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Acknowledgment

The farmers we’ve worked with are at the forefront of the sustainable agriculture movement. Their knowledge, passion, and management and marketing skills make their businesses successful. We thank them for willingly sharing their knowledge, thoughts, and intuition with us in the hopes that others can share their successes.
Eighteen Characteristics of Successful Mid-Atlantic Farms

Essential Characteristics
- Local Marketing
- Diversity
- Relationship Building
- Educational Mission
- Stewardship
- Obtaining Value from Nature
- Compromise and Flexibility
- Willingness to Question
- Knowledge and Experimentation
- Logistics and Management

Production Characteristics
- Crop Rotation and Cover Cropping
- Off-farm Materials
- Holistic Pest Management
- On-farm Nutrient Sources
- Tillage
- Affordable Equipment
- Irrigation and Mulch
- High Tunnel Production

Six Farm Profiles

Calvert’s Gift Farm
Jack and Beckie Gurley farm less than five acres in north-central Maryland. They produce vegetables for their Consumer Supported Agriculture (CSA) operation, farmers’ markets, restaurants, and an organic cooperative.

One Straw Farm
Drew and Joan Norman farm 200 acres in north-central Maryland. They wholesale their produce, sell at two farmers’ markets, and have a CSA.

Ecosystem Farm
Shane LaBrake operates an eight acre, non-profit demonstration farm with a CSA for the Accokeek Foundation in southern Maryland.

Village Acres Farm
Roy Brubaker and his daughter, Angie, farm 35 acres in central Pennsylvania. They produce fruits, vegetables, cut flowers, and meat animals for their CSA, a farmers’ market, and an organic cooperative.

Beech Grove Farm
Anne and Eric Nordell farm on 90 acres of mountainside in north-central Pennsylvania. They produce primarily cool season vegetables for a farmers’ market, a grocery store, and restaurants.

Blackberry Meadows Farm
Jack and Dale Duff farm on 85 acres in western Pennsylvania. They grow produce and raise animals for their CSA, as well as for the Greater Pittsburgh Community Food Bank.

Steve Moore’s U-bar.
The Small Farm Success Project facilitated a discussion with seven experienced and highly successful farmers from the Mid-Atlantic region. We also visited 44 other farms as part of this project. These men and women farm using sustainable practices. To use John Ikerd’s definition of sustainability, the agricultural methods used are ecologically sound, the farm operations are economically viable, and the farmers are socially responsible. Out of a subset of the 44 farms, there were 19 diversified vegetable operations without an institutional sponsor. The sizes of the farms in this subset ranged from 2.5 to 200 acres, and the average farm size was 58 acres. All of these farmers had highly diversified vegetable, fruit, herb, and/or flower production. Some had incorporated poultry and meat animals into their operation. All direct market to some extent. Many have a CSA operation or are vendors at farmers’ markets. This article is a crystallization of what we learned from these farmers about their methods of production and marketing. The insights shared in this article come from the seven farmers who participated in our focus group (Brett Grohsgahl, Jack Gurley, Shane LaBrake, Erroll Mattox, Drew Norman, Chip Planck, and Heinz Thomet) and from the farmers who opened their farms and their thoughts to us.

We found that these farmers share commonalities in their agricultural practices and beliefs, and we have focused this article on the discussion of 18 sustainable agriculture characteristics. Ten topics relate to the basics of farming sustainably and eight topics relate to production characteristics.

However, each farm and its farmer is unique. One overriding lesson that emerged from this exercise is that the individuality of the farm determines the agricultural strategies used on it.

Following the 18 analyses are profiles of six of these farm operations. All of the farms and their farmers were worthy of a profile, but in the interests of keeping this piece of writing to a manageable size, we’ve chosen six that show a wide range of farming operations and styles. In keeping with the focus of the Small Farm Success Project, we have focused on farms producing a variety of vegetables, fruit, herbs, and/or flowers. Many other farms that are less diversified or are animal-only producers could also be cited as examples of successful sustainable farming. The farms profiled are all certified organic (although that is not a prerequisite of a sustainable system).

**ESSENTIAL CHARACTERISTICS**

**LOCAL MARKETING** is the process of selling a commodity close to its source.

Local marketing is an important component of sustainability. Food that travels one or two hours to market is obviously fresher and more nutrient dense than food that has spent three days traveling across country in a trailer. Local marketing also reduces the use of fossil fuel in the food distribution system. (On average, produce in the United States travels 1,500 to 2,500 miles to market.) But local marketing is also key to the success of small farms. To compete successfully with the mega-farms, given their economies of scale, requires the development of loyal customers and premium prices, as well as an efficiently run farm with a minimum of purchased inputs. The production system and all other activities on these farms are directed primarily by the marketing plan and customer preferences.

Customer loyalty is important to all producers, but especially to small farmers. They acquire it by building a relationship with the customer with one-on-one contact. They also build it by selling a superior product. The product is superior because it’s fresher, because it’s not readily available anywhere else (e.g., purple Peruvian potatoes), and because it’s unique (e.g., artisanal cheese).

Premium prices can be charged because the products are better. Many of these products don’t even have a counterpart in the grocery store. (Green Zebra heirloom tomatoes just aren’t that easy to come by.)

**DIVERSITY** in sustainable farming means growing and promoting many species of plants and animals on the farm. It also refers to having a variety of marketing options and opportunities. Successful farms are characterized by diversity at many levels.
These farmers grow a range of crops, cultivars, and species. Often, they have more than one marketing outlet. In addition, their stewardship plans foster a habitat that supports a diversity of life from soil microbes to birds and pollinators. The cropping strategies require many crop species and often many cultivars of the same species to diversify marketing opportunities. Their marketing plans entail using a variety of market outlets such as farmers’ markets, CSA operations, and restaurants. In addition, some farmers wholesale to organic distributors or belong to a cooperative. In the same way that a diversity of species can buffer against pests and adverse environments in an ecosystem, so a diversity of marketing options can buffer against adverse downturns in the economic sector or changes in consumer preferences.

RELATIONSHIP BUILDING is an important factor in sustainability. The desire to create an abundant, thriving landscape carries over to the creation of a thriving, healthy community.

These farmers show a strong sensitivity not only to their relationship to the landscape but also to everyone that their landscape touches, whether it is hired labor or customers. Their need to improve their land carries over to the desire to make the quality of life better for their hired labor and for their customers. There is a strong need to spend extra time educating customers, future farmers, and others in their communities about the advantages of supporting small farms and buying locally grown food. There is a desire to actively promote a healthy and sustainable relationship between the land, the farmer, and the community to enhance the health and vitality of all components of this system.

Many different types of relationships are built and one of the first is the one with their employees. The quality and availability of labor is often an issue on farms. Good labor can be difficult to find and many farming decisions are based on how much labor is available. In addition, farm chores can be back-breakingly repetitive and menial, as well as potentially dangerous. There’s a need to provide a job that has variety, learning opportunities, and enrichment in addition to drudgery. Some farmers take interns, some use migrant labor, some require work from their CSA members, some hire the help they need, and some use a combination thereof. All showed concern for the needs of their employees—the need for a living wage and a meaningful work experience.

Good relationships have been crafted with their customers. These farmers are not in this business for the quick profit. They want to win their customers’ loyalty by providing the freshest, healthiest, best tasting produce they can. However, they also want to educate their customers about the value of their mode of farming to the community.

EDUCATIONAL MISSION is the fundamental role of informing interns, customers, and the general public of the many benefits of sustainable farming.

Many of these farmers are dedicated educators. They want to convince the world that sustainably run small farms are the future of agriculture. Erroll Mattox looks forward to the time when the Mid-Atlantic is once again a tapestry of small farms — farms that will nurture the soil and the wildlife and the local community as well as the farmers themselves. These farmers educate their customers on the value of pesticide-free produce and antibiotic and hormone-free meat. They point out the benefits of cleaner air, cleaner waterways, and lower soil erosion rates. They discuss the benefits of sustainable farming to the community — values such as pastoral views, interrelated, vibrant, and supportive local businesses, as well as a smaller population base and less congestion.

Interns and their training are an integral part of many farming operations. Internships involve a wide variety of agricultural learning experiences as well as visits to other farming operations. Southeastern Pennsylvania has a structured internship training program (Sustainable Agriculture Internship Training Alliance/SAITA) that schedules a half-day of training every other Saturday at various farms in the alliance. Topics range from soil building methods to the philosophy of biodynamic farming to farmers’ market sales techniques.

Most of the farmers are actively involved in sustainable agriculture organizations such as Future Harvest — Chesapeake Alliance for Sustainable Agriculture (Future Harvest — CASA) and the Pennsylvania Association for Sustainable Agriculture (PASA) as well as their local organic organizations. Many of them are regular speakers at conferences and training programs. Some of them open their farms for public field days.

Whether one-on-one with customers or interns or in front of a large crowd, these farmers are working to make a difference in the world of sustainable agriculture. Many of the farmers we spoke with believe that it is their responsibility to share their knowledge and vision with others.
STEWARDSHIP of the land is an essential component of farming sustainably. Successful farmers are passionate about their role as stewards for their land.

Many commented that there were many business opportunities that would make them more money, but they chose farming because of a desire to create and steward an abundant, living landscape. They expressed not only a desire to make the land productive but also to be good caretakers and leave the land and environment more ecologically sound than when they started. All the farmers cultivate enough land to maintain a diversified rotation while keeping some land in soil-building crops at all times. Although all of the farmers admit there are some activities associated with farming that they would prefer to avoid (e.g., tillage and plastic mulch), they feel that, overall, their farms have improved in several aspects. Most measure stewardship in terms of the diversity of species that the land supports, the activity of birds and pollinators, the tilth of the soil, the drainage of their fields, the reduction in weed and insect pest problems, and the vigor of their crops.

OBTAINING VALUE FROM NATURE refers to the beneficial services that nature may provide if we don’t thwart her. These services include: the biological fixation of nitrogen; control of insect pests and weeds by creating habitat for beneficial organisms; and the air and water pollution controls inherent in a healthy ecosystem.

The farmers we visited are aware of the valuable services that nature can provide. For example, keeping stream edges in a natural, forested state serves several purposes. It filters runoff to the stream eliminating or minimizing the amount of sediment and/or pollutants that enter the stream. It shades the stream, creating a cooler environment so more species of aquatic animals can thrive, and it stabilizes the stream bank with tree roots, slowing erosion of the bank.

Many of the farmers we talked to are interested in the pest control services they receive from beneficial insects and other animals. Often, they encourage the proliferation of naturally occurring beneficial insects such as the ladybird beetle and the green lacewing. Beneficial insects can be encouraged by planting insectary plants in or near fields. Many farmers use Dutch white clover as an underplanting or in walkways or perimeters. The clover fixes nitrogen and is an excellent source of nectar for beneficials. Some farmers plant insectary plants (many of the composites, mints, and other herbs) within the field to encourage beneficial insects that can kill pest insects. In addition, they may buy and release insects such as the tiny non-native wasp Pediobius foveolatus to control the Mexican bean beetle.

Shane LaBrake puts up bluebird houses, purple martin houses, and bat houses to encourage these pest-eating animals. He’s had success getting bluebirds to help with Colorado potato beetle control by providing perching posts in the potato field for the birds.

Another animal that sustainable farmers love to see is the earthworm. Although cultivation is hard on this species, minimal and shallow tillage can help keep a population in the field. Earthworms eat plant residues and turn them into plant food. Worm excrement is rich in minerals and other plant nutrients. Earthworms also distribute these nutrients throughout the soil, improving soil tilth, water-holding capacity, structure, and aeration.

COMPROMISE AND FLEXIBILITY refers to the ability to readily respond or react to events such as weather patterns or marketing opportunities.

The farmers we spoke with have the ability to make compromises and remain flexible. Farmers are at the mercy of the weather, and it doesn’t matter what your schedule says — some things can’t be done in the rain, some things can’t be done when it’s windy, and some things can’t be done when it’s 95°F. Good farmers bend their schedule to the weather report. However, sometimes they’re forced to compromise. Beans shouldn’t be picked when they’re wet, but if it’s going to rain all day and the market is tomorrow morning, you either pick the beans wet or go to market without them.
Many farmers use black plastic to enhance growth of certain crops, control weeds, and maximize efficient use of soil moisture. Some of the farmers that use plastic mulch regret the need for it, and some minimize the amount they use. (The use of petrochemicals to produce it and removal and disposal issues are the reasons it's disliked.) This is one of several areas where farmers have to weigh the advantages against the disadvantages of a particular farming strategy and then choose the best fit for their farming situation. Sometimes a compromise is necessary.

Tillage is another area that requires frequent compromise. Many of the farmers we talked with try to minimize the amount of tillage they do. They don’t want to damage their soil’s structure, reduce the amount of organic matter in their soil, or disrupt the macroinvertebrates present — all of which are consequences of tillage. However, vegetable production and weed control require some degree of tillage. These farmers compromise on this issue and use techniques that limit the amount of tillage they do. Some cultivate shallowly or less frequently; some use weed control techniques (such as flaming) that don’t involve turning the soil; some use more tillage but rebuild their soil by putting the land into sod for several years at a time.

Another area of frequent compromise is in the length and quality of rotations. While all the sustainable farmers we visited appreciate the value of a good and lengthy rotation, many were forced to compromise on this issue. For some, the compromise is necessitated by a limited amount of tillable land. For others, their markets demanded a high percentage of a specific family be grown (e.g., brassicas or cucurbits). Some farmers had to deal with a limited ability to irrigate. For them, the rotation was driven by the water needs of the various crops grown.

An area where farmers must remain flexible is in marketing. Crop failures and gluts require marketing adjustments. There are market forces that seem to defy reason. Jack Gurley resists pressure from his distributor to specialize in mesclun and grows a wide variety of vegetables, because it gives him flexibility in his marketing and financial safety in case of a crop failure.

Heinz Thomet increased sales significantly at one of his farmers’ markets by off-loading and moving his truck off-site. The increased space he obtained by moving the truck allowed more display area and more room for customers. The additional labor and inconvenience was made up for in increased sales.

WILLINGNESS TO QUESTION is important to the sustainable agriculture movement. Let's face it, these farmers are the revolutionaries. They didn't get where they are by accepting the status quo.

Most of the farmers we spoke with reject many of the conventional approaches to agriculture including primacy of yield, standardized nutrient management strategies, and the need for synthetic materials. However, they also question some of the approaches used in organic agriculture as well including those specified in the National Organic Program’s (NOP) guidelines. Some farmers choose not to be certified (and make their own decisions about which agronomic practices they will follow). These farmers feel that high quality, taste, and variety are more important for achieving their marketing goals than maximizing yield. Consequently, they feel that results of soil tests and nutrient recommendations that are directed toward maximizing yield are of limited use. There were questions regarding whether nutrient management requirements are really applicable to farms that use a variety of organic sources for nutrients and that maintain high vegetative and/or residue cover at all times. Some farmers questioned whether the organic program’s rotational requirements are essential on farms that have such high diversity of species that pest populations and disease organisms are naturally limited, or whether they are primarily appropriate for monoculture-based, conventional production systems.

KNOWLEDGE AND EXPERIMENTATION are important facets of successful sustainable farming. Farming in a manner that renews the soil and doesn’t degrade the environment takes knowledge, thought, and an understanding of the natural world. Experience is important, but there must be a willingness to observe and learn on an on-going basis. It’s important to keep current on the issues. Organic and nutrient management regulations change. New equipment and products become available. Marketing trends change. Farmers who stay current on farming issues have the advantage. They also often feel a responsibility to share their knowledge with their peers, their customers, and possibly even with the academic community.
All types of agronomic methods have their underlying theory, rules of practice, and basic dogma. None of them offer the perfect solution to every situation. Many of the farmers we talked to synthesized agronomic practices from more than one discipline and source. Some were organic but used some biodynamic techniques as well. Some used organic practices in all but one aspect of their farming. Some were organic, but wished they had the freedom under the NOP to use a specific prohibited material or practice.

These farmers also believe that it is their responsibility to keep learning. They discuss, they read, and most of them attend sustainable agriculture conferences in the off-season. The PASA and Future Harvest-CASA conferences were often mentioned as great places to learn and network. A publication that was praised by many was “Growing for Market.” Other farmers seemed to be the most popular source of new information.

**LOGISTICS AND MANAGEMENT** refers to the art of running a farm.

These farmers are planners. They actively manage their farms down to the smallest details, however, they’re also flexible. They realize that good farming comes from a combination of knowledge, planning, experimentation, and the ability to adapt to the vagaries of nature and the marketplace. None of them are satisfied with the job they’re doing. They’re always searching out better ways to deal with agricultural problems, better methods of stewarding their land, and better ways of marketing.

They have a vision of where they’re going and what they want to happen on their farm. Small-farming is a business; it is subject to the same economic principles and requires the same skills necessary to operate any small business. A business owner must decide on the level of capitalization, equipment, and debt he or she needs for a successful operation. A vision of where the business is going and how fast it will grow is also needed. These farmers had a very clear idea of who their customers were, what their preferences were, and how to deliver the required products. Their marketing plans drive their production and time management plans. They have established the logistics for dividing their time between recruiting customers, production of crops, post-harvest handling of produce, delivering products to their customers, and supervising hired labor. They are willing to work hard and long hours to ensure that all phases of the operation function smoothly. Often, a husband-and-wife team or a partnership provided a wider range of production, marketing, business, and interpersonal skills than a single farm operator, alone.

They all agree that there is a need for a business/marketing plan, but there were definite opinions about the form it should take. A formal plan may be necessary to get the bank to lend you money, however, the consensus was that the one you draw up for the bank isn’t the most important one: the important one is your vision of what you want to produce, and that is tied in very tightly to stewardship and your vision of what you want your farm to become.

Heinz Thomet says he has a strong business plan. He knew how much he needed to earn to make a success of farming. He revises the plan periodically but not every year. He feels he was able to make a realistic assessment of whether he could farm successfully on his own, because he had solid farming experience from working on other farms.

**PRODUCTION CHARACTERISTICS**

**CROP ROTATION AND COVER CROPPING** are important sustainable agricultural practices. Crop rotation is the process whereby a crop family is not grown in the same area for a specified number of years in order to break the cycle of a soil-borne disease and/or reduce damage from soil-dwelling or soil-overwintering pest insects. Cover cropping is the process of planting crops that are used for soil improvement and protection. The two practices are tightly linked. A cover crop can improve the soil by integrating plants that facilitate beneficial changes in the character of
the soil. For instance, some cover crops add significant quantities of below-ground organic matter, or have roots that penetrate deeply to open up channels for crop roots to follow and allow oxygen and rain water to penetrate. Planting a cover crop also helps to protect the soil from erosion by wind and water. Crop rotation and cover cropping can facilitate nutrient management. Leguminous cover crops increase fertility by converting atmospheric nitrogen to a form usable by plants. Other cover crops are known for their ability to mine nutrients low in the soil profile and return them to the upper levels of the soil where they are accessible by cash crops. Successful sustainable farming operations utilize cover crops regularly and rotate their cash crops.

All of these farmers practice crop rotation and cover cropping. Some farmers are able to plan and implement multi-year rotations, while others have more limited rotations due to special challenges posed by their location or their market. All need to keep their rotations flexible in order to adjust to weather and field conditions and changing marketing opportunities. These farmers showed a strong preference for keeping their soil covered—either with a crop, a mulch, or with residue. Some use periods of bare fallow in the summer to control particularly noxious perennial weeds with repeat cultivations. Sometimes the land is fallow simply due to a lack of time and labor to plant the cover crop. However, fall cover crops were used by all. There was a heavy reliance on fall-planted hairy vetch, cereal rye, oats, wheat, and various clovers. There was also much experimentation with cover crops as the farmers sought out variety and soil-building improvements.

One strategy used by many of the farmers interviewed was intercropping. This is the strategy of using a cover crop in the roadways and alleys while the cash crop is growing. This technique may add nitrogen if a leguminous intercrop is used. It usually reduces weed competition. However, successful intercropping takes experience and experimentation to minimize competition with the cash crop. Often, Dutch white clover was used and was kept mowed to reduce its competitiveness. In addition to adding nitrogen to the soil, Dutch white clover provides nectar for beneficial insects.

**OFF-FARM MATERIALS** and their judicious use is an important feature of sustainable agriculture. The goal is to provide for the crop’s nutritional and cultural needs with on-farm materials and minimize the use of off-farm materials. Organic matter should be increased by the use of cover crops and mulches grown on-site and incorporated, nitrogen can be obtained from leguminous cover crops, and the need for pest control is minimized by thoughtful cultural practices. Sustainable agriculture requires planning ahead to have crop nutrients in place and minimize pest problems before they occur.

Most of the farmers surveyed use a minimal amount of purchased inputs and these purchased inputs supplement the nutrients provided by the agricultural system. A sustainable system produces much of the needed fertility on farm by incorporating cover crops, farm animal manure, and compost. Most farmers were eager to receive free organic matter such as municipal leaves or a neighbor’s horsebedding and manure. Lime, rock dusts, and organic fertilizers were generally purchased only when the soil was out of balance or nutrient deficient. Other amendments purchased included compost and hay or straw bales for mulching. One major purchase on many farms is plastic for mulch, drip-irrigation, row covers, and high tunnels.

**HOLISTIC PEST MANAGEMENT** is important to sustainable farming. Deer are a nearly universal problem and electrified fencing is the control measure most often used. Weeds are a universal problem with a multitude of tactics being used to combat them. The use of a stale seedbed is one method of control; another is the use of black plastic or organic mulching, as well as timely cultivation and hand-weeding. Pest insects and disease are present, to a lesser or greater extent every season. Scouting to detect and quantify the extent of the problem, understanding insect life cycles and disease progression, knowing when intervention is appropriate and how to intervene—these are all important factors in successful, sustainable management.

*Jack Gurley uses Dutch white clover as an intercrop with his heirloom tomatoes. He uses large tomato transplants so they get a good headstart on the clover, and he keeps the clover mowed. After the tomatoes come out, he tills a row through the clover and plants fall lettuce.*

*Eric Nordell cleans his cover crop seed before planting to reduce the amount of weed seed he brings into his fields.*
These farmers use a holistic approach to managing these pest problems and they realize the key is balance. They know that total eradication of insects, disease, or weeds is neither possible nor desirable. Timing of seeding and cultivation are important parameters that can reduce weed, insect, and disease problems. Crop rotation can help deter some weeds, insects, and diseases. Other tactics used are more individualistic and shaped by the farm set-up and the personality of the farmer. Many of the farmers surveyed use biological controls (such as \textit{Bacillus thuringiensis}), protective sprays of low toxicity (such as \textit{B. foveolatus} to parasitize Mexican bean beetles), floating row covers that act as a physical barrier to pest insects.

\textbf{ON-FARM NUTRIENT SOURCES are integral to sustainability. However, farmers who believe in producing food sustainably with minimal reliance on outside inputs need to manage fertility much more carefully than conventional farmers might.} Nitrogen (N) is often supplied by growing leguminous cover crops to fix atmospheric nitrogen and by planting fall cover crops that keep nitrogen left in the soil from leaching away. Phosphorus (P) is often high in Mid-Atlantic soils (and animal manure is high in phosphorus). Most Mid-Atlantic soils are also high in potassium (K) although it may be held in slowly available forms—bound tightly to minerals and clay particles. The key to proper plant nutrition is to know the fertility status of your soil—micronutrients as well as NPK, know the nutrient requirement of your crop, and plan ahead to supply what will be needed.

The farmers we spoke with use cover crops as their primary method of adding nutrients to their soils. Many also use a hay or straw mulch to minimize weeds. This organic mulch is incorporated after harvest and improves their soil’s tilth and fertility. All the farmers agreed that soil test results are important but are only a piece of the puzzle. Each farmer had an individualized plan for supplying the necessary fertility to his plants based on the specifics of his farm and his farming philosophy.

Fall-planted grains are planted to retrieve the highly mobile nitrogen left in the soil after harvest. Deep-rooted cover crops are used to pull other moderately leachable nutrients such as calcium and potassium from lower soil levels and return them to the soil surface for the next season’s crop. Cover crops such as buckwheat and lupin are also utilized to enhance the bioavailability of phosphorus. (See \textit{Managing Cover Crops Profitably from the USDA’s Sustainable Agriculture Network (SAN)} for additional information on cover crops.)

In addition, several of the farmers have developed compost-making skills. Much of their beginning raw materials are available for free or at low cost (e.g., rained on hay, spent mushroom soil, and horse bedding). Municipalities will often deliver leaves in the fall that can be stockpiled for future use. Bob Muth spreads up to 20 tons of leaves per acre (a six inch layer) on some of his fields each fall to improve his southern New Jersey mineral soil. Having a cover crop established when the leaves are spread keeps them from blowing.

\textbf{TILLAGE is the process of working the soil with mechanical implements to prepare a seedbed and control weeds.} Most of the farmers we spoke with tried to minimize their tillage. They wanted to preserve soil structure, keep weed seeds from surfacing, maintain the macroinvertebrate population in their soil, and reduce the use of fossil fuels. However, none of the farmers we interviewed did permanent no-till vegetable production, although some are experimenting with no-tilling a few select cash crops into killed cover crops. The organic farmers are prohibited from using most herbicides, currently essential to a permanent no-till farming system.

Otherwise, there are a variety of tillage methods utilized. Shallow tillage and the use of a chisel plow or spader were common. The Nordells farm with horses and are limited to lightweight horse-drawn equipment. They advocate ridge tillage. Until recently, the Gurleys cultivated with rototillers and hired custom tillage when needed.

Several of the farmers utilize the stale seedbed technique whereby they cultivate, wait a couple of weeks for weeds to flush, cultivate to kill the first flush (or two) of weeds, and then plant.

\textbf{AFFORDABLE EQUIPMENT comes from auctions, sharing with neighbors, retrofitting and adapting currently owned machinery, and of course utilizing the stuff that came with the barn.} Many farmers obtain their equipment at farm auctions. Older farm machinery is often smaller and more suitable to small-scale farming than is modern machinery. Many...
farmers also modify existing equipment to suit their needs. They expressed a desire to limit the amount of debt carried. Reducing equipment costs is one way to limit debt.

There was little use of the moldboard plow, although Drew Norman uses it for hay production and for laying plastic. Chisel plows were frequently used. Most of the farmers liked to buy used equipment and a mechanical inclination by someone in the family seemed to be a distinct advantage. Chip Planck apparently isn’t mechanically inclined, because he feels having someone else service his tractor is money well spent. Some of the farmers inherited equipment with the farm and that dictated what they used. Allis Chalmers G tractors and Imants spaders seemed to be universally approved. Drew Norman feels that it’s cheaper for him to buy extra tractors that can be set up and ready to go than to have to change tools repeatedly. That sentiment was shared by other farmers.

IRRIGATION AND MULCH are the means to provide and conserve soil moisture for consistent crop production.

The ability to irrigate varied widely from farm to farm. Most farms had some irrigation capability, and trickle irrigation was widely used. Farmers with a limited ability to irrigate used more plastic mulch than they might have liked because it conserves soil moisture (and suppresses weeds). Straw or hay or an intercrop such as Dutch white clover was used in the row middles. Some farmers use a plastic mulch for most of their crop whereas others use it only with crops that do especially well under plastic. Jack Gurley likes plastic with onions, spring broccoli, bak Choi, and summer squash. Plastic drip tape is generally laid below the plastic to provide water directly to the plant, as well as to minimize the amount of water used. Many of the farms we visited mulch heavily with hay or straw. This also serves to conserve soil moisture and minimize weed pressure.

The Nordells’ farm is located high on a mountain with no access to water for the field crops. Much of the production strategy is geared toward minimizing moisture loss. Attention is paid to cover cropping over the winter to build up soil organic matter, and consequently the moisture-holding capacity of the soil. Cultivation is shallow so as not to dry out the soil. Summer fallow is practiced on some fields with several shallow cultivations to kill moisture-robbing weeds. Ridges are formed on some fields in the fall when the cover crop is planted. In the spring, just the top of the ridge is cleared for planting. The residue from the top of the ridge is pushed to the row middles to add to the cover crop residue there. This helps to conserve soil moisture and reduce weed pressure. Some crops (e.g., garlic) are mulched heavily.

HIGH TUNNEL PRODUCTION is becoming increasingly common. A high tunnel is a high hoop house with a single layer of plastic. It often has roll-up sides and/or removable ends to provide good ventilation. It may be unheated or it may have some supplemental heat. Traditionally it is used for season extension. It can bring produce in 2 – 3 weeks earlier in the spring and keep plants producing 2 – 3 weeks longer in the fall. It can be covered with a second layer of plastic and additional insulation used within the tunnel to produce cool season crops throughout the winter.

Tomatoes are probably the most popular crop in high tunnels, although high tunnels are increasingly being used for production of other high-value crops such as mesclun, strawberries, and raspberries. High tunnels are useful also because they prevent damage to crops from rain and wind.

Many of the farmers we spoke with had high tunnel production. Although a few farmers did not want a longer season, many farmers liked the marketing flexibility and premium prices for early produce afforded by a high tunnel. Most of the farmers interviewed did not move their high tunnels, but proper design and siting can allow high tunnels to be moved to an adjacent site facilitating crop rotation. Removable ends allow tillage inside with full size farm equipment. Some farmers use cover crops inside their high tunnels, and Jon Weaver-Kreider has found paper mulch to be effective inside his high tunnel.
Calvert’s Gift Farm

Production field at Calvert’s Gift Farm.

Jack and Beckie Gurley farm on a little less than five rented acres in Baltimore County, Maryland. They did not come from a farming background and started off farming organically more or less by accident. They’ve since come to fully support the organic movement. They grow a wide variety of vegetables, herbs, fruits, and flowers which they market in a variety of ways. They farmed using just a rototiller for many years and hired custom tillage when needed, but they decided to invest in a tractor in 2002 when they added up the custom tillage costs. Beckie is the one in the family who’s mechanically inclined, so she drives the tractor and fixes any broken equipment. The Gurleys are unusual in the sustainable agriculture movement because they farm and parent two young children. Jack said he rarely works past 5 p.m. (often because there are children’s activities to attend to), and then he’s done for the day. He also said that sometimes he starts at 5 a.m. With a set end to his day, Jack feels like his time is more his own and he has a better rhythm to his life.

Jack doesn’t have a written business plan, but he does have a vision. That vision includes stewardship. He says the bottom line is that his land is better this year than it was the year before. His plants are healthier, his soil tilth has improved, there’s a diversity of life on his farm, and the farm feels vital.

Local marketing
Jack says it’s important to know who your market will be before you start to farm. Will you be marketing to high-income, food-savvy clientele at a farmers’ market or directly to ethnic restaurants? Who your market will be determines what you will need to grow. While some farmers are comfortable with one marketing outlet or with one type of marketing outlet, Jack feels there’s safety in diversity. The Gurleys’ focus is on high-value crops. These crops are highly intensive and require a lot of manual labor.

Diversity
Calvert’s Gift Farm produces a wide variety of produce and flowers. They have fava beans, fingerling potatoes, and heirloom tomato varieties in addition to more standard fare. In addition to this biological diversity, there is diversity in marketing outlets. The Gurleys have a 40-member CSA. They sell to restaurants – through a broker in the District of Columbia and directly in Baltimore. They sell at two weekend farmers’ markets as well as to an organic cooperative. Jack says he frequently gets requests to specialize (e.g., his D.C. broker would like all the mesclun he could produce), but he’s firm on the wisdom of maintaining a wide diversity in what he grows and in his marketing options.

Educational mission
The Gurleys are both educators. Beckie manages the farmers’ market sales and enjoys getting people to try something new, like garlic pigtails, the stalks harvested from their hardneck garlic. Beckie is also on the Maryland Organic Certification Advisory Board. Jack is very active in the sustainable agriculture field. He’s on the board of Future Harvest - CASA and was past chairperson of the Maryland Organic Food & Farming Association (MOFFA). He is a frequent speaker on sustainable agriculture issues and was recently selected as a Sustainable Agriculture Research & Education (SARE) Sustainable Agriculture Educator. He says, “We have to educate people about what we’re doing, and that they’re important to our financial success.” He’s learning more and more that education is important to the sustainable agriculture movement, and it’s interconnected with keeping farmers successful. He feels compelled to participate in education and outreach. It’s important to him to be a role model and teach and inspire others. And after ten years of farming, he’s beginning to feel comfortable as a role model.
Logistics and management

Jack may be an anomaly among farmers. When he thinks about the future, he doesn’t see more land in cultivation, he sees a higher income from the land he now farms. He wants to stay small, but acknowledges that staying small forces him to think. To maximize his profits, he needs to finetune his cropping and marketing strategies. Time is his biggest constraint. When he has some time, should he spend it on a sales call, on agricultural research, or on farmwork?

When he and Beckie started farming, Jack kept an off-farm job for a long time so they would have no debt, and they rent their farmland rather than have to carry a loan on the land.

Jack says it’s important to know your strengths and weaknesses so you can maximize your effectiveness. You also have to be able to track your progress – over a full year and over the period of time you’ve been farming. Records are really important. They evaluate each crop they grow and know how much it made. They keep track of what techniques were used each year and what the weather was like. The only way to know whether the planting of Dutch white clover under the tomatoes was a good thing is if you have records. Jack says he has an insatiable appetite for information. He researches on the Internet, while walking down a produce aisle at the grocery store, and every time he visits a library. He enjoys visiting other farms to gain a different perspective and observe another farmer’s techniques. He also likes attending sustainable agriculture conferences because of the wealth of information and networking available. But when all is said and done, each farming situation is unique and needs its own set of answers. Farm plans aren’t transferable and there are no “trade secrets.”

Jack finds farming intellectually stimulating because he learns so much every year. He has learned a lot on his own by trial and error and is a firm believer in experimentation. He tries new things every year.

Crop rotation and cover cropping

Jack believes a good rotation is the key to his farming success, and he follows the one he’s laid out religiously. Actually, he uses three basic rotations, all of them interrelated. One of his rules is that garlic is planted in the same place only once in nine years. He likes to underplant his first heirloom tomato planting with Dutch white clover. He uses large transplants so the tomatoes get off to a good start, and he keeps the clover mowed to reduce its competitiveness with the cash crop. The second heirloom tomato planting goes into a killed hairy vetch mulch. He also uses a living mulch, hairy vetch, with fall-planted broccoli. He uses large broccoli transplants but doesn’t need to mow the vetch.

“"We have to educate people about what we’re doing, and that they’re important to our financial success.”"
Drew and Joan Norman farm on 200 acres in Baltimore County, Maryland. All but 35 acres of the land is rented. Drew rents additional land because he believes single cropping and long rotations into hay are beneficial for his soil. At any given time, about half of the land is in vegetables and half in hay. The Normans have been farming since 1983 and are the second largest organic farm in Maryland. Their principle market is wholesale, but they have a thriving 70-member CSA and attend one farmers’ market. Joan also has about a hundred laying hens and markets eggs to her CSA and at the market.

**Relationship building**
The Normans build relationships in several ways. On the farm, they house their Mexican workforce in housing they built especially for that purpose. A swingset is in the grass outside one of the apartments and laundry may be found drying in an empty greenhouse. One Straw Farm is home as well as employment for these workers for much of the year. The Normans began with a few Mexican workers, and that initial core group has done the remaining recruiting for them. What they’ve ended up with is a team of friends and relatives that come in March and leave when it gets cold. The crew changes a little from year to year, but the labor is reliable and highly skilled.

Joan is the one who goes to the weekly farmers’ market and manages the CSA. She also hosts farm tours. One of her favorite tours is when the fourth graders visit. They pick their own produce and make (and eat) a salad. She delights in getting kids to try new vegetables. The CSA pick-up is principally at a local vineyard where CSA members get a discount on wine on pick-up day. Joan uses the point system for her CSA rather than having a uniform distribution. She finds that her members are happier when they get to choose the items they want rather than having to take a predetermined kind and amount of produce. Joan loves to visit with her CSA members and market customers and excels at building relationships.

**Stewardship**
Drew wants his land to be sustainably productive forever but realizes that farming is somewhat destructive. He’d prefer to put his land in trees and native grasses, but since he needs to earn a living, he seeks to minimize the destructive aspects of farming by single-cropping his fields and keeping half of his land in hay. He feels that hay is very good at building up the fertility and tilth of his soil: cover cropping just does not do as good a job as leaving the land in hay for two to three years. He also said that everything is easier the first year vegetables are planted after hay. Soil fertility is good, and insect and disease pressure is less.

After years of practice, Drew has become accomplished at making compost. His core materials consist of rained on hay, leaves, horse and chicken manure, and spent mushroom soil. He makes long windrows that he turns frequently with a compost turner. He would like to use compost on every crop every season but is obliged to use less now because of the state mandated Nutrient Management Plan he follows. Adding compost to his fields is part of his stewardship: it replaces lost fertility and adds beneficial microorganisms to his soil.
Logistics and management
Drew feels that small farmers don’t pay enough attention to detail and said One Straw Farm didn’t begin to make money until they started focusing on details. Weeds, insects, and diseases warrant more attention than they typically get on a small farm. For instance, Drew begins to spray his tomatoes preventatively with an organic fungicide as soon as the workers start tying them to stakes. He feels you’re growing more than you can take care of if you can’t pay attention to the detail.

One Straw Farm is known for their consistency in producing extremely high-quality produce — “People know our produce is quality.” All One Straw Farm produce is labeled. The bundles of greens have a hang tag, the boxes are clearly designated, and the new delivery truck has the same One Straw Farm logo on its side. Drew and Joan are proud of the quality of their produce and want everyone to know it’s theirs.

Drew says that most of his agronomic decisions are not based on making a sale, but rather on ways to make his farm more productive within the organic regulation constraints. He doesn’t especially like being in the wholesale trade and imagines a day when the CSA numbers 7 or 800, and he doesn’t sell wholesale at all.

Drew originally envisioned a small operation that he and Joan could handle with minimal outside help. He said he quickly realized that he couldn’t spend the rest of his life on his knees and would have to do more management and less down-on-his-knees work. Thus, One Straw Farm grew to its current size. He’s now at the point where he doesn’t have time to be as good an agronomist as he’d like to be, and yet the operation is too small for him to hire a manager.

One of the management issues that Drew struggles with is figuring out whether he’s making money on a specific crop. He feels it’s difficult to get a handle on input costs and apportion them out among various crops. He uses the software program FarmWorks™ and likes it a lot. Joan likes FarmWorks™ less than he does because it doesn’t handle inventory well.

Crop rotation and cover cropping
Drew rarely gets a summer cover crop in but tries to have cover crops on all his fields in the winter. He usually uses a cereal rye and hairy vetch mix or hairy vetch with crimson clover. He’s experimented with other cover crops. Lupines winterkilled when he didn’t want them to. He likes annual ry e for the better ground cover and thicker root mass he gets with it, but it goes to seed too readily. Cover cropping is an important part of his fertility management plan.

Drew’s rotations are generally long. He uses a moldboard plow and then seeds a hay crop, usually an alfalfa and orchard grass mix. This stays in for two or three years. When the alfalfa starts to decline, he takes a first cutting, lets it grow back and then plows it down. He leaves the field clean for about a month so the residue can break down. He then cultivates a few times after weeds flush on the field. He then drills in vetch and crimson clover for winter cover by mid-September. Mid to late spring the following year, he plows the cover crop in and puts a solanaceous crop in with black plastic and trickle irrigation. That fall he plants wheat. The next spring the field will get a non-solanaceous crop, maybe lettuce with a dressing of compost followed by a fall planting of brassicas. The next year might be squash and then back into hay.

Occasionally he has a cash crop in the field for so long he doesn’t have time to plant a cover crop, but cover cropping is a priority with him so this happens rarely. Drew will seed wheat until the third week in October and still get a decent stand.

Irrigation
Drew has a limited amount of irrigation water available and it drives some of his decision-making. He uses trickle irrigation when he irrigates and, out of necessity, he uses more plastic than he feels comfortable with. He prefers embossed black and red plastics. He finds the embossed plastic well worth the extra $5 a roll, because it lays better and pulls up more easily. He didn’t like working with silver mulch: you had to have your sunglasses on because it created so much glare, and it was brittle and would split where wheels pushed it down. It was also expensive. He used degradable plastic once, but the edges didn’t degrade, he couldn’t cross cut disc, and it was in his fields for years afterward. He’d like to use paper mulch if the price ever gets competitive.

Swiss chard ready for shipping at One Straw Farm.
Ecosystem Farm

Ecosystem Farm is the organic demonstration farm operated by the Accokeek Foundation. The Accokeek Foundation is a non-profit, educational organization that advocates sustainable use of natural resources and good land stewardship practices. The organization also historically interprets the natural and cultural resources of the Potomac tidewater region. The Ecosystem Farm and the Accokeek Foundation are both located within Piscataway Park, under the jurisdiction of the U.S. National Park Service, in southern Prince George’s County, Maryland, directly across the Potomac River from Mount Vernon. The farm is sited on land that had primarily been used to grow tobacco for 300 years. Eight acres are currently used to grow vegetables, herbs, fruits, and flowers for a CSA.

Ecosystem Farm was established in 1991, and Shane LaBrake came on as farm manager in 1995 and started the CSA. The CSA currently has 56 members, down from 70 last year, and has a season of about 30 weeks. The CSA is the sole retail outlet for the farm. Ecosystem Farm is not self-supporting and much of its income comes from the Accokeek Foundation. However, it is an educational farm and staff time is used to conduct tours and host educational field days.

Diversity

What Ecosystem Farm lacks in marketing diversity is more than made up for in the diversity of its plants and animals. The farm produces a great variety of vegetables. Herbs and flowers are grown for their insect-attracting properties as well as to round out the weekly CSA share. Fruits are currently limited to strawberries, but blueberry bushes and fig trees have been planted and will add variety to the share in future years. The farm is surrounded by natural forest and wetland areas. Zebra Swallowtails and their host plant, the native Paw Paw tree abound. Shane has seen an increase in the bird fauna over his nine-year tenure and proudly points out American eagles soaring overhead. He has encouraged beneficial wildlife by putting up bluebird boxes, purple martin apartments, and bat houses. He has about a dozen hens in chicken tractors that produce eggs for the staff and manure for the farm. Guinea fowl have been used to eat pest insects, especially ticks. Deer are abundant but are kept out of the farm with deer fencing. There is an overabundance of geese in the winter that feed on the cover crops; Shane is still searching for a humane and workable solution for that problem.

Educational mission

Ecosystem Farm’s primary mission is education. The original intent was to establish an organic farm on depleted soil and demonstrate how good stewardship could improve the fertility and tilth of the soil while still producing food. Although that has proven more difficult to do than envisioned, Ecosystem Farm still shines in its educational role.

The CSA shareholders get a weekly newsletter. The well-written 2-page piece takes the CSA members into the pains and joys of everyday farm life. It talks about the weather and gives concrete examples of how this week’s rain (or lack of it) affects their shares today and in the future. The members get a feel for diseases and insects that may be affecting the crop and more importantly, how the farm crew is dealing with these crises and reducing their severity. There’s also usually a philosophical article that looks at issues such as the importance of eating in season or the effect of agricultural run-off on the Chesapeake Bay. And, of course, there are the recipes that tell you how to cook the tat soi in your share this week!

Ecosystem Farm also gives regular and impromptu tours. They host 5th to 8th grade schoolchildren for “Land and History” school programs. They help high school and college kids with special projects as well as collaborate with researchers from the USDA and the University of Maryland. Workshops are sponsored for local farmers and other interested parties on topics such as high tunnel production and post-harvest handling of vegetables.
Perhaps the most important educational mission of Ecosystem Farm is its training of apprentices. The farm hosts 3–4 apprentices a year who come for most or all of the agricultural season. There have been 27 in the last 9 years. Most have continued in farming or a related field. Some are running farms of their own now. Shane feels that education is the key to building a strong community and to articulating the vision of sustainable and regenerative agricultural stewardship.

Stewardship
Stewardship at Ecosystem Farm began with the design of the farm. There is a 100-foot-wide naturalized buffer next to the Potomac River. Closer to the farm, is a wet area between 50 and 100 feet wide that was planted with wetland-adapted trees and shrubs (the agroforestry buffer). Fields were graded so that water runs onto grassy waterways that lead into the adjacent woodlands and eventually into a freshwater tidal swamp. The grass strips and wetland helps to filter out any soil or nutrients that have left the fields before they reach the river.

Shane and the Accokeek Foundation administrators recently decided to reduce the number of CSA members from 70 to 56, because they felt that the land was being overtaxed. Shane tries ways to shrink the land he has in production so that more can be left in regenerative cover crops or sod. He finds his role as steward challenging but also humbling. It takes years to understand the ecological systems involved. The challenge is to always look for a better way to farm—to get synergy by working with nature instead of being opposed to her.

Off-farm materials
Ecosystem Farm began on a worn-out tobacco field. The field is low-lying with an impermeable clay layer under the topsoil. As a consequence, it drains poorly and is wet much of the year. Fields began and remain very deficient in potassium. Boron is also very low. However, the organic matter component of the soil has risen slightly since it was first checked in 1998. This land is better suited to being in forest than in crops. However, the Accokeek Foundation runs Ecosystem Farm as a demonstration farm. They want to examine the mechanics of and promote the improvement of marginal land. Shane works to increase the fertility of the soil by cover cropping, minimizing tillage, and adding organic matter. However, he also buys more off-farm inputs than most small farmers.

Shane buys straw bales that are used to mulch the vegetable crops, primarily for weed control since retaining soil moisture is normally not desired. He adds lime periodically to lower the pH. Gypsum is applied regularly. Shane feels that it alters the soil chemistry so that water moves more easily. He adds greensand for slow release of potassium and to loosen his heavy soil. Humates (finely decomposed organic matter from New Mexico) are added to increase soil organic matter if the field’s cation exchange capacity is under 10. Kelp and bloodmeal, and sometimes bonemeal, are used as starter fertilizers in the spring. Feathermeal has been used as a slow release nitrogen source for garlic and asparagus.

Shane has purchased Leafgrow compost and also makes his own. His compost is made from available materials: old hay, National Park Service horse manure and bedding, grass clippings, leaves, etc. And, of course, he cover crops as much as possible. He experiments with a wide variety of covers and mixes. Buckwheat is often used in the summer. Pathways in fields are primarily Dutch white clover.

Irrigation
Irrigation, if needed, is provided by the Potomac River. Ecosystem Farm has a solar-powered pump and uses trickle irrigation.
Roy Brubaker and his daughter Angie farm 35 acres in central Pennsylvania, 15 acres of which are rented. They use about eight acres to produce vegetables, herbs, fruits, honey, bedding plants, and cut flowers. They also produce pastured poultry, rabbits, and pigs, and they have a u-pick strawberry field. About half of their total land is in production. In 2001, they acquired a small, private orchard with a collection of established pear, apple, peach, cherry, and plum trees. They’ve been organic since 1982. In addition, the Brubakers have a small soap-making operation using many of their own herbs and flowers.

Local marketing
The Brubaker family began a 26-week CSA in 1998 with 19 members, and the CSA has grown steadily. They had 101 members in 2003. In 2002, they began a winter share, and this year they have 50 members signed up and a waiting list. CSA members have the option of purchasing pork sausage, chicken, and/or rabbit to supplement their share. They also sell to a wholesale cooperative, Tuscarora Organic Grower’s Cooperative, which takes about 60 percent of their produce plus some of the flowers. The CSA uses 30 percent of their produce. They also have a stand on the farm but minimal selling is done there.

The Brubakers participate in a weekly farmers’ market in Carlisle and sell less than 10 percent of their total produce production there. Cut flowers are a strong seller at the market. Angie and an intern take ready-made bouquets as well as buckets of loose flowers. They sell custom-made bouquets for $1.00 more than the pre-made ones and find some customers prefer having the bouquets made up at the market. This is their fifth year at the market. The market has grown steadily and thrives with good community support.

Their handmade soap is sold at the farmers’ market, through local gift shops, and via the Internet. Currently 21 varieties of soap are made, most of which will be available at any given time.

Diversity
There are woods and hedgerows, providing habitat for beneficial insects and birds, surrounding the production fields. Four and a half acres of woods have also been left as a wildlife area. A stream flows through the edge of the property, and 800 black walnut trees were planted there 11 years ago with the prospect of providing nuts and lumber in the future. There is a bat house on one of the outbuildings with a 400-strong bat colony. (Roy and Angie lie on their backs in the grass at dusk on a summer’s evening and count bats as they leave the house.) They collect the guano for horticultural uses. There are purple martin colonies present each summer to eat huge quantities of flying insects, as do the bats. They have honey bee hives, which Roy’s son maintains for him. They also have a good assemblage of native pollinators. Penn State entomologists collect pollinators from their farm in connection with research being done on red raspberry pollination in high tunnels. Roy enjoys collaborating on research.

In addition to a wide variety of vegetables, herbs, fruits, and flowers on the farm, Roy also raises pastured poultry (about 300 chickens a year plus turkeys for the holidays) and rabbits. He also has a couple of pigs that are used to turn compost (and later become sausage).
Educational mission
Roy was a mission teacher in Kenya and Somalia for many years so the educational mission of agriculture comes naturally to him. His experiences there amid drought and other natural disasters convinced him to return to his roots when he came back to the U.S. and join “the radical wing of the farming revolution” (i.e. grow organically). Roy feels that how we eat determines how the Earth is used. “Encouraging people to eat locally-grown food is an environmental act. The consumer and the farm ought to be natural allies.”

In addition to educating their customers about the value of locally grown, organic food, the Brubakers host as many as four interns a year. Interns are trained in the techniques of farming organically and direct-marketing as well as in the philosophy of the sustainable agriculture movement.

Knowledge and experimentation
Roy has been active in the organic movement for years and is a director of Pennsylvania Certified Organic (PCO). He attends the yearly PASA conference, likes Appropriate Technology Transfer for Rural Areas (ATTRA) publications, and his farmer cooperative’s winter meetings. He also attends workshops that interest him (e.g., Penn State’s high tunnel workshop).

He is innovative on his farm and likes to build or adapt the equipment he uses. He experiments with new equipment and techniques. He was looking for a low-labor alternative to netting his blueberries to reduce bird damage and read about spraying them with grape Koolaid. He decided it was worth a try. He was intrigued by the idea of using vinegar as an herbicide and planned to try it out for weed control in the blueberry field. He hasn’t used oil with his sweet corn yet but figures that, if he does, he’ll make his own applicator rather than purchase a Zealator.

Crop rotation and cover cropping
Roy keeps a record book with a page for each field. He keeps a record of the majority crop for that field and follows a rotation whereby the field has a cash crop for one to three years followed by wheat or spelt followed by sod. If the soil is good, there’s a cash crop on it for three years; poorer soils have a cash crop for one or two years before the soil is cover cropped to rebuild it. His organic matter started at 2 to 2.3 percent and is now at 3 percent or more with this system.

He admits that he often has to deviate from the rotation he had planned, but tries not to repeat any crop family within a field except during the same season.

A variety of cover crops are used. Cereal rye and hairy vetch are often used in the fall. Dutch white clover and rye may be used in alleyways and are kept mowed. Roy has experimented, with mixed results, with planting into killed hairy vetch. He lost a lot of tomatoes one year to damping off (and maybe voles) when he planted into a rolled hairy vetch cover crop and the weather turned wet.

Holistic pest management
Roy is also innovative in his pest control tactics. He uses goats to control multiflora rose. He uses Pediobius foveolatus wasps to control the Mexican bean beetle. He’s working on a technique to start the wasps early in the greenhouse and then move the mummies to his outside bean plantings in order to reduce the number he needs to buy. He encourages insectivorous birds and bats by providing housing for them. He encourages beneficial insects by having natural areas on his farm and also by providing lots and lots of flowers. Many good cut flower plants are also good insectary plants.

Roy even ordered a helikite from England to scare birds away from the blueberries. The helikite soars and looks like a hawk. Unfortunately, the kite escaped (as might a hawk) from the intern in charge of getting it up and tethering it, so Roy doesn’t know how well that pest control tactic might actually have worked.

High tunnel at Village Acres Farm.
Beech Grove Farm

Field day at Beech Grove Farm.

Eric and Anne Nordell bought their mountaintop farm in north-central Pennsylvania 21 years ago. They have 90 acres, some of it forested, some of it quite steep. They farm on a fairly level ten-acre site near the top but have no access to water for irrigation. Originally they grew medicinal herbs for the wholesale market, but moved into direct sales of vegetables because Anne liked the public contact it provided. With a heated greenhouse to start transplants and several high tunnels, they’re able to produce vegetables from the second week in May until Thanksgiving. Because of their cool climate, they focus on cool season crops. They have no hired labor and no tractor. They farm using draft horses and horse-drawn tillage and cultivation equipment.

Local marketing
The Nordells market their produce in several ways. They attend one farmers’ market in nearby Williamsport, they market directly to local restaurants, and they sell at a local grocery store. Their produce is popular at the store; the produce manager will pay more for it than he would have to pay for organic California produce, and sometimes he uses it as a loss leader. He only gets their excess and only when there is excess. Anne says the key to their success with the produce manager is that they’re friendly and reliable. She thinks that making an effort to be “nice” to the produce manager has made the arrangement work.

Anne said that the farmers’ market has really grown in the last six years, mostly by word of mouth. She says that Williamsport is a little off the beaten path and is about ten years behind the times on food trends so it’s easy to be ready for the trend when it hits (unless the trend passes Williamsport by entirely).

Educational mission
The Nordells are natural educators. While they cherish their privacy, they also enjoy public contact and the chance to share their philosophy and farming style with their customers and their peers. They write extensively for publications such as “Acres U.S.A.” and “Small Farmer’s Journal.” They have hosted many group tours and a field day for PASA and are regular speakers at sustainable farming conferences. They share their agricultural prowess and discuss strategies and techniques that work for them and explain why. In addition, they have produced two booklets of their written articles and a video ($10 each) that provide a complete description of their cropping and tillage strategies.

They also collaborate regularly with USDA and university researchers and are currently one of eleven focal farms for the Northeast Organic Network (NEON). They’re just as interested in learning from others as they are in sharing their knowledge.

Logistics and management
The Nordells are very methodical in their farming. You get the sense that things are done for a reason and always get done on time at Beech Grove Farm. They’ve made a conscious decision to farm without hired help which means they’ve made decisions to prioritize their own labor expenditures. The Nordells farm with horses, and horses need hay. Their original decision was to buy the hay rather than grow and cut their own. Growing their own would have committed them to more labor than they could handle without additional help. For the last three years, they have sharecropped with a neighbor. They fertilize their hayfield, the neighbor cuts and bales it, and they split the hay 50/50. They like to keep the horses in their stalls during the day so they’re ready to work, and they get the manure for their compost deposited close to where they want it. The horses are in the field at night during the summer and in the day during the winter.

Their farming decisions have more structure to them than the decisions of many other farmers we visited. For instance, their compost making begins with manure and bedding from the horses. They add manure from the dairy heifers they board to add diversity to the compost mix. They buy two piglets each fall whose job it is to turn the compost. This is accomplished by plunging a rod to the bottom of the compost pile in several areas twice a day and pouring shelled corn down the hole. The pigs root to the bottom of the compost to get to the corn and aerate and turn the compost at the same time. When the compost is ready, the pigs go to a fresh pile. In the winter the chickens are put on the compost to scratch it and worry it for a while longer. The chicken assisted compost is used for special purposes such as potting mix. At the end of the season, the pigs are butchered and the meat given to charity. The oldest two-dozen chickens are also killed and processed. The remaining two-dozen chickens will supply them with eggs over the winter. In the spring they buy another two-dozen pullets, so they don’t have the trouble of dealing with chicks. The only problem is they haven’t found a source of...
organic pullets that haven’t been debeaked, which isn’t an optimum condition for free-range birds. They’ve used no fossil fuel to make the compost, and little of their own labor until it’s ready to be spread.

Their greenhouse is heated with a wood-burning stove. The hot air is channeled through rocks under the benches. One stoking of the stove causes the stones to heat up and release heat slowly throughout the night. There’s no need to tend the fire through the evening.

The Nordells are very tough on weeds and do their best to suppress weeds at every available opportunity. They have a seed cleaner that they use to clean the cover crop seed they buy before they spread it in their fields. It’s a small thing, but it’s this attention to detail that makes their farming methods so dynamic and so wonderful to observe. Virtually weed-free conditions make it possible for the Nordells to grow labor-intensive crops without hired help and to adapt reduced tillage systems to organic vegetable production.

**Crop rotation and cover cropping**
The Nordells also have a very structured approach to crop rotation and cover cropping. It could be said that the cover crops drive the rotation. Each year about three to four acres are in cash crops and three to four acres are in cover crops. The purpose of their cover crop plan is to keep the soil fertile and reduce weed pressure. They have divided their market garden into 12 half-acre sections and use a 4-year rotation. Their cool season crops are considered early or late, depending on their scheduled planting date. For their early spring crops, they use a cover crop that will winter kill so that a seedbed can be prepared with a minimum of tillage. Shallow tillage prevents the soil from drying out deeply; it keeps the residue on the surface to slow erosion and improve rain infiltration. The residue also serves as a mulch which reduces evaporation from the soil. The added advantage of using a winterkilled cover crop is that it does not attract maggots and cutworms, as will turning in a fresh overwintering cover crop. They like the cover crop combination of Canadian field peas and oats, which reliably winterkills for them. Winter cover crops are generally planted by the second week in August. They don’t have a drill, although they could use one, so they harrow or shallow plow to cover seed.

For their late crops, the Nordells use a cover crop that does not winterkill. They like using annual cereal rye with hairy vetch, and they use Italian rye and clover before a potato crop. Italian rye is a biennial. It grows fast but doesn’t set seed until the second year so they don’t have to mow it. Eric warns that you need to have the equipment to handle the residue your cover crop will provide. Mowing can make the residue easier to handle.

They manage legumes so that they don’t flower because flowering creates tarnished plant bug (TPB) problems for them. They will use buckwheat as an intercropped living mulch to distract TPBs from the cash crops and to increase the number of beneficial predators, parasites, and pollinators in the market garden. Slugs are a problem with surface residue. They tried using ducks once for slug patrol, but it didn’t work well. However, they’ve had good success using their small flocks of laying hens to “chicken-till” and munch on slugs. The chickens are pastured on clipped cover crop residues or on the Italian ryegrass/clover mix in the fall. Using the birds in the fall year before production complies with the new Federal organic rules prohibiting application of fresh manure within 90/120 days of harvest.

Cover crop management and tillage strategies are continually evolving at Beech Grove Farm. Their four-year rotation seems to be transitioning to a six-year rotation as they more fully utilize specific cover crop-tillage combinations that were developed for specific planting windows.

**Tillage**
The Nordells farm with horses. In general, they use shallow tillage to conserve soil moisture and till just enough so that they can plant. Because cover crop residues that are worked into the soil can keep the ground too wet and cold for their earliest crops, they’ve become advocates of ridge till planting, in part because it helps to warm up soil in the spring. They like the concept of no-till and no-tilling on the top of a ridge seems to work for them. They often form the ridges in August, incorporating the cover crop seed as they go, and then come through in the spring and cut the top off the ridge and plant into that residue-free area. The row middles get the extra residue pushed off the ridge and that helps with weed and erosion control. They’ve found that carrots can be planted into fairly high residue using this method, and they can ridge-till spinach by just barely scraping off the ridgetop.

Their early transplanted crops follow winterkilled cover crops; they then use a disc to break up the residue and a field cultivator to form planting beds. For fields where they have formed ridges in the fall, they scrape the top off with an extra large sweep to expose a narrow strip of clean soil for planting direct seeded crops with their walk-behind seeder. For onion sets, garlic, and transplants, they just make a slit into the cover crop residue on the ridgetop and plant directly into the undisturbed ridge. The crop gets the best of both worlds: a warm, well-aerated root zone in the ridge and a large reservoir of moisture in the mulched valleys.
Jack and Dale Duff have an 85-acre farm in western Pennsylvania just north of Pittsburgh. They bought the property in 1988 and initially had a very large vegetable garden for themselves, friends, and family. Jack is a retired banker, and Dale has an advertising business. The garden gradually got bigger, and Jack and Dale began selling produce at two farmers’ markets. In 2002 they were farming on about 7 acres, working on getting another 15 acres ready for farming, and had acquired an old orchard. Their marketing outlet is now a 20-week CSA with 70 members and 2004 will be its sixth year.

The CSA has a wide variety of vegetables, herbs, flowers, and fruit in the share. In addition, the Duffs buy organic fruit for purchase as well as provide poultry, eggs, and lamb they produce themselves. They also have an arrangement with Frankferd Farms, an organic dry goods wholesaler, whereby their CSA members can call in an order which the Duffs pick up and make available to the customer on CSA pick-up day. The customers pay the wholesale price plus 12 percent which works out to a good deal for everyone. The CSA newsletter is posted online so that members will know what will be in their share later in the week and can shop accordingly.

Diversity
On the Duffs’ farm there is a wide range of plants and animals. Much of the farm is in woods and pasture with appropriate complements of native plants. A wide variety of vegetables, herbs, and flowers are grown, and there is an orchard with apple and pear trees. They also planted 2000 Christmas trees with thought of a future harvest but haven’t found the time to maintain them.

There are broiler chickens being raised free-range and also laying hens (Rhode Island Reds and Australian Australorps). They especially like the Australorps. They’re gentle and good winter layers. The laying hens produce chicks as well as eggs for the CSA with the help of the resident rooster. There are Barbados blackbelly sheep that produce lamb for purchase by CSA members. The Barbados blackbelly is a haired sheep that doesn’t require shearing. Oakie the llama is the official sheep guardian and does a good job of protecting them from prowling coyotes.

In 2003, they even acquired a male peacock that just showed up and announced his presence with a piercing mating call and show of feathers.

Relationship building
The Duffs are actively involved in their community. They plant substantially more produce than is needed in order to support the Greater Pittsburgh Community Food Bank. They donate as much as three tons of food a year to the food bank. They believe that high-quality, fresh, organic produce should be available to families regardless of their economic circumstances. They share this vision with their CSA members, and the weekly CSA newsletter periodically announces the current year’s poundage of donated food. CSA members can leave produce they don’t want on the trading table for other members to take and know it will go to the food bank if another member doesn’t want it. The Duffs also actively support the food bank’s farm stand program.

The Duffs have become involved with Goodwill Industries as a source of labor. In 2003, they hosted two disabled people and their job coach for a few weeks as the three of them learned the farming operation. They plan to hire Goodwill Industry workers full-time next season. Goodwill Industries helps people with mild mental and physical disabilities and the unemployed learn job skills. These employees may require more training and supervision than other employees initially, but the Duffs have found fulfillment working with them. They have announced in the CSA newsletter that they’re looking for volunteers to help get the new employees started next year.
Educational mission
The Duffs have an educational mission. They are available as consultants on topics such as organic farming and CSA operations. They work to educate their CSA members on the value of organic food and discuss their vision of healthy and nutritious food being available to everyone regardless of means. They also support the food bank’s efforts to expose inner-city children to the food system by giving the kids farm tours. The tours are given to children aged 5 to 7 in groups of 15. They show them where their food comes from—from apples to zucchini. They also deal with the issue of cute little lambs becoming lamb chops. The Duffs give presentations to schools and say that the younger these kids start learning about where their food comes from the better.

Knowledge and experimentation
Jack and Dale are believers in the value of knowledge and education. Jack’s on the board of the Organic Farming Association, an Ohio organization. They’re both long-time PASA members and attend the annual conference.

They have been involved in the start-up of a new organic cooperative, Pennsylvania Local Organics Work (PLOW), and Jack’s the treasurer. One of their first customers was the Slippery Rock University cafeteria. Jack felt that there was a need for an organic-only cooperative. The other cooperative in the area had conventional growers, too, and Jack felt there was a confusing message going out that equated organic and sustainable.

They experiment and innovate on their farm based on the knowledge they acquire. They’ve experimented with red and white plastic mulch. They didn’t feel there was a yield or quality increase with the tomatoes on red plastic, but they liked the white plastic. It reflected light and kept the ground cooler under crops that benefited from cooler soil. They’ve tried interplanting Dutch white clover with cabbage, but their original experiment resulted in the clover outcompeting the cabbages.

The Duff’s are also savvy about seeking available grant money. They received a USDA grant for $28,000 to clear land to expand their organic production. They’re also contemplating applying to the game commission for money to pay for deer fencing. The money’s available if you allow people to hunt during hunting season.

Crop rotation and cover cropping
Jack and Dale keep detailed rotation maps so they don’t plant the same family in the same place two years in a row. They occasionally have a field that’s fallow, but they usually have a rye cover crop on over the winter and will use buckwheat when they have time for a summer cover crop.

Irrigation
A farm pond was built and stocked with large-mouth bass and blue gill so that fresh fish will be available to them. They use both the pond and city water for irrigation purposes. They use drip irrigation when they use plastic mulch. They have mulched brassicas with straw to reduce weed pressure and conserve moisture but found the resulting slug problem hard to deal with.

Actively involved in their community, the Duffs plant substantially more produce than is needed in order to support the local Food bank.
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