture Organic Program

The New Mexico Department of Agriculture (NMDA) Organic Program provides USDA/National Organic Program–accredited organic certification for farmers, ranchers and processors/handlers throughout New Mexico. Application and marketing assistance is also available.

Contact NMDA with questions about becoming certified organic, finding allowed inputs, sourcing organic ingredients, or finding buyers for organic products.

Organic Program Manager
505-852-3088
Email: organic@nmda.nmsu.edu

Organic Commodity Advisor
505-889-9921 or 575-646-0329

For questions about the status of certification, call:

Brett Bakker, Inspector/Certifier
505-889-9924 or 575-646-0339

Martin Sanchez, Inspector/Certifier
505-889-9880 or 575-646-0337