MINNESOTA
FRUIT & VEGETABLE GROWERS MANUAL
FOR THE BEGINNING GROWER

Developed by the University of Minnesota Extension Service

Revised in 2004 with funding from the
USDA-Risk Management Agency, Community & Outreach Assistance Partnership Program
through a partnership agreement with the Minnesota Fruit and Vegetable Growers Association

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PREFACE

1. Who is this manual for?

This manual is for people who want to start growing ftuits and vegetables to sell to other people.

2. What will I find in this manual?

The manual has **basic information** that we think all growers should know BEFORE they start planting their crops. We hope that experienced growers who want more information will use the bulletins listed at the end of each section.

Please send any comments about the manual to:

Fruit and Vegetable Growers Manual, c/o Cindy Tong
Department of Horticultural Science, University of Minnesota
1970 Folwell Avenue
St. Paul, MN 55108

3. How do I get more information?

At the end of each section of this manual is a section on finding more information related to that section. You could also write to the people listed below:

4. Who helped write this manual?

Cindy Tong, Department of Horticultural Science, University of Minnesota, wrote many sections and put this manual together. Any errors in the manual are her responsibility.
Gigi DiGiacomo, consultant, wrote the Risk Management and Business Planning sections, updated the Marketing section, and wrote the Café Brenda and Farm Profiles.
Eric Mader organized new photos, developed the key for carrot diseases, and revised some sections of this manual.
Rosemarie Park, Dept. of Vocational & Technical Education, University of Minnesota made the first version easy to use.
Marilyn Johnson helped obtain the funding for this revision.
Roger Becker, Robert Cramer, R. Ford Denison, Vince Fritz, Kevin Edberg, Karl Foord, Laurie Fredricks, Emily Hoover, William Hutchison, Gary Luebke, Julie McGrew, Terrance Nennich, Kenneth Olson, Robert Olson, Gary Pahl, Carl Rosen, John Shutske, and Jerry Wright provided material and/or reviewed and revised parts of the manual.
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This manual assumes that you have already found land to grow your crops on.

If you are still looking, consider the following questions:

Is the soil good for my crops?	Check the soil pH, type, drainage, and slope.
Is there enough water?	You will need water for irrigation, sanitation, washing or precooling produce.
Is the water quality good?	Check water pH and salt (chlorine, sodium, calcium, and nitrate) levels.

Also, food crops grow best in areas with loose, well-drained soil and 8-10 hours of sunlight a day. Avoid sloped, easily-eroded areas; low spots susceptible to flooding; and windy locations. You should have enough land to allow for crop rotation.

Also consider how much labor you will need and what the supply of labor is in your area. Be aware of Minnesota labor laws. Contact the Minnesota Department of Labor and Industry (612-296-6107) for information on regulations and laws regarding insurance, benefits to workers, workers' compensation, and hiring foreign nationals.

RISK MANAGEMENT

In this section, we address the following questions:

1. What is risk and risk management?
2. What type of risk will I encounter as a commercial grower?
3. How can risk affect my business?
4. What can I do to limit my exposure to risk?
5. Where can I go for help?

1. What is Risk and Risk Management?

What is Risk? Risk can be defined as the chance of loss or an unfavorable outcome associated with an action. Uncertainty is not knowing what will happen in the future. The greater the uncertainty, the greater the risk. Risk is what makes it possible to make a profit.

What is Risk Management? Risk Management is supervising or controlling the farm to avoid loss or injury and to make a profit.

2. What Type of Risk Will I Encounter As a Commercial Grower?

Production risk May adversely affect yield and quality:

- Weather
- Insects and wildlife
- Disease
- Machinery and equipment failure
- Little or no production knowledge
- Timing
- Quality of Inputs
- Product Quality
- Genetic Variation

Marketing risk May adversely affect sales volume and revenue:

- Poor quality
- Change in customer preferences
- Price volatility
- Increased competition
- Poor customer service/communication skills
- Little or no advertising/promotion
- Lack of Market/No Buyers
- Inadequate storage or transportation

Human resource risk May adversely affect productivity and management:

- Conflicting goals within family
- Timely loss of family and hired labor
- Lack of skilled labor
- Injury or illness
- Little or no of management experience
- Divorce

Legal risk May affect business and personal liability:

- Federal and state environmental laws
- Tort laws (personal liability)

- Zoning laws (construction, operation)
- Statutory laws (sales and income tax)
- Social Security tax regulations
- Food safety and handling laws
- Federal OSHA farm safety regulations
- Unemployment Workers Compensation regulations
- Migrant and Seasonal Agricultural Workers Protection Act provisions
- Estate Planning and Farm Transfer

Financial risk May adversely affect profitability, cash flow, equity and borrowing capacity:

- Interest rate fluctuations
- Income and property tax increases
- Price volatility
- Little or no operating capital
- Poor credit history
- Credit history/borrowing capacity
- Seasonal cash flow
- Family Living Expenses
- Cash Lease Payments
- Risk of Losing Lease

3. How Can These Risks Affect My Business?

Below is a brief summary of a few "what-ifs" – risks and their consequences for fruit and vegetable businesses. These are not meant to scare you away from commercial production, but simply to give you a feel for what can go wrong, particularly when precautions are not taken. Suggestions for managing and preventing these risks follow in Section (3).

Production

Your knowledge of the soil, fertility, and pest management will have a great impact on productivity. Without knowledge it will be impossible to grow healthy, high-quality crops or to achieve commercial yields. Knowledge is something that you will build over time. Expect some failures in the beginning. Even experienced growers can lose entire crops (and a season's worth of income) due to poor weather, insects, wildlife and disease.

Marketing

Your greatest marketing risk is to not know your competitors or customers. As a commercial grower you may choose the route of being one of many green pepper or sweet corn growers who will have a lot of competition, or you may choose to specialize and target a small pool of buyers. In either case, you will need to produce what customers want to buy, not only what you want produce. Without knowing your competitors and their products, customers' preferences, and market prices, you can almost count on failing. Even experienced growers, who know their

markets well, can find themselves with excess harvest and the need to dump product at the end of the day or season due to unforeseen competition or a change in customer preferences. Sales and income are at stake.

Human Resources

Every grower, even those without employees, are exposed to human resource risk. Personal injury or illness, can affect the entire business, particularly if you are the sole manager. Likewise, should one of your employees or guests become injured when visiting the farm, you are legally and financially liable for paying their lost wages and for covering costs associated with their recovery. Moreover, if you hire migrant workers, you should be aware of local and national provisions concerning fair treatment and payment. Failure to abide by these provisions could have legal and financial repercussions.

Legal

Failure to pay income and sales tax or to abide by building codes and environmental laws can have financial consequences as well as other repercussions. If you do any processing or "preparing" of food, you may be responsible for collecting sales tax and for your customers' food safety. The best way to lose customers, income, and your business is to offer products of questionable quality or safety.

Financial

Any time you begin a business, particularly one in which capital investments are required (e.g. for tractors or greenhouses), you risk assets, your credit rating, and income potential by borrowing and building debt.

4. What Can I Do to Limit My Exposure to Risk?

Below are common risk management practices used by growers. Not all of them will work for you. Pick and choose from those that make the most sense for your business and for your risk level:

Production

- Stagger planting dates to interrupt pest cycles
- Diversify production/crops to limit spread of disease and pests
- Build production knowledge through mentors, workshops, and reading
- Follow "best management" practices
- Plant disease resistant fruit, vegetable and herb varieties
- Rotate annual crops
- Use herbicides and pesticides
- Use biological controls and Integrated Pest Management
- Irrigate crops
- Keep records (planting, weather, pest infestation, yield,

management practices) to learn about what works best
- Utilize high tunnels, rowcovers, cold frames or greenhouses to protect against weather, isolate disease, and extend the marketing season

Marketing

- Research products, markets
- Know your buyers wants/needs
- Find a niche
- Advertise and promote crops and products
- Market to a range of buyers (diverse customer base)
- Watch competition and adjust prices/crop mix when necessary
- Communicate regularly with buyers (particularly retailers)
- Utilize storage to extend marketing season
- Plant crops with different maturity rates to provide continuous product flow
- Monitor sales (best sellers, worst sellers, customer requests)
- Maintain records necessary for organic certification
- Develop a marketing plan

Human resources

- Discuss and revisit goals regularly with family
- Register for federal tax Employer Identification Number (EIN) if hiring
- Comply with minimum wage requirements
- Obtain Worker's Unemployment Compensation insurance
- Comply with federal and state migrant worker provisions
- Train employees and family members
- Train other employees for back up
- Offer good working environment, benefits to retain good help
- Use temporary employees
- Hire custom work
- Maintain employment records
- Take a class to build your own management skills
- Work with a mentor to build experience
- Utilize labor-saving, ergonomically-designed equipment
- Purchase life and disability insurance
- Monitor hours

Legal

- Maintain production licenses (pesticide application or organic certification)
- Understand the Worker Protection Safety laws
- Know and respect food safety, quality, processing and handling laws
- Know zoning requirements and secure permits
- Collect and report all taxes (sales, income and social security)

- Purchase general liability insurance
- Purchase Property insurance
- Use Professional Assistance
    - Attorneys, Accountants and Consultants

Insurance Overview

Comprehensive Farm Liability. This type of insurance is designed to provide liability coverage for family, employee and third party (customer) accidents that occur on the farm during work hours, U-pick season or other events.

Crop Insurance. This type of insurance provides reimburses the grower for the value of crop losses associated with a reduction in expected and/or historical yields and prices.

A Note About Sales Tax

Fresh food items (including those that are sliced, washed and packaged) are legally exempt from taxation. *Prepared food* products, however, are subject to state taxation. Food that is heated or combined (where two or more ingredients are mixed or combined by the seller) is considered "prepared." Examples of prepared taxable foods include: jam, salsa, pies, and mixed salad greens.

Finances

- Purchase crop insurance, if not available purchase NAP (See below)
- Lease rather than purchase equipment
- Share production expenses with other farmers; cooperative
- Negotiate multi-year farmland leases
- Use crop share leases
- Maintain income and expense records
- Monitor profitability (best versus worst performing enterprises)
- Develop annual cash flow projections
- Grow slowly through reinvestment
- Make limited use of credit

A Note About Crop Insurance

Buying a crop insurance policy is one risk management option. Crop insurance policies that compensate growers for production-related losses are available for many grain and oilseed crops, however, fruit and vegetable growers' crop insurance options have been traditionally quite limited. Today, there are several pilot insurance programs being offered outside Minnesota.

Contact the MN Fruit and Vegetable Growers Association for more information about existing and pilot crop insurance programs in the state.

AGR – LITE (pilot outside MN): The Adjusted Gross Revenue-Lite (AGR-Lite) program is a whole farm revenue protection package available to fruit and vegetable growers. It provides protection against low revenue due to unavoidable natural disasters and market fluctuations that affect income during the insurance year. Coverage is based on a producer's historical Schedule F income tax form.

NAP (available in MN): The Noninsured Crop Disaster Assistance Program (NAP) is managed by USDA's Farm Service Agency. It provides financial assistance to producers of non-insurable crops when low yields, loss of inventory, or prevented planting occurs due to natural disasters.

5. Where Can I Go for Help?

Professional Assistance:

- Extension educators
- Lender
- Crop Insurance Agent
- Farm Service Agency
- Financial Planner
- Clergy
- Trusted friend

* Ask for references and credentials as appropriate. Rely on experience from other farmers or trusted friends in seeking recommendations of who to use.

Agencies:

Internal Revenue Service, 316 N. Robert St., St. Paul, MN 55101, (651) 312-8082, www.irs.gov.

Minnesota Revenue Department, 600 N. Robert St., St. Paul, MN 55146-6330, (651) 296-6181, www.taxes.state.mn.us.

Risk Management Agency, Regional Office, 30 East 7th St., Suite 1450, St. Paul, MN 55101-4943, (651) 290-3304, www.rma.usda.gov.

Publications:

"Farm Labor Laws and Regulations in Minnesota, 1999." Bill Lazarus, College of Agricultural, Food and Environmental Sciences. University of Minnesota Extension Service. WW-6528-GO, Revised 1999.

Income Tax Management for Farmers. George F. Patrick and Phillip E. Harris. Midwest Plan Service, Revised 2002.

The Legal Guide to Direct Farm Marketing Neil D. Hamilton. Drake University Agricultural Law Center, Des Moines, Iowa, June 1999.

"Minnesota Sales and Use Tax: Instruction Booklet.", Minnesota Department of Revenue, Revised June 2004.

"Risk Management Toolbox for Specialty Crop Growers", University of Minnesota Extension Service, 2002, www.extension.umn.edu/specialtycrops.

BUSINESS PLANNING AND START-UP

In this section, we address the following questions:

1. What is a Business Plan?
2. Do I need a Business Plan?
3. What should I include in my Business Plan?
4. I have a Business Plan – now what?
5. Where can I go for help?

1. What is a Business Plan?

A business plan is a written document that reflects your vision, your goals, and your strategy for beginning and operating the fruit and vegetable business. A well-prepared business plan (one that you research and write) can help you:

- Determine the feasibility of ideas
- Map transitions, changes, or growth
- Monitor business performance
- Communicate with lenders and business partners
- Make effective, meaningful decisions

2. Do I Need a Business Plan?

There are lots of reasons for writing a business plan. A plan is most useful, however, when beginning a new business or when making a change in the way you currently manage the business. You should write a business plan if you intend to:

- Purchase farm land or equipment
- Transition from backyard gardening to commercial production
- Transition from conventional production to organic production
- Gradually transfer farm ownership or management
- Add value to your produce through processing and packaging
- Invite customers to your farm for U-Pick and other events
- Borrow money for start-up expenses and operating capital
- Form a partnership or cooperative

That said, there are lots of growers who simply find value in going through the business planning process regardless of whether they are making a change. Because business planning involves visioning, goal setting and a significant amount of budgeting, it is often valuable as a means of evaluating your current marketing, production and management practices. Your personal business strengths and weakness become obvious when writing a business plan. And you may be surprised to uncover marketing opportunities or legal threats when researching and writing a plan.

3. What Should I Include In a Business Plan?

All business plans contain information about your personal or business history, future vision and goals, and most importantly, your strategy for reaching those goals. Almost all business plans describe:

- Industry trends (opportunities, threats)
- New markets (location, customers, preferences, prices)
- Products (crops, value-added, services)
- Competition (location, strategy, products, prices)
- Marketing (advertising, packaging, delivery)
- Operations (season, crops, rotation, pest management, equipment, schedule)
- Management (labor, schedule)
- Finances (start-up expenses, capital, income, cash flow, balance sheet)
- Risks and assumptions (inevitable risks, risk management, potential problems, worst case scenarios, contingency statements)

It will be your job to decide what to include. But remember, the business plan is a tool you will use to manage and monitor the business as well as to communicate outside the business to lenders and partners. Include information that will make your business plan a meaningful tool. Keep it simple.

A good place to start when developing a business plan is by outlining your goals. With goals in hand, you're ready to:

- Talk with experienced farmers about start-up challenges, workloads
- Brainstorm one or more marketing strategies:
    - Identify markets and competitors
    - Create a written description of products
    - Develop a pricing and promotion strategy
- Identify production strategies
    - Fertility management
    - Pest control (wildlife, insects, weeds, disease)
    - Water management
    - Harvest and postharvest handling
- Identify labor and management strategies
    - jobs or tasks (seasonal, year-round, full-time and part-time)
    - machinery
    - hired help
- Research equipment and supply costs
- Prepare expense budgets for each crop or enterprise
- Estimate your sales volume and revenue by enterprise
- Calculate net returns for each enterprise
- Identify finance needs

Don't ignore the tough questions and be honest about the answers when writing your plan. It's better to identify problems on paper before you spend money and time in the field.

Sample Business Plan Outline:

Executive Summary
Vision Statement

Business Description
- Ownership structure
- Industry overview
- Marketing Opportunities
- Management
- Financing
- Entrance/Exit Strategy

Marketing Plan
- Target market and customers
- Products and services
- Competitors and advantages
- Packaging & pricing
- Promotion & delivery

Production Plan
- Location
- Soils and water
- Equipment
- Planting and harvesting
- Pests, wildlife and disease

Human Resources Plan
- Organization
- General management
- Employee management
- Responsibilities

Finances
- Production expense budgets and break-even
- Projected income (2-5 years)
- Projected cash-flow (month-by-month)
- Balance sheet (beginning and year-end)
- Historical tax returns

Risk Management
- Summary of unavoidable risks
- Risk management strategies
- Worst-case scenarios and strategies ("What if")

Implementation Plan

Business Start-Up. One you have a feasible, well-written business plan, you're ready to get started. Create a to-do action list or implementation schedule of tasks that must be completed before you sell your first tomato. Everyone's "to-do" list will look different depending on goals, resources and organization. There are a few tasks, however, that every new business owner must address. If you are a first-time commercial grower/business owner, you need to:

- Establish a business checking account.
- Purchase General Farm Liability insurance.
- Decide how to organize your business (proprietorship, partnership, corporation)
- Register your business name and/or file articles of incorporation if necessary (contact the MN Secretary of State).
- Obtain Sales & Use Tax Permit if you plan to sell prepared food products (contact the Minnesota Revenue Department).
- Register for IRS Federal "Employer Identification Number" (EIN) if organizing as a partnership or corporation (contact the Internal Revenue Service)
- Register for a Minnesota tax ID number if you sell taxable items or withhold income taxes from employee's wages (contact the Minnesota Revenue Department).
- Purchase Unemployment Workers Compensation insurance if you plan to hire employees.

Types of Business Organization

Proprietorship (Sole Proprietorship). Business is owned and managed by one person. This person receives all profits and is responsible for any losses and liability. Income and expenses are reported on the individual's income tax return using his/her social security number.

Partnership (General or Limited Liability). Business is owned by two or more people (eg. husband and wife). Each person is responsible for the debts and obligations of the business unless they file for "limited liability." Income and expenses are reported on federal and state "information" tax returns filed by the partnership. Partners are taxed on their respective share of the profits at their individual income tax rates.

Corporation ("S", "C", or "Limited Liability). Business is owned by one or more shareholders who elect a board and hire managers. Owners who perform services for the business must be hired as an employee. A corporation is a separate legal and taxable entity.

5. Where Can I Go for Help?

Agencies

Internal Revenue Service, 316 N. Robert St., St. Paul, MN 55101, (651) 312-8082, www.irs.gov.

Minnesota Revenue Department, 600 N. Robert St., St. Paul, MN 55146-6330, (651) 296-6181, www.taxes.state.mn.us.

Minnesota Secretary of State, 180 State Office Building, 100 Rev. Dr. Martin Luther King Jr. Blvd., St. Paul, MN 55155, (651) 296-2803, www.sos.state.mn.us.

Minnesota Small Business Assistance Office, Minnesota Department of Trade and Economic Development. 500 Metro Sq., 121 Seventh Place E., St. Paul, MN 55101-2146, (651) 296-3871, www.sba.gov.

Publications

Backyard Market Gardening: The Entrepreneur's Guide to Selling What You Grow. Andrew W. Lee. Good Earth Publications, LLC., 2003.

Building a Sustainable Business: A Guide to Developing a Business Plan for Farms and Rural Businesses. Sustainable Agriculture Network Handbook Series Book 6. Gigi DiGiacomo, Robert King, and Dale Nordquist. Minnesota Institute for Sustainable Agriculture, 2003.

How to Farm for Profit: Practical Enterprise Analysis. Donald M. Fedie. Iowa State University Press, 1997.

"Food and Food Ingredients" *Sales Tax Fact Sheet 102.* Minnesota Revenue Department. Stock No. 2800102A. Revised January 2002.

Growing Profits: How to Start and Operate a Backyard Nursery. Second Edition. Michael and Linda Harlan. Moneta Publications, 2000.

A Guide to Starting a Business in Minnesota. 21st Edition. Charles A. Schaffer, Madeline Harris, and Ann M. Wilczynski. Minnesota Department of Trade and Economic Development, January 2003.

Minnesota Sales and Use Tax: Instruction Booklet. Minnesota Revenue Department. Revised June 2004.

Northwind Nursery & Orchards: Business Plan. Prepared by grower/owner Frank Foltz. Attached.

Preparing a Business Plan: A Guide for Agricultural Producers Extension Systems Branch, BC Ministry of Agriculture, Fisheries and Food, February 1992 (Includes example business plans for "Greenhouse Vegetables" and "Floriculture.")

Secrets to a Successful Greenhouse and Business: A Complete Guide to Starting and Operating a High-Profit Organic or Hydroponic Business That Benefits the Environment. T. M. Taylor. GreenEarth Publishing Company, Inc., 2003.

Software & Workshops

Business Plan On-Line Workshop:
http://www.smallbizlending.com/resources/workshop/sba.htm (Recommended by the Minnesota Small Business Assistance Office).

CSA Works! Software.

FINPACK Business Plan Software. Center for Farm Financial Management. 249 Classroom Office Building, 1994 Buford Ave., St. Paul, MN 55108-6040, (612) 625-1964, www.cffm.umn.edu.

Northwind Nursery & Orchards

Business Plan

Executive Summary:

As the nursery industry moves, along with the rest of agri-business, toward centralized, large corporate structures for the growth and distribution of horticultural products, it is leaving in its wake a prime niche market for small, alternative, entrepreneurial enterprises that are prepared to pick up the pieces that the large corporations cannot, or do not care to have. This is very similar to the bread and breakfast phenomenon in the hotel/motel industry where people have made it clear that they want an "experience", not just a product or service.

Northwind Nursery, with seventeen years of consistent research, growth, and expansion, is now in a unique position to capture a significant portion of that special market. It is our intention as an innovative sustainable enterprise, to utilize the strengths we have built into our business, while minimizing or eliminating the weaknesses, to move into a stronger position in the marketplace for fruit bearing and edible landscaping plants, particularly with an eye toward the specialty plant products required by the backyard and small commercial growers.

In brief, we will build on the experience and groundwork we have lain in the areas of human resources, marketing, operations, and finances, as highlighted here and described in detail in the following pages. Our stance as a small business has many of the inherent weakness of most small agricultural business operations, such as lack of personnel, limited market potential, and limited resources and finances. However, through innovative management, and the implementation of new concepts of community agriculture, as well as old ones that are worthy of reintroduction, we will turn these inherent weaknesses into strengths that will work to our advantage in the market place. We will overcome the competitive threats of the large discount/chain stores by targeting the areas where we have, due to our stance as a small horticutlural business, the distinct advantage in capturing significant portions of the market. A basic understanding of the competition's business plan will allow us to be effective in this strategy. For instance, where they sell "price", we will sell quality and personal service; where they sell "convenience", we will sell experience and knowledgeable help.

Along with our values, goals and other ingredients that make us unique as an alternative agricultural enterprise, we believe the following business plan and our previous history in the market will make for a bright future for Northwind Nursery in the horticultural industry.

Values:

We consider our values statement to be the heart of our business plan, perhaps because it is directly related to and heavily influences every other part of our operation. Also, in a business climate such as is generally encountered in today's market place, clearly stated, unshakable, time-honored company values can become the bed-rock for healthy, profitable, long-term customer relationships as well as the catalyst for new contacts. Therefore we summarize as concisely as possible our values in the three areas in which we primarily function:

Personal or family values: Our business is a "family" business. It is operated by our immediate family and characterized by close personal relationships which are typically exhibited in any family. We desire that our business be an extension of our personal values and relationships as well as the means by which we provide for the needs of our family and the needs of our customers in a healthy and responsible manner. In terms of our personal lives, it is our

intention to "live simply that others may simply live", to live within the carrying capacity of our land base, and to live as independently of off farm inputs as possible, particularly environmentally risky inputs. This intentionally simplified lifestyle, besides being satisfying in it's own right, has the added benefit of significantly reducing our cash flow needs.

Community values: The rural community ethic is at the core of our business and being part of a thriving local economy with it's own viable food chain and cultural integrity is one of our greatest desires. In our fast paced society, a sense of community is seldom present, yet often missed. We aim to structure our business in such a way as to encourage a return to strong community relationships, whether it be our local community or our "community" of mail order customers.

Environmental values: We are committed to using only natural, organic cultural practices on our farm, providing for our sustenance in a manner that is not only ecologically sustainable but also enhances the quality of the soil and the environment for future generations.

Mission:

Our primary mission is: "To enable backyard gardeners in cold climates to grow all or part of their own family's fresh fruit needs, utilizing the principles of organic cultural practices in an edible landscape setting at one's own homestead.

A secondary mission is: "To provide small commercial fruit growers with plants of the most adaptable varieties for commercial production for local markets."

In order to accomplish these goals, we have two primary objectives:
1. Supply northern hardy, organically grown nursery stock that has been tried and tested in our own research orchards, and is dug fresh each spring and ready to grow. We also supply quality books, tools, and supplies that are hard for small growers to find at local shops or discount stores.
2. Provide our customers with the difficult-to-find information on organic fruit culture that will empower them to grow fresh fruit for themselves or for market in a manner that will:
    A. Protect and enhance their family's health.
    B. Be in keeping with community relationships and values.
    C. Preserve or restore local ecosystems and the environment.

This includes the publication of informative catalogs, brochures, & fact sheets, as well as the opportunity to attend many classes and workshops throughout the year. Private tutoring in such skills as grafting and pruning is also available.

Summary of Current Operation

Northwind Nursery and Orchards is a small family farm growing extra hardy, organically produced nursery stock for our harsh Minnesota climate and other similar climates in the northern tier of states. We specialize in fruit trees, small fruits, native fruiting shrubs and shade trees. Many of the plant cultivars we propagate and sell are difficult to find elsewhere.

Financial:

We are organized as a single proprietorship, operating from the same property, which we own and is fully paid for, for seventeen years. We are debt free and, primarily through the sale of nursery stock and conservative management of expenses, have met our financial goal of providing for the needs of our family from the land we live on for the last nine years.

Marketing:
Currently we sell about 60% of our products through our mail order catalog and the rest is direct marketed from our farm or at local tree sales and farmers markets. Quality products and knowledgeable, personal service along with a series of informative factsheets on fruit growing culture and problems are an integral part of our catalog sales strategy. That, along with on-farm learning opportunities and community activities and cultural events are the back-bone of our local marketing efforts.

Operations:
Currently we are operating from a little over 3000 square feet of building space including display areas, cold storage, green house, tool and maintenance area, classrooms and office space. Plans for future expansion include more green house space and cold storage facilities. Our buildings incorporate principles of low cost, energy efficient, and environmentally friendly building techniques which lend themselves to small scale agricultural practices. The use of locally available, indigenous materials is stressed, including Minnesota grown and milled lumber. Future projects will include variations of cord wood , timber, pole, and strawbale construction. Our land base is 30 acres of Zimmerman loamy sand which lends itself well to the type of nursery stock production we are engaged in. At this point we have approximately two acres in nursery stock along with 60 propagation beds that are cycled over a three year rotation. While our sandy soil is well suited to nursery stock, it is only moderately satisfactory for fruit production. We are overcoming this deficiency with short term organic fertilizers and a long range soil building and nutrient management program involving soil testing, micro-nutrient amendments, green manure, mulching, composting, and cover crops.

Human Resources:
We meet our personnel requirements within our immediate family or through seasonal part time help from the community. Using family members provides for a higher degree of control and supervision, but also has draw backs in that a growing family such as ours is in a constant state of fluctuation. We have recently been plummeted into a labor shortage as a result of the loss of two daughters to marriage. For that reason, we will be seeking to establish more long term seasonal help from within the community.

Customer and Competitor Description:
The majority of our customers are urban, suburban, and rural individuals or families who own their own home, have an interest in gardening and fruit growing, particularly using organic or natural practices, and have a desire to learn the basic gardening and homesteading skills required to living more simply and independently in an increasingly industrialized society. Our competitive threat lies in two areas: Large chain and discount stores who sell low quality plants of a very limited selection and nurseries who sell better quality plants in a wider selection but are also, like the chain stores, unable to offer locally grown plants specific to our climate with the experience and expertise on how to grow them.

Goals and Future Business Plan
Our immediate, short term goal is too make a smooth transition from our current two pronged (mail order and local) marketing approach to marketing entirely in our local community. While the mail order business has been profitable and offers much more opportunity for expansion, we feel the "local only" sales approach fits more with the values and mission of our business. This is particularly true, since we have decided not to expand to the point that it would

necessitate hiring full time help. Therefore, over the next year we will sell the mail order portion of the business to a like minded individual or family and begin the process of transition. This will eliminated a portion of our income and also a portion of our work load. The loss of income will be partially compensated for by continuing to provide nursery stock to the mail order buyer for a period of two to three years and by servicing other retail outlets in our geographical area on a wholesale basis. This will help us to streamline our production facilities and enable a more efficient use of space and time. The lighter workload will enable us to initiate our next goal of a community oriented nursery, fruit farm, and sustainable agriculture research facility, where customers (community members) come not only to purchase products and learn how to grow their own fruit, but also to "experience" a working farm in a congenial family atmosphere. A long term goal is to help other interested families establish their own small scale, sustainable, agricultural enterprise, thus encouraging the restoration of the family farm and the revitalization of our rural communities. While it may seem counter productive to encourage competitive enterprises, we believe, in fact, that nothing will be better for our business than a happy, healthy, vital, rural economy.

Products and Services:

We will continue to offer the best varieties of fruiting and edible landscaping plants for our specific soil and climate conditions to local customers, along with products and services to complement our nursery stock. Research and educational opportunities will be stressed to enable customers to take full advantage of the horticultural products we offer.
In addition, many types and varieties of organically grown fruit will be offered in season at our farm sales stand or on a U-pick basis. While the nursery stock and fruit will always be priority and remain the backbone of our product line, the most exciting concept we envision implementing in the future is selling the "experience" of the farm itself. We will do this in a variety of ways as numerated below:
1. Sales room for nursery stock and fruit will be decorated with a country theme and include locally crafted items useful for gardening, orcharding, and homesteading purposes. We will avoid all but the very highest quality products.
2. Staff will be friendly and knowledgeable in all aspects of fruit growing and orcharding.
3. Picnic and camping areas, hiking and ski trails, will be provided to encourage family participation.
4. Property will be developed in a free flowing, park like fashion, with an interspersion of fruit trees and edible landscaping plants that will elevate our customers from the simple act of buying fruit or nursery stock to that of experiencing our natural environment at its best. This arboretum-type setting will provide customers the opportunity to take a "fruit walk" to sample many different fruit cultivars in season and subsequently purchase more fruit, or the nursery stock to grow their own.
5. Related classes, workshops, and cultural events will be held regularly to enhance the on~farm experience.

Financial:

In order to maintain our financial freedom we will, first of all, remain debt free. This is the foundation upon which we will build toward a higher income level for ourselves to provide for a growing family. We see lack of indebtedness as a strength but the flip side is the weakness of low working capital. We will overcome this by making operations as efficient as possible, using low cost, on farm inputs, and by utilizing the community barter system for materials and services. As our business is highly seasonal, cash flow is irregular and tight budgeting is

important. We anticipate a yearly income need of $20,000.00, most of which would come in the spring or fall which is also the time of most expenditures. Other supplies, such as books and tools, will provide some cash flow throughout the year. Fruit and nursery stock will be the two main operations to provide our financial needs immediately. As the farm develops in its entirety, the cash flow will be balanced more evenly, with the farm "experience" providing an ever increasing part of our income. Careful management of expenditures will include checks and balances to assure economic sustainability.

Marketing:
We are determined not to compete on price alone. Setting a fair price for our farm products is mandatory to sustainability. Cutting prices below production costs is not an option. Therefore, in order to compete in a "dog eat dog" corporate world, we will compete on ground that our corporate counterparts cannot win. Here are a few areas we will focus on that will give us the competitive edge over any of the mass marketers that may pose as threats to our sales.
A. Quality and integrity.
B. Personal service.
C. Organically grown.
D. Craftsmanship.
E. Community mindedness.
F. Educational opportunities.
G. On farm activities, demonstrations, festivities, etc.
H. Experience.
I. Iron clad guarantee.
J. Locally grown.
K. Price (in the long run).
We will not reduce marketing to a con game. The type of customers we want to build our business on are too wise for that. Marketing and community go hand in hand. Our customers are our neighbors and we will treat them accordingly. We will take as much of our advertising budget
as we can and invest it in our customers in various ways. These are our real sales people!

Goals:
1. If anyone gets a "deal", it should be our loyal, long-term clientele. We will reward them by giving them first chance at any specials, discounts, etc.
2. We won't cheat ourselves by lowering prices just to make a sale to someone who is simply trying to take advantage of us.
3. Excess product will not be wasted. Rather, we will use it as advertising "samples" and give it to customers who can use it. They will repay us many times over in "word of mouth" advertising. This may seem counter-productive, and is the exact opposite of what large retailers do who destroy millions of dollars worth of merchandise every year, but it has proven to be very helpful for us.
4. We will give customers discounts or dividends for bringing in other customers or distributing our literature, etc. Give those who organize group orders a bonus.
5. Reward loyal customers with extra services that will help them succeed.
We will succeed only if our clientele succeeds. We will do everything we can to help them and they will be your best advertisement. We will treat our customers as an extension of our "research" and "development" departments. Their problems and complaints about our products can help us eliminate future production problems and their suggestions may be as helpful as any

hired consultant. We will listen attentively to their concerns, dealing with problems immediately and always give the customer the benefit of the doubt. We will implement a five fold marketing plan for the coming years to include the following strategies marketing strategies, listed in the order of importance to us.

A Direct, on farm sales. Pre-picked or U-pick, "fruit walks", etc. This will be where the on farm "experience" will be most effective.

B. Community Supported Agriculture (CSA's). Encouraging direct participation by the community in the risks and profits of the farm.

C. Local farmers markets, festivals, and tree sales.

D. Local Food Co-ops or other co-operatives.

E. Other local retailers.

Operations:

Immediate plans include putting three to five more acres of various fruits, including grapes, apples, pears, plums, cherries, raspberries, currants, and gooseberries into productions. This will be accomplished using additional acreage that was cleared from our 30 acre red pine forest during recent forest management practices. Nursery stock production is at an acceptable level now, but will become more efficient as we limit the varieties grown to the ones that are adaptable to our Minnesota climate. Over the next few years, edible landscaping plants will be interspersed in openings of the forest canopy and clearings mentioned above. Soil improvement and nutrient management will be chiefly accomplished through our new one acre on farm yard waste composting facility. In the next two years, plans will be implemented to remodel existing buildings in keeping
with the overall theme of the farm. We have also designed a comprehensive ten year plan for the overall development of the farm to make full use of the thirty acres of property in order to fully implement the specific aspects of this business plan. For more details, see the maps entittled "Existing Farm Layout" and "Future Farm Layout" that are attached to the end of these plans.

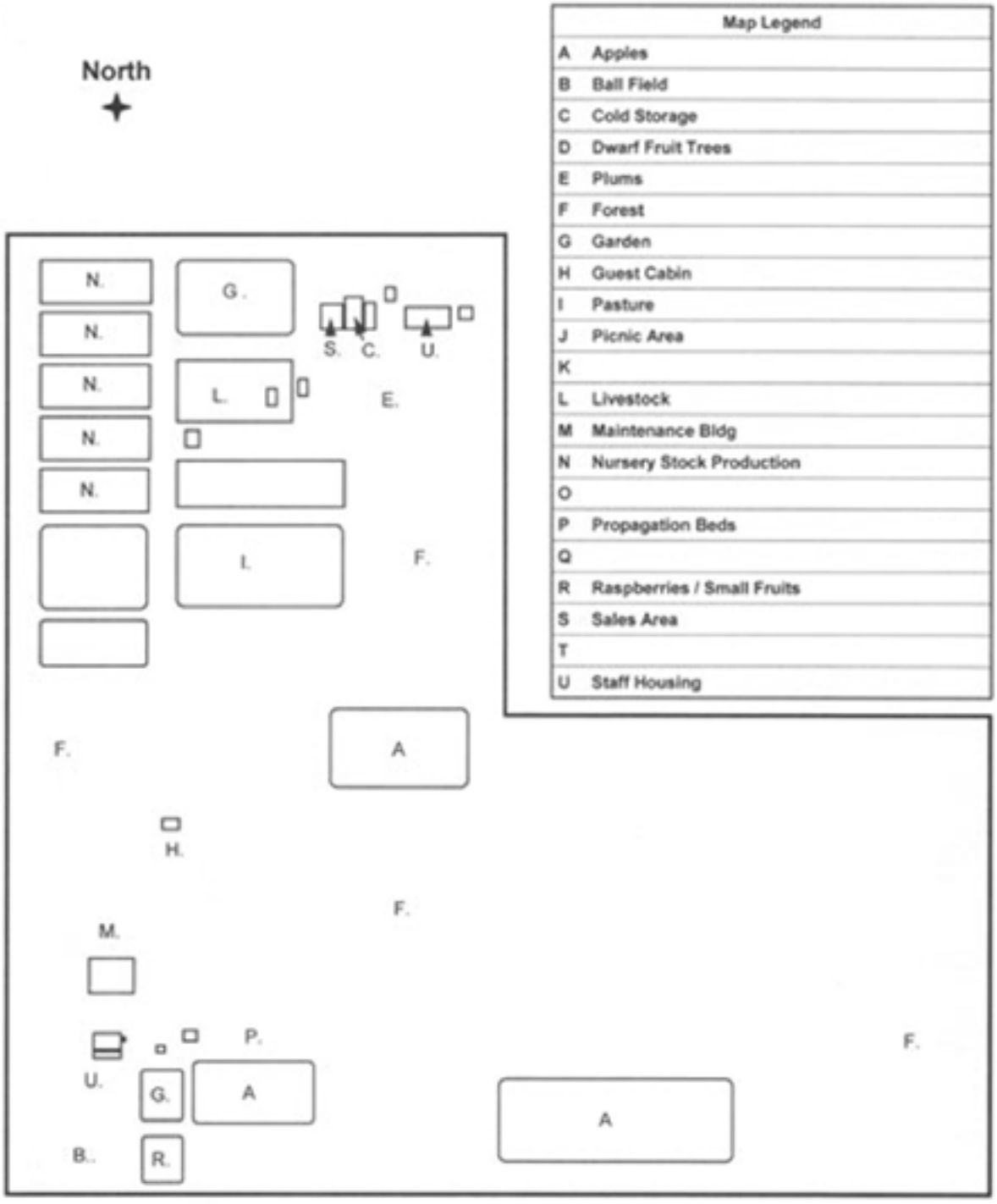
Human Resources:

A current, part time, seasonal helper who has had several years of working with us, will be key to our future personnel needs. He will make a transition to full time and will have a stake in the business by way of land or crop acquisitions. His responsibilities will include orchard/vineyard manager and propagation manager. He will be paid on a production rather than an hourly basis. For miscellaneous part time labor needs, we hope to utilize the resources available among our senior citizens, college students, or other community members. Many human resource needs are also met on a contract basis with professionals in the Princeton area. This arrangement will be even more attractive as our labor needs grow and we strive to avoid hiring full time, permanent help. It also is in keeping with our desire to encourage other small enterprises within the community. Another avenue we are exploring to meet increased labor demands is the idea of a Community Supported Fruit Farm based on the CSA (Community Supported Agriculture) model that is currently so popular. However, though we are exploring this concept, we expect that it will be a long range solution and won't solve our immediate labor needs. An intern program has also provided some human resource needs although we view this program more as an extension of the values and goals of our business. Some interns go on to establish their own orchards, nursery or similar agricultural enterprise, even becoming our competitors. However, we have found the long term effect of this spin off has been to increase our standing in the market place, not to decrease it.The challenge many small farm enterprises, including us, face in meeting labor needs is being able to compete favorably with larger

employers in the city. While it may be difficult or impossible to do this on a dollar basis alone, we will attempt to meet this challenge with other "perks" that larger employers may not be able to provide. Some examples include: apprenticeships that will enable the worker to begin his own trade or business, educational opportunities not commonly available elsewhere, on farm events and festivities that provide a sense of community and belonging, and a share in the products and services of the farm.

Checkpoints:
Our timeline for evaluating our progress in the above areas is as follows:
1. Within two years, have Mark Jenson on line full time as orchard and propagation manager, have an on farm sales room and part time sales staff in place, and have another two acres of orchard and fruit planted.
2. Within five years, meet our financial goals, have the farm "experience" operational, such as camping & picnic sites, trails, & "fruit walks", and settle into a routine that would be enjoyable, sustainable, and reproducible.

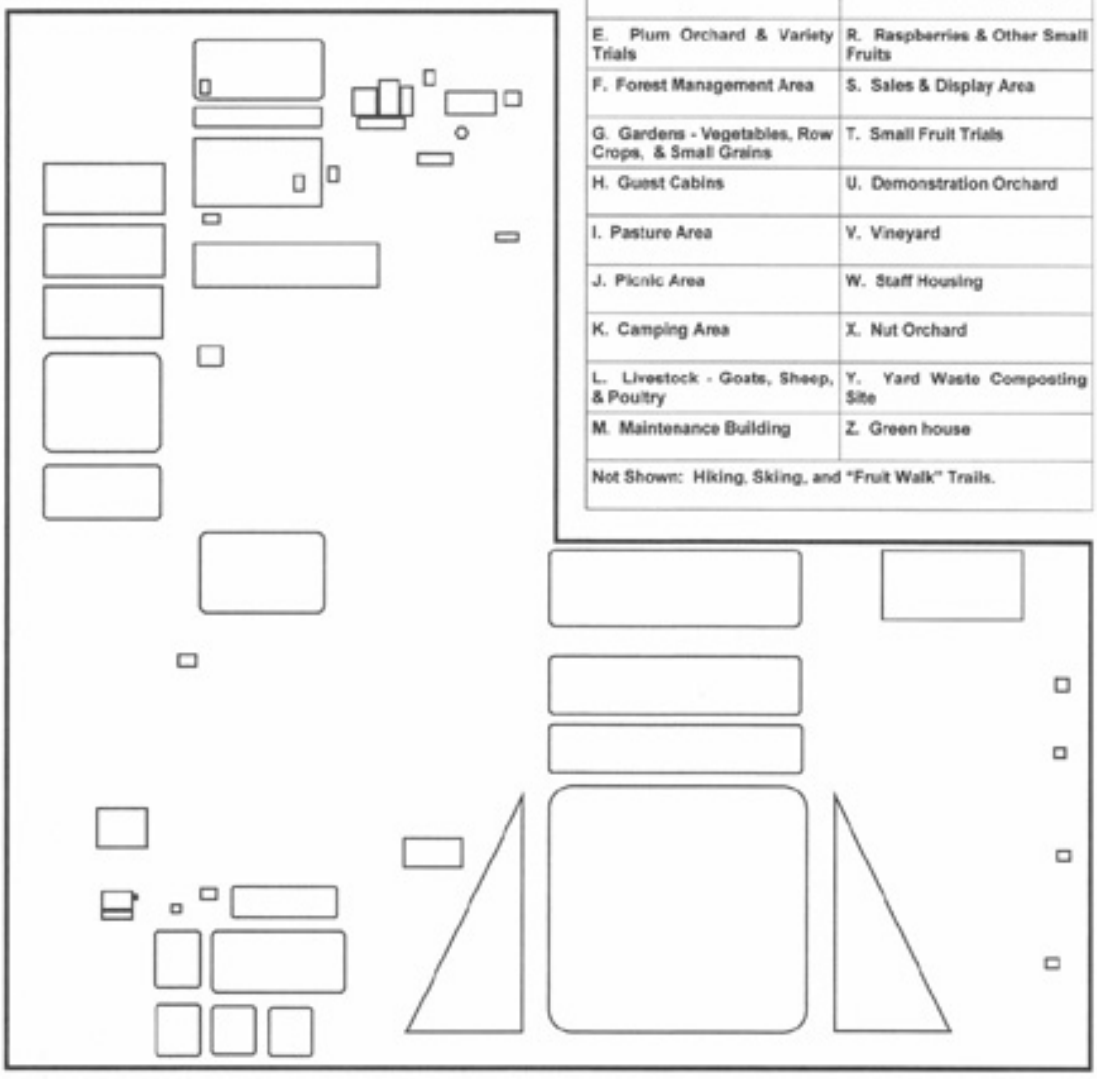
Northwind Nursery & Orchards
Existing Farm Layout



Map Legend	
A	Apples
B	Ball Field
C	Cold Storage
D	Dwarf Fruit Trees
E	Plums
F	Forest
G	Garden
H	Guest Cabin
I	Pasture
J	Picnic Area
K	
L	Livestock
M	Maintenance Bldg
N	Nursery Stock Production
O	
P	Propagation Beds
Q	
R	Raspberries / Small Fruits
S	Sales Area
T	
U	Staff Housing

Northwind Nursery & Orchards
Future Farm Layout
(Ten year plan)

North



Map Legend	
A. Apples & Other Tree Fruits	N. Nursery Stock Production
B. Ball & Game Field	O. Tender Varieties Trial
C. Cold Storage Facility	P. Propagation Beds
D. Dwarf Apple Trials	Q. Forest Products Storage
E. Plum Orchard & Variety Trials	R. Raspberries & Other Small Fruits
F. Forest Management Area	S. Sales & Display Area
G. Gardens - Vegetables, Row Crops, & Small Grains	T. Small Fruit Trials
H. Guest Cabins	U. Demonstration Orchard
I. Pasture Area	V. Vineyard
J. Picnic Area	W. Staff Housing
K. Camping Area	X. Nut Orchard
L. Livestock - Goats, Sheep, & Poultry	Y. Yard Waste Composting Site
M. Maintenance Building	Z. Green house
Not Shown: Hiking, Skiing, and "Fruit Walk" Trails.	

Northwind Nursery & Orchards
Ten Year Timeline

In order to spread our work load as evenly as possible, the following improvements to our physical property are separated into two distinct categories:

1. Building and remodeling projects or other structural improvements such as fences, wells, etc.

2. Grounds improvements such as clearing, thinning, and planting in preparation for the establishment of new orchards, vineyards, or other productive or educational plantings or forestry projects.

While we expect to accomplish these improvements in a timely manner, our focus is not "goal" oriented and the emphasis will be on maximizing the experience and educational aspects of each task, as it relates to the sustainability of the entire farm, community, and environment.

Timeline

YEAR	BUILDING & REMODELING PROJECTS	GROUNDS IMPROVEMENTS
1998	Erect a building near main orchard and vinyard for on farm marketing of fresh fruit.	Clear area for main orchard and vineyard expansion. Begin clearing sections A & B for Edible Landcaping Demonstration Area.
1999	Remodel sales area in Nursery Building.	Expand main orchard and vinyard (phase 1). Continue clearing of sections A & B.
2000	Finish classroom and educational area. Remodel existing cold storage facility.	Layout roads throughout property. Finish clearing of sections A & B and begin development of Edible Landscaping Demonstration area.
2001	Construct greenhouse/propagation facility.	Finish work on roads. Expand main orchard and vinyard (phase 2)
2002	Install irrigation well and equipment at main orchard and vineyard site.	Finish Edible Landscaping Demonstration area. Plant nut orchard.
2003	Install new roof on nursery building	Layout and clear trails for "Fruit Walks", ski & hiking trails, etc.
2004	Construct composting outhouse.	Develop picnic area.
2005	Build an additional cold storage facility.	Expand main orchard and vinyard (phase 4)
2006	Start cabin construction.	Plant small fruit trials
2007	Finish cabins.	Develop camping area. Expand main orchard and vinyard (phase 3)

Marketing

I. Pre-marketing Assessments.

A. Carrying capacity of our land.
1. In our quest to earn a living for our family in a sustainable agricultureal enterprise, I came to realize that I needed to take a rather unconventional approach to marketing. In all actuality, some of the items I consider a part of our marketing plan are not normally thought of as such. Nonetheless, I mention them here where they seem to me to fit in best. No marketing plan of any sustainable farming operation can long ignore the carrying capacity of its usable land. Any attempt to market more product than the land base is capable of will result in depletion and lack of sustainability. Fortunately, this does not have to be a problem, if thoughtful farming practices are used and if we can adust our lifestyle to that of a more appropriate agrarian society. However, it would behoove all of us who are working for sustainability to reduce the demands we put on our land as much as possible. I am of the opinion that we have done very little to address this issue. Following are some goals for our enterprise.
a. Reduce our cash needs to a minimum. We will accomplished this by reducing expenditures, using on farm inputs where posible, purchasing quality equipment, etc.
b. Simplify our lifestyle. Turn community relationships into opportunities for low cost relaxation, rest, recreation, and entertainment.
c. Grow as much of our own food as we are able.
d. Barter anything we can.
e. Buy anything we need locally, when possible.

B. Target unsustainable practices and avoid them. Every management decision we make will either work for or against sustainability, it will add or subtract from our bottom line. Of course, every operation is going to have some minuses but if the minuses out weigh the pluses, we are in trouble. We will make conscious decisions as to which minuses our land can tolerate. Below are just a few of the minuses we encounter. We will seek to reduce the pressure these put on us to produce and sell more product than our land will support sustain ably. Also listed are a few pluses. We well seek to incorporate these into our operation in order to enhance sustainability.
1.. Minuses
a. Insurance.
b. Excessive Taxes.
c. Excessive dependance on Fossil fuels and other off farm inputs.
d. Excessive or unnecessary equipment.
e. Governmental bureaucracy and excessive regulations.
2. Pluses
a. Using renewable, on farm inputs.
b. Trading labor with other farmers.
c. Simplifying your cultural practices with a corresponding simplification of needed supplies or equipment.

C. Build your support team. Almost all of us need others in our business from time to time. Will

you be able to find the people you need within your community or nearby? Are you willing to invest time and effort into supporting other sustainable practices or businesses in your area? This too is a part of community.

II. Marketing Concepts.

We are determined not to compete on price alone. Setting a fair price for our farm products is mandatory to sustainability. Cutting prices below production costs is not an option. Therefore, in order to compete in a "dog eat dog" corporate world we well compete on ground that our corporate counterparts cannot win. Here are a few areas we will focus on that will give us the competitive edge over any of the mass marketers that may pose as threats to our sales.

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E. Community mindedness.
F. Educational opportunities.
G. On farm activities, demonstrations, festivities, etc.
H. Experience.
I. Iron clad guarantee.
J. Locally grown.
K. Price (in the long run).

III. Marketing Attitudes.

We will not reduce marketing to a con game. The type of customers we want to build our business on are too wise for that. Marketing and community go hand in hand. Our customers are our neighbors and we will treat them accordingly.

A. We will take as much of our advertising budget as we can and invest it in our customers in various ways. These are our real sales people!

Goals:
1. If anyone gets a "deal", it should be our loyal, long-term clientele. We will reward them by giving them first chance at any specials, discounts, etc.
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4. We will give customers discounts or dividends for bringing in other customers or distributing our literature, etc. Give those who organize group orders a bonus.
5. Reward loyal customers with extra services that will help them succeed.

B. We will succeed only if our clientele succeeds. We will do everything we can to help them and they will be your best advertisement.

C. We will treat our customers as an extension of our "research" and "development" departments.Their problems and complaints about our products can help us eliminate future production problems and their suggestions may be as helpful as any hired consultant. Listen attentively to their concerns.

D. We will deal with problems immediately and always give the customer the benefit of the doubt

IV. Marketing Methods.

We will implement a five fold marketing plan for the coming years to include the following strategies.

A Direct, on farm sales. (Pre-picked or U-pick)
B. Local farmers markets.
C. Community Supported Agriculture (CSA's)
D. Local Food Co-ops or other co-operatives.
E. Other local retailers.

Statement of Intent and Purpose

Jan. 3O, 1996

Northwind Nursery & Orchards is a small family owned & operated farm located in east central Minnesota using sustainable, natural, & organic cultural practices. Our main income is from growing and selling extremely hardy fruiting trees and shrubs for cold climates. In our trial orchards we test many cultivars for such things as disease resistance, hardiness, productivity, keeping characteristics, and quality and taste of fruit. We also grow and sell shade and ornamental trees and shrubs.

Our primary goal is aimed toward helping families who are "homesteading" to grow or provide their own fruit, food, and other necessities. Therefore, we are heavily involved in other aspects of homesteading on our farm, as well as various research and experimental projects. Our farm is not our "business", it is our way of life and it also provides us with a "comfortable subsistence". We seek to center our lives around the teaching and love of Jesus for all men and that is reflected in our attitude toward sustainability in agriculture, community, and culture. Some of the many things we are involved in include the following:

1. Planting, grafting, growing, and marketing fruit trees and nursery stock.
2. Growing apples, pears, plums, cherries, grapes, raspberries, and other small and native fruits for home use, specialty markets, and test purposes.
3. Using simple, locally available materials for practical, energy efficient housing and other construction projects for farm and homestead
4. Woodlot management for fuel and lumber.
5. Raising goats, chickens, ducks, & geese in relationship to nursery and orcharding operations and other homesteading needs.
6. Vegetable gardening.
7. Composting toilets, etc.
8. Educational classes and workshops.
9. Community relationships, spiritual and physical.

If you have further questions please contact us.

Sincerely,

Frank Foltz

MARKETING

In this section, the questions we address are:

1. What are the differences between growing for myself (home use) and growing for others (commercial production)?
2. What are my marketing options?
3. What skills and resources will I need to direct market?
4. How do I find a market and advertise to buyers?
5. How much should I charge?
6. Do I need to be certified to market organic products?
7. Where can I go for help?

1. What Are the Differences Between Growing for Myself (home use) and Growing for Others (commercial production)?

Growing for *home use*:

- I can accept any quality
- I don't need a lot of acreage
- I don't have to worry about yield

Growing *commercially*:

- I need the right resources - land, , water, labor
- I must set and meet quality standards
- I must think about expenses and income
- I must learn about buyer preferences and needs
- I must grow what buyers prefer and need, not what I like to grow
- I need to grow enough to supply the market
- I need to cover expenses by obtaining good yields and/or market prices
- I must be prepared to let low quality produce rot or give it to charity
- I should realize that it is easier to grow produce than to sell

2. What Are My Marketing Options?

Direct marketing	Roadside stands Pick-your-own Farmers' Markets Community-supported
Not-as-direct	Restaurants Institutions (schools, hospitals, churches, prisons, etc.)
Wholesale	Local grocery stores Supermarkets Suppliers Brokers

WHY DO SOME PEOPLE LIKE TO BUY DIRECTLY FROM GROWERS?

People buy direct from growers because they:

- Like fresh produce

- Seek unusual, gourmet varieties (Gold Rush zucchini) as well as traditional favorites (Big Boy tomatoes)
- Enjoy socializing (Friendliness to your customer is important!)
- Are looking for a bargain – expect to pay less than at the supermarket
- Expect above-average quality

3. What Skills and Resources Will I Need?

For a.....	You'll need....
Pick-Your-Own	A desire to socialize with customers; answer questions Advertising A traffic control and parking plan A child management plan Scales to weigh produce Containers **Consider:** nearness of restroom facilities and general liability insurance
Roadside Stand	Everything needed for pick-your-own operation Variety of produce A stand - one with an overhead awning is inviting to public (locate stand near fields to make transporting easy); A road with significant traffic, but not a (dangerous) highway A cooler to store excess produce; **Consider:** zoning permits
Farmers' Markets	A willingness to socialize with customers The ability to manage cash (make change quickly) Display area Protection from sun and rain (for your produce, not you!) Transportation to move your produce Money for association dues or rental fees Containers A water source Insurance **Consider:** acceptance of personal and farmers' market food nutrition checks
Subscription (CSA)	A good relationship with the community A contract Transportation Containers Advertising

Restaurants and Institutions	A good relationship with chefs To make daily or weekly phone calls The financial flexibility to wait up to 100 days for payment To offer a regular supply of produce To process (clean, bundle and package) fruit and vegetables Containers and/or packaging Transportation **Consider**: a food handler's license if requested
Wholesale	Regular, medium to large supply of produce Produce with dependable quality To minimally process (clean, bundle) Containers A storage facility Transportation

4. How Do I Find a Market and Advertise to Buyers?

Locating new and identifying buyers can sometimes seem overwhelming. But it need not be. Try:

- Polling friends and family to find out where they shop
- Contacting your local Chamber of Commerce to obtain a list of retail food establishments
- Visiting the USDA Agricultural Marketing Service's website or call for a state-by-state list of fruit stands and farmers' markets (www.ams.usda.gov/farmersmarkets/map.htm)
- Visiting the Local Harvest website for a directory of farmers markets, restaurants, food coops and on-line stores committed to buying local produce (www.localharvest.org)
- Mapping major cities within 25 miles of your farmland and use the telephone directory to identify wholesale and retail establishments within those cities

HOW DO I ATTRACT DIRECT MARKET CUSTOMERS?

- Offer good quality products
- Sell "hard-to-resist" products
- Offer free samples for tasting
- Organize promotional events, like hay wagon rides or egg hunts
- Offer specials like special prices for quantity purchases or new varieties

Display:

- Create an attractive, brightly-colored display
- Use good lighting and a covered display to keep produce fresh
- Use attractive landscaping and signs around your roadside stand

Advertising:

- Create an "image" for your stand or market
- Develop a logo
- Advertise in local newspapers or on the radio
- If it rains on a weekend, advertise again the next week
- Use descriptive words, like "juicy", "mouth-watering", and "tangy" in your advertisement or photos of your farm and fields
- Distribute recipes at retail establishments and at markets
- Don't forget to list your market name, location and telephone number

Communication:

- Be friendly and respectful.
- If someone complains, apologize and offer to return or exchange their product
- Hire friendly people
- Educate employees who market about: varieties, good storage procedures, cooking recipes

HOW CAN I ENCOURAGE LOCAL SUPERMARKETS AND WHOLESALERS TO BUY MY PRODUCT?

Retailers and wholesalers often are unwilling to buy from local suppliers. They worry that local growers will not:

- Provide consistent quality
- Grade produce
- Use poor packaging and storage
- Be organized
- Supply the volume needed

If you want to encourage local retailers and wholesalers to buy your products:

1. Make sure you can address buyers concerns listed above.

2. Know your product well. Be able to explain your products' features (advantages) to the buyer:

- What sets it apart from other people's?
- What's so wonderful about your products' features?
- How would selling this help the buyer's sales?

3. Grow what people want to buy, not what you want to grow. Talk with buyers before planting to learn about their needs (variety preferences, volume, etc …)

4. Be pleasant to deal with.

5. Know your buyer and make sure you can offer them good service (are your buyers close enough to ensure regular and fast delivery?)

6. Realize that it may take several visits to a buyer to get a commitment/sale:
   - Cold call to introduce yourself - expect the buyer to be busy and make an appointment for a return call.
   - Return call to tell the buyer about your operation and product and find out what they buyer is interested in; offer a "product availability" sheet.
   - Sample call - if the buyer really is interested, bring in samples and discuss specific details of delivery, expected service, and prices.

7. Sell your produce, personalizing it to the buyer's needs.

8. Provide good service:
   - Check on buyer's satisfaction level.
   - Provide point-of-purchase handouts - general information about the farm or product, recipes.

WHAT INFORMATION DO I NEED TO SELL TO RESTAURANTS?

1. Visit the restaurant to gather information:
   - Study the menu - ingredients, prices
   - Find out the kitchen costs
   - Study the restaurant operation

2. Make sure you talk to the right people – those who know about current suppliers and chef needs.

3. Give the people doing the buying the information they need:
   - Provide costs per plate
   - Provide sample recipes

4. Make sure you can provide the level of service and product quality needed.

SHOULD I JOIN A COOPERATIVE?

Cooperatives are an excellent marketing option if you want to process, expand the scope of your marketing efforts, or are unable to bear distribution and marketing expenses independently. Cooperatives are legal business structures that:

- Combine negotiating power to get the best price for everyone;
- Pool products to reach a wider audience - having more to offer may open retailer

- doors;
- Share marketing costs – reduce your expenses; and
- Often process products – jointly manage processing and packaging.

Before joining a cooperative, ask yourself the following questions:

- Can I find other people to help me form a cooperative?
- Do we believe in open membership?
- Can we operate democratically?
- Will we be dedicated to the cooperative idea?
- Will we be or hire good managers?
- Will we agree on an operating policy?
- Will we have system of checks to see that management follows policy?

5. How Much Should I Charge?

The price you charge for produce will depend on many factors: buyer preferences, number of competitors, and produce quality among other things. Do you have the flexibility to set prices or will your buyers decide? Wholesalers and retailers, for example, typically offer a fixed price based on their own market research. In most cases, you will need to learn what your customers are willing to pay or "what the market will bear." The best way to do this is to survey buyers and visit markets. Once you know the going market price for a crop, estimate your own costs of production to determine if you can be competitive.

On the other hand, if you plan to grow a specialty product or target a niche market, you may have some flexibility in setting prices. If so:

- Estimate your costs of production (growing, harvesting, advertising, etc.)
- Next, calculate your "break-even" price
- Finally, mark up individual items based on demand and competition

HOW DO I ESTIMATE PRODUCTION COSTS?

Estimate your expenses using the space below. You may do this for the whole farm or for each crop.

	Hours/acre or price/acre	Total acres		Total Cost
PLANTING				
plowing				
disking				
transplanting				
transplants/ seed				
FERTILIZER				
soil testing				
nitrogen				
phosphorus				
potassium				
application				
IRRIGATION/PEST CONTROL				
scouting				
herbicide				
insecticide				
application labor				
cultivation/hoeing				
HARVESTING				
harvesting				
grading/washing				
cooling				
water/ice				
packing labor				
refrigeration				
DELIVERY				
delivery				
gasoline				
MARKETING				
research (eg. surveys)				
marketing labor				
promotion/advertisement fees				
flyers, signs, handouts				
labels and packaging				
OVERHEAD	total annual cost			
land rental				
property taxes				
insurance				
fees				
liability insurance				
sanitation services				
interest on operating capital				
START-UP INVESTMENTS	repair costs	depreciation	interest	total
buildings				
fuel tanks & pumps tractors				
sprayer				
irrigation equipment				
bins/containers				
coolers				
vehicles				
hand tools				
other equipment and supplies				

HOW DO I ESTIMATE BREAK-EVEN (BE) PRICES?

Your break-even price is the minimum price you must charge in order to cover all production expenses associated with one crop or enterprise. You should estimate a break-even price for each crop before you plant it. By doing this ahead of time, you'll know whether or not the crop can make money. If the going market price, for example, is well below your estimated break-even price, then the crop may not be worth growing (unless the crop is necessary to attract buyers and generate other sales).

Calculating a BE price is fairly simple:

BE = (overhead expenses + cash expenses) / yield or expected sales volume

Overhead expenses are those fixed costs associated with owning and running your farm. They are costs you incur regardless of what you grow. Examples of overhead expenses include: rent, insurance, taxes, depreciation on equipment and buildings, as well as utilities. You should allocate an equal share of overhead expenses to each crop. For example, if you raise five crops, divide your total overhead expenses by five and this becomes the value of overhead expense for each crop.

Cash expenses are those costs associated directly with the crop produced. If you grow tomatoes, for example, your cash expenses for this crop might include: seed, labor, fertilizer, stakes, weed control mats, and pesticides.

6. Do I Need To Be Certified To Market Organic Products?

Any farmer who sells less than $5,000 worth of organic products/year is exempt from certification. That said, if you plan to advertise your products as "organically grown" you are legally responsible for following National Organic Standards (overseen by the US Department of Agriculture).

If you sell more than $5,000 worth of produce, you must become certified by a local agency. The Minnesota Department of Agriculture maintains a list of local certifiers titled "Accredited Organic Certifying Agencies Operating in Minnesota." Contact Meg Moynihan with the Minnesota Department of Agriculture for questions or more information: (651) 297-8916.

7. Where Can I Go For Help?

Agencies and Organizations

Agricultural Marketing Service, Fruit and Vegetable Programs, 1400 Independence Ave. SW., Room 2077-South Building, Washington, DC 20250-0230, (202) 720-4722, www.ams.usda.gov.

Agricultural Technology Transfer for Rural Areas (ATTRA), PO Box 3657, Fayetteville , AZ 72702, (800) 346-9140, www.attra.org.

Minnesota Department of Agriculture, 90 West Plato Blvd., St. Paul, MN 55107, (651) 297-2200, www.mda.state.mn.us.

Minnesota Farmers Market Association, 8082 33rd St., Princeton, MN 55371, www.mfma.org.

Minnesota Grown Program, Paul Hugunin, 90 West Plato Blvd., St. Paul, MN 55107. (651) 297-5510, www.mda.state.mn.us/MNGROWN.

Publications

"Accredited Organic Certifying Agencies Operating in Minnesota." Minnesota Department of Agriculture. Fall 2003.

Backyard Market Gardening: The Entrepreneur's Guide to Selling What You Grow. Andrew W. Lee. Good Earth Publications, Inc. 2003.

Becoming a Certified Fresh Market Grower. Karen Delahaut and Harriet Behar. University of Wisconsin-Madison, College of Agricultural and Life Sciences. September 2003.

"Community Supported Agriculture," Katherine L. Adam. ATTRA. February 2002.

"Market Prices for Fresh Fruits and Vegetables." *Fruit and Vegetable Market News.* USDA, Agricultural Marketing Service, www.ams.usda.gov/marketnews.htm.

"Quality Standards – Fresh Fruits and Vegetables." USDA, Agricultural Marketing Service, www.ams.usda.gov/standards.

Café Brenda Dishes Out Advice for Local Growers

Interested in marketing to buyers at local restaurants? Brenda Langton, head chef and owner of Café Brenda in downtown Minneapolis, has some advice: offer reliable service. "The cooks have a very planned menu and day," explains Langton. "If we are expecting produce in the morning, it needs to be there in the morning; on-time."

Since 1991, Langton has purchased approximately 30-40 percent of produce used at the restaurant directly from local growers. Café Brenda is well-known for signature vegetarian dishes, organic ingredients and local flavor. She has consistently purchased from grower Sandra Anderson (see grower profile about Sandra Jean's) as well as a few other growers – some of whom just haven't worked out. "One grower came to us with produce that was dirty and needed a lot of extra prep [time]," Langton says, explaining why she's stopped using some suppliers.

When approaching a restaurant buyer for the first time, Langton advises:

- Meet in person
- Come with a list of available varieties
- Discuss buyer expectations about produce quality, processing, and packaging
- Establish a delivery schedule

Once a delivery agreement has been made, Langton suggests that you communicate regularly with the restaurant buyer. "One of the most important things that Sandra [Anderson] does is to call me every week. She gives me a forecast; a list of what will be available in the coming weeks so that I can plan the menu and specials

Brenda Langton of Café Brenda (right) with Sandra Anderson of Sandra Jean's farm

KNOWING YOUR SOIL

In this section, the questions we answer are:

1. What kinds of soil are there in my area?

2. If my plants don't look right, how do I know what minerals they need?

3. How do I know how much fertilizer to use?

4. Why should I add organic matter to my soil?

5. Should I add lime to my soil?

1

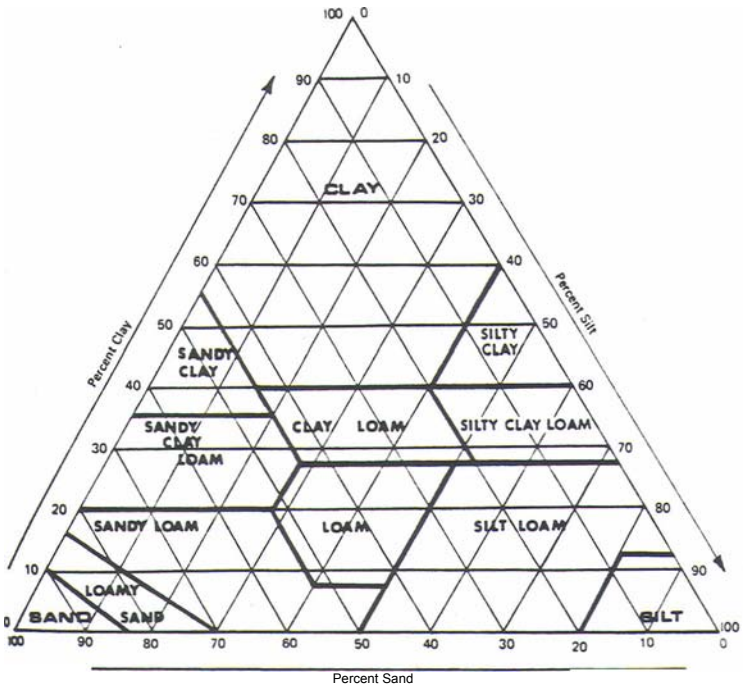
1. What kinds of soils are there in my area?

Soil is composed of sand, silt, and clay. These particle are grouped based on their size.

Send a sample of your soil to a soil testing laboratory. Its textural class will be determined by the feel method and classified as one of the following:

C coarse sand, loamy sand, and sandy loam
M medium loam and silt loam
F fine clay loam, silty clay loam, silty clay, and clay.

Soil texture can be further subdivided into 12 different textural classes as illustrated by the textural triangle shown below:



Note: You can also find out what kind of soil you have by looking at a soil survey map. Your local county extension office should have one for your county.

Silt and clay loams	absorb & hold large amounts of water, potassium, & phosphorus keep minerals from leaching often poor drainage
Sandy soils	low water holding capacity, drains excessively

Note: Besides minerals, soil also contains biological organisms.
Biological organisms in soil include

Microorganisms, like bacteria, fungi, actinomycetes, protozoa, and algae. They

- decompose organic matter & release nutrients
- fix nutrients & nitrogen
- reduce nitrate to a gaseous form
- oxidize ammonium to nitrate
- oxidize sulfur

Macroorganisms, such as earthworms, nematodes, ants, centipedes, grubs, millipedes, mites, springtails, mice, voles, and moles. They can consume organic matter and mix soil.

2. If my plants don't look right, how do I know if the problem is a nutrient deficiency?

To determine if your plants have a mineral deficiency, send plant tissue samples to a laboratory and have them do an analysis of the elements in the plants.

Your plants need 16 elements to grow. Thirteen of the needed elements come from soil. They are listed below. The other 3 elements, carbon, hydrogen, and oxygen, are derived from the atmosphere and water.

nitrogen (N)	These are macronutrients and the elements most necessary
phosphorus (P)	for plant growth. P and K are relatively immobile in soil,
potassium (K)	so need to be incorporated before planting.

Fertilizers labels list N-P-K ratios. For example, urea is 46% N, and listed as (46-0-0).

calcium (Ca)	These are secondary
magnesium (Mg)	macronutrients and are
sulfur (S)	not usually problems in Minnesota.

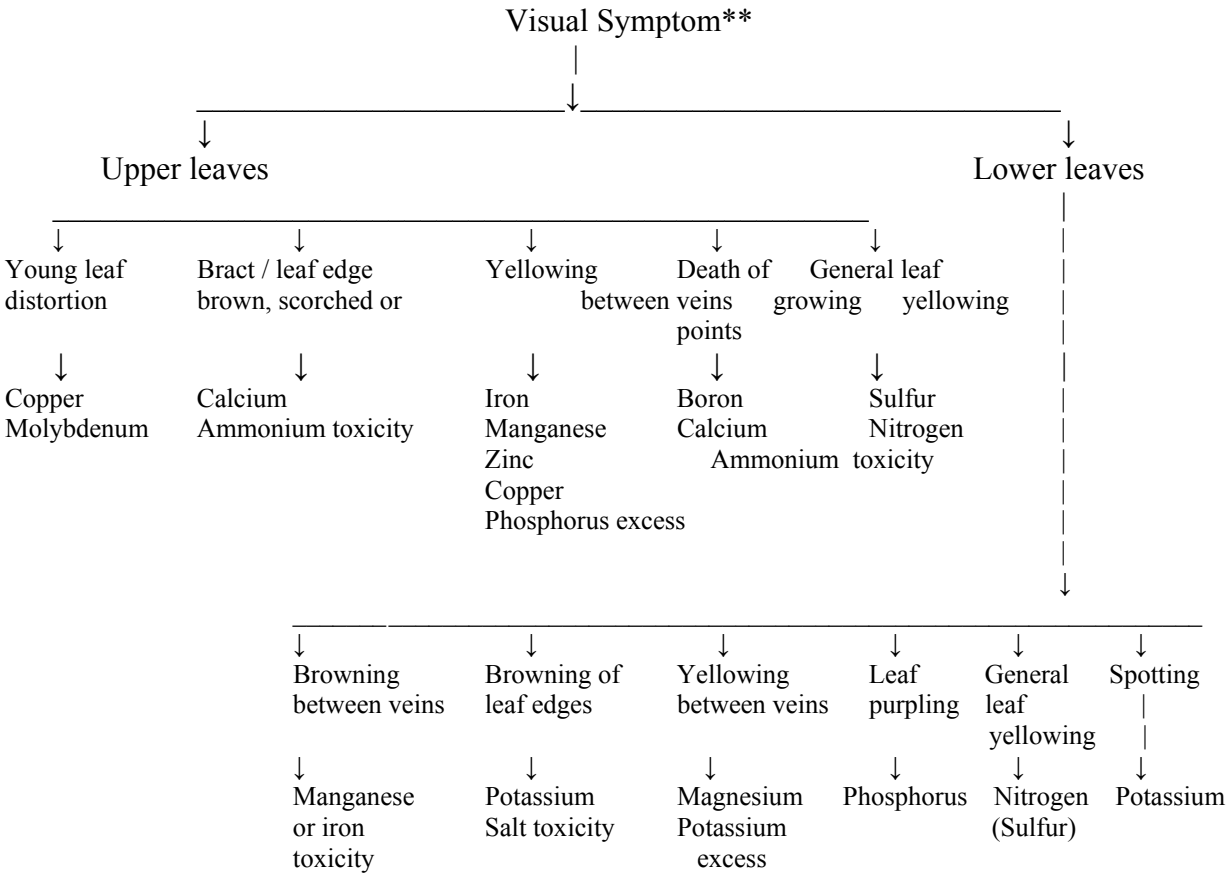
Note: Acid sandy soils may be low in calcium, magnesium, and sulfur (less than 300 ppm calcium or 100 ppm magnesium or lower). Soils farmed in potatoes for many years may be low in calcium.

iron (Fe)	These are micronutrients.
manganese (Mn)	There are usually enough
zinc, (Zn)	of these in soil in Minnesota,
copper (Cu)	but you may need to add them
boron (B)	for some crops
molybdenum (Mo)	
chlorine (Cl)	

If you think that your plants need a mineral listed above, you could follow the outline on the following page to try to determine which ones are needed. A plant tissue analysis will help to confirm if any minerals are needed.

KEY TO DETERMINING NUTRIENT DISORDERS

(from MN Flower Growers Bulletin, September 1993)



**symptoms refer to deficiency unless otherwise stated

3. How do I know how much fertilizer to use?

Get a soil analysis

Do this BEFORE you plant.
Take soil samples in the spring or fall.
Split your fields into areas with the same soil texture, color, and cropping history.
Take one sample for every 20 acres of flat land or 5 acres of hilly land.
Scrape off all surface residue from your soil sample.
for annuals: pull up soil 6-8 inches of soil
for perennials: pull up soil 10-12 inches
Take 15-20 cores.
Mix them all up in a clean plastic pail.
Send about one pint of the soil mix in a plastic bag to a soil testing lab.

Soil test results will be reported as parts per million (ppm; see next page for sample), and will tell you how much nutrient to add based on the soil test level and the crop being grown. If you get a report that gives the results as pounds per acre of nutrient, divide the number of pounds per acre by two to get ppm.

To determine how much fertilizer to add, you need to know what your fertilizer grade is, and the amount of nutrient required. Fertilizer grade states the percentage of nutrient in the bag. For example, 8-10-30 contains 8% nitrogen, 10% phosphate, and 30% potash. 46-0-0 contains 46% nitrogen and no phosphate or potash. To determine how much fertilizer to apply based on the soil test recommendation, divide the recommended amount by the percent nutrient in the fertilizer.

Example: the soil test says to add 150 pounds of nitrogen per acre. You want to use urea, which is 46% N (46-0-0). Divide 150 by 0.46, which equals 326 pounds of urea per acre.

Note: see the Minnesota Extension Service Nutrient Management for Commercial Fruit & Vegetable Crops in Minnesota bulletin, AG-BU-5886-F; http://www.extension.umn.edu/distribution/cropsystems/DC5886.html.

Get a plant analysis

Take several leaves with and without the problem. Keep each group separate from each other. If the leaves are dirty, rinse them quickly in water. Send leaf samples to a testing laboratory.

Plant analysis is not a substitute for routine soil testing. Plant analyses can provide additional information related to crop nutrition and the effectiveness of a particular fertilizer program. See the bulletin listed above for use of tissue analyses.

Sample Soil Test Report

Soil Texture Code
C (coarse): sand loamy sand, sandy loam
M (medium): loam, silt loam
F (fine): clay loam, silty clay loam, silty clay

Sample/ Field Number	Estimated Soil Texture	Organic Matter	Soluble Salts mmhos/cm	pH	Buffer Index	Titrate NO, N	Olson Phos phorus ppm K	Bray I Phos phorus ppm K	Potassium ppm K
1	**M**	**MED**		**5.9**	**6.6**			**2.9**	**89**

PREVIOUS CROP: CORN, GRAIN

Crop and Yield Goal	Method	Lime Tons/A	N lb/A	P_2O_6 lb/A	K_20 lb/A
1st choice	Broadcast	**0.0**	**80**	**100**	**150**
MELONS	Row/Drill				
2nd choice	Broadcast	**0.0**	**80**	**75**	**150**
CUCUMBERS	Row/Drill				
3rd choice	Broadcast	**0.0**	**130**	**150**	**150**
TOMATOES	Row/Drill				

NOTE: TO CONVERT PPM TO LBS/ACRE MULTIPLY PPM BY 2.

4. Why should I add organic matter to my soil?

Organic matter in....

heavy clay soils	improves soil structure and tilth increases amount of water, air, and heat in soils decreases leaching, water run-off, and soil erosion
sandy soils	helps soil hold water

WHAT KIND OF ORGANIC MATTER SHOULD I USE?

Animal manures	may be low in potassium if added to soil too close to planting time, can: interfere with cultivation & burn young plants if mixed with seed
Crop residue or organic mulch	can cause soil bacteria to lock up nitrogen so that it won't be available for your plants can spread disease if diseased itself; if diseased, rotate to a crop that is not susceptible to the disease
Composted manure	does not cause the problems that fresh manure does nutrient release is slower than fresh manure
Green manures	include plantings of legumes or grasses or mixes of the two keep soil temperatures low in the spring can prevent early planting can be cut or plowed in just before transplanting crop
Legumes	add nitrogen improve subsoil reduce erosion seeds may need to be mixed with bacteria they need to fix nitrogen
Grasses	prevent erosion adds more carbon to the soil can choke weeds

For N-P-K compositions of different organic fertilizers, see page 7 in the MES bulletin AGBU-5886-F, *Nutrient Management for Commercial Fruit & Vegetable Crops in Minnesota.*

Note: follow green manures with easy-to-cultivate crops (like corn, beans, or peas) before growing small crops, like leafy greens

5. Should I add lime to my soil?

In addition to knowing the nutrient needs of the crops you are growing, you need to know their pH requirements. Some plants will not grow well under certain pH soil conditions.

Have a soil test done and look at the pH result.

pH.... is a measure of soil acidity or alkalinity, measured on a scale of 0-14:
pH < 7 is acidic
pH = 7 is neutral
pH > 7 is alkaline
affects nutrient availability and soil bacterial activity

Note: for most fruits and vegetables you want:
pH = 5.8-7.0 for mineral soils
pH = 5.4-6.2 for peats and mucks
for **blueberries, use pH = 4.5-5.2**
potato scab diseases can be a problem in soils with pH> 5.3

*** Lime increases soil pH and makes soil more alkaline.**

Note: Soils in western Minnesota will probably not need liming, because they were formed from limestone and are already alkaline enough.

IF MY SOIL IS ACIDIC, WHAT KIND OF LIME SHOULD I USE?

You can use...

agricultural limestone calcium carbonate (calcitic limestone)
a mix of calcium carbonate and magnesium carbonate
(dolomitic limestone)
sugar beet lime
water treatment lime
wood ash

Factors to consider:

* cost (dolomitic limestone usually the most economical)

* calcium carbonate equivalent (CCE) .
the higher the CCE value, the greater its liming potential

* particle size
the smaller the particle size, the better it mixes with the soil

WHAT IS ENP OF LIME?

ENP is....

effective neutralizing power	It describes CCE, size, and percent dry matter and compares different materials for their liming ability. It determines how much of liming material to use

HOW DO I KNOW HOW MUCH LIME TO USE?

Divide the ENP value from your soil test report by the ENP per ton value of the liming material you want to use. You will get tons of ENP to apply per acre.

For example: If ENP required based on soil test is 2000 lbs., and the liming material provides 1000 ENP/ton, you will need 2000/1000 = 2 tons of lime per acre.

WHEN AND HOW DO I ADD LIME TO MY SOIL?

F or most fruits and vegetables	* mix the lime with damp soil to 6 inches deep * add lime 6 months to a year before planting (it should last 3-5 years)

HOW DO I ACIDIFY MY SOIL FOR BLUEBERRIES?

Use finely ground elemental sulfur. See Table 3 in the bulleting titled “Nutrient Management for Commercial Fruit & Vegetable Crops in Minnesota” to determine how much sulfur to apply.

Do this one year before planting.
Have your soil tested 3-4 months later.

Note: if you use iron sulfate instead of elemental sulfur, use 7 times more iron sulfate than elemental sulfur. Do not apply more than 2 tons of iron sulfate per acre at one time.

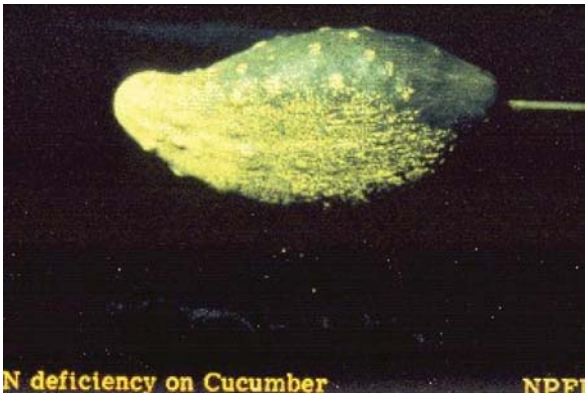
Nutrient Deficiencies

Boron deficiency in broccoli (hollow stem)

Boron or calcium deficiency in cabbage

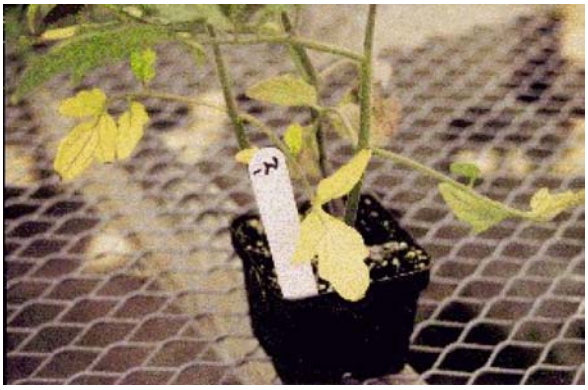
Magnesium deficiency in corn

Nitrogen deficiency in cucumber



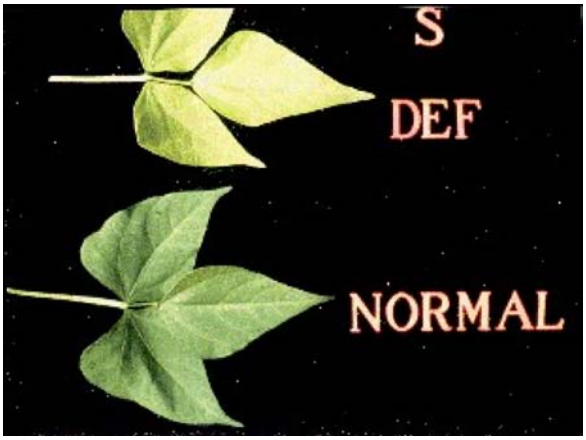
Nitrogen deficiency in radish

Nitrogen deficiency in tomato



Phosphorus deficiency in tomato

Sulfur deficiency in bean



Webster Farm Organics: Bagging Up New Ideas for Community Supported Agriculture

Nett Hart and L. Tamarack (Tam) operate Webster Farm Organics – a garden farm in Foreston, Minnesota. These two women have been farming organically all their lives but started managing and marketing their produce commercially seven years ago. They modestly refer to themselves as "big scale home gardeners" who generate all of their income from annual subscription sales of over 450 varieties of fresh vegetables and herbs.

Marketing

Nett and Tam have gone after a small niche within the Community Supported Agriculture (CSA) community and have succeeded where others have failed. When first starting out, they listened and learned from experienced CSA operators who repeatedly lost customers because the subscriptions: supplied more produce than small, busy households could prepare; offered little variety; or did not include enough "traditional" produce. In response, Nett and Tam created Salad Days® subscriptions: small family-size boxes of easily prepared, custom packed "beautiful salad makings."

Nett and Tam liken the CSA subscription to a "season ticket" where buyers receive a weekly bag of produce May – September. The subscription costs $350 for 20 bags. Each Salad Days® bag contains freshly picked, seasonal, organic produce including lettuces, herbs, Asian and European greens, scallions, radishes, asparagus, summer squash, cucumbers, cabbage, carrots, garlic, sugar pod peas, potatoes, beans, tomatoes, peppers, and edible flowers. "We offer 43 varieties of heirloom organic tomatoes and over 30 varieties of lettuce," says Nett. They spent a lot of time during start-up years learning to grow for others; to "account for other people's tastes in vegetables."

In addition to offering "variety," Nett and Tam have devised a system for customizing subscriptions so that no household receives "too much of something they don't want." Subscribers are provided with a "wish list" when applying for CSA membership and asked to circle their favorite vegetables and herbs. Members also are given the opportunity to cross off the list any produce they simply won't use or enjoy. Nett and Tam laminate their members' wish lists each season and display these lists in their pack room. "We custom pack boxes for each household," explains Nett. "We try to make sure they get plenty of the vegetables they like. And if we have someone who doesn't like radishes, for example, then we just substitute something else." All Nett and Tam ask of their members is that "you leave us room [on the wish list] to surprise you with something new."

All salad bags are delivered weekly at four locations in the Twin Cities and in St. Cloud. Harvesting, washing, packing and delivery takes place within 24 hours. "We've learned to allow enough time for picking, washing and post harvest handling so we're not exhausted as we head

into a delivery," says Nett. In fact, this balancing act of time and energy was one of "our biggest challenges going from home use to commercial [production]," says Nett.

Deliveries themselves are "hard work" according to Nett and Tam. "We always spend time with members during pick-up to help them use and enjoy the food and to help make the connection between farm and kitchen real," says Nett. "Communication is a big part of marketing." With this knowledge, Nett and Tam host field days and other events at their farm. The events give members and others a chance to "see the gardens at work," try something new and exchange recipes. It is also an opportunity for Nett and Tam to get feedback about what's working and what isn't.

So far, Webster Farm Organics' marketing approach has worked very well. Nett and Tam signed up 56 members in 2004 – most of whom are repeat customers.

Production Management

Four gardens, totaling five tillable acres, generate all of Webster Farm Organics' vegetables. The remaining acreage is what most farmers would characterize as "marginal." Wetlands, hills, creeks and boulders abound. Nett explains that they couldn't afford prime farm land near the city when first starting out. But she says, "the land is perfect for us." Natural borders have become "benefits for our organic practice as we have few concerns about [chemical] drift [from neighboring farms]."

Nett and Tam characterize their approach to farming as "knowledge-based" rather than "materials-based." They work hard at understanding the inter-relationship of plants, soils and seasons. Seedlings are started in January. They are planted in flats filled with a coir-leaf mold-compost mix and placed in the basement under lights. Seedlings are moved to one of three glass greenhouses (constructed from recycled materials) shortly thereafter and regularly fed nettle tea. The greenhouses are heated just enough to avoid freezing at night. "We let the temperatures fluctuate and increase gradually with the season," says Nett. "We have virtually no transplant shock." A fish emulsion is applied as a foliar feed to greenhouse plants twice per season.

A little later, in March, cool-season greens are planted in one of two opaque cold frames. Before planting, Nett and Tam use a solar-powered tiller to prepare the beds. These beds are direct sown and will produce harvests in May while the remaining gardens are being planted and again in the "post season" of fall.

Between April – July, small seedlings – which numbered over 100,000 in 2004 – are transplanted from greenhouses to the outdoor, gardens. Gardens are divided into four-foot wide permanent beds. In three of the gardens, cover crops are mowed and incorporated into the soil using a 1959 Fordson Dexta 25 hp, six-foot span tractor with discs and PTO-powered tiller. A smaller tractor is used for hauling and seedlings, harvested produce and other heavy materials throughout the year. A fourth garden has small irregularly shaped beds of perennial and annual herbs, greens and edible flowers. This garden is tilled with a five hp Allies Chalmers tiller. One of Nett and Tam's greatest ongoing production challenges is finding equipment and machinery "appropriate for our scale of growing." Nett explains that most machinery is either too big for their operation or can't handle their crop variety.

All garden beds are leveled by hand with landscape rakes. Transplanting is also done by hand. "We tried mechanical transplanting and found that we were just as fast using an Asian-style hand hoe," says Nett. They can transplant 10-12 flats (containing 36 seedlings each) in one hour using the hoe. Seedlings are watered briefly at the time of planting (and only again during drought conditions).

Once the gardens are planted, Nett and Tam heavily mulch their crops to protect young seedlings against wind and weeds, to prevent soil compaction, to help with moisture retention, and to preclude the spread of disease spores. Cover crops of oats, vetch, Dutch white clover, buckwheat, winter rye as well as organic matter inputs of hay, leaf mold, plant residue, composted vegetation, kelp, and foliar feeds of various "herbal teas" are used to manage fertility in the gardens.

When it comes to disease and pests "we try not to have either," says Nett. At Webster Farm Organics they save a lot of seed and grow as many of their own soil amendments as possible to avoid contamination from outside sources and to control costs. Weeds and pests are further controlled by inter-cropping, rotation, hand-picking, barrier netting, and cover cropping. In early spring, for example, you can find Nett and Tam hand-picking first-generation pests such as squash bugs and cucumber beetles off their crops. They record all pest infestations in a log so that they know when and where to scout for pests the following year. Barrier netting has also proven very effective. It's satisfying, Nett says, to see cabbage moths "fly up and down outside the netting like teenagers cruising the strip in a small town. We know they aren't getting in." And when weeds do emerge, Nett and Tam tackle them by hand weeding and string trimming or "topping."

Nett and Tam perform most of the work themselves – hiring only one part-time apprentice during summer to help with planting, mulching, and weeding.

Organic Farm Planning and Risk Management

As certified organic growers, Nett and Tam are required to prepare and maintain an "organic farm systems management plan." Their plan, in accordance with Federal regulations, contains information about input sources, management practices, production schedules, garden maps, seed sources, and a produce audit trail from seed to final customer. For Nett and Tam this means keeping records about planting, mulching, fertilizing, pest management, suppliers, labor, yields, and membership. They use these records to annually update their organic farm plan and say the records have become indispensable risk management tools.

In addition to record keeping, Nett and Tam protect membership sales and their business by growing over 450 varieties of vegetables and herbs. "It's always a good year for something," says Nett suggesting that Webster Farm Organics has plenty of produce to fill their member bags each season. Moreover, Webster Farm Organics holds a general farm liability insurance policy. The insurance covers Nett and Tam legally in the event that CSA members and other visitors injure themselves while at the farm.

Words of Advice

Webster Farm Organics has been certified for five years by Farm Verified Organic. Nett and Tam say their biggest challenge farming organically has been sourcing certified seed. In 2004 they ordered seed from 26 seed suppliers – it simply wasn't available from a single seed house. Despite this challenge, Nett and Tam aren't the least bit discouraged. In fact, they enthusiastically encourage new growers to explore organic production. "Certifiers can be incredibly helpful," says Nett. "We don't think of them as 'organic police' but rather 'organic production specialists.' Certifiers have always been there to help us out by identifying books, approved suppliers and other resources. They want to see us succeed."

Webster Farm (above); deer fence (left); salad pick-up (right) with Nett (middle) and Tam (right, in blue shirt); salad crate(below)

PRODUCTION

In this section, the questions are:

1. What is a "good" variety?

2. How do I find out where to get different varieties?

3. Should I use transplants or seeds?

4. What are some varieties recommended for Minnesota?

5. At what temperatures can I seed my crops?

6. What are the optimum temperatures for crop growth?

7. At what temperatures do crops freeze?

8. How do I estimate crop yield?

1. What is a "good" variety?

a good variety	is resistant to diseases and insect pests in your area
	has high seed germination rate and strong seedling vigor, especially in cold, wet soils
	has qualities your buyers ask for
	has high yield
	has good keeping quality
	grows well
	is easy to care for
	is readily available
	produces product within 90-110 days

2. How do I find out where to get different varieties?

trade magazines
newsletters
seed company representatives
commercial organization meetings
All-American Selections
University variety trials
grower conferences and workshops

3. Should I use transplants or seeds?

seeds	are less expensive than transplants
	are available from many sources
	gives you many varieties to choose from
	will not tell you how many healthy plants you will get
	may not provide a uniform stand

Note: look for seeds that are clean of debris, disease-free, look uniform, and are true to variety. Hybrid seed will have greater uniformity than open-pollinated seed. However, if planning to save seed, save only those from open-pollinated varieties. Hybrid seed will not be the same as the parent plants, so should not be saved for next year's crop. Also, seeds resulting from cross-pollinations can result in problems with hand-pollination and isolation, biennial habits, and genetic variability. Saved seed can carry seed-borne disease into the next year.

transplants	can get you earlier and faster growth than seeds
	cost more than seeds
	provide less choice than with seeds unless you grow your own
	improve your final stand of plants
	may have to be grown by you in a greenhouse
	may have to be protected from early season frost

Note: look for transplants with short, thick stems, that are disease-free, and that have good root growth that is not root-bound. Harden plants before transplanting. Transplant in when cool and protect transplants from excessive wind.

4. What are some varieties recommended for Minnesota?

The varieties listed below have been successfully grown in Minnesota. Not all varieties available have been field tested. For more information, see the **Midwestern Vegetable Variety Trial Report** (see Section 7 in this manual for ordering information).

Crop	Varieties
asparagus	Viking KB3, Jersey Giant, Jersey Gem, Jersey Knight, Jersey Prince
snap bean	Derby, Brio, Podsquad, Allure, Narborne, Tavera, Strike, Seville
blueberries	Northblue, Northsky, Northcountry, S1. Cloud
broccoli	Green Belt, Brigadier, Patriot, Emperor, Bejo 1483
cabbage	green: Royal Vantage, Cheers, Stonehead, Minicole, Grenadier, Quisto red: Regal Red, Sombrero, Rio Grande, Rona, Ruby Perfections
carrots	Gold Pride, Vida Sweet 781, Gold King, Nantes Fancy, Apache
cauliflower	Andes, Snow Crown, Candid Charm, Yukon, Rushmore, Cumberland
sweet corn	su: Horizon, Prime Pak, Earlibelle, Honey N Frost, Debut, Jubilee se: Seneca Dawn, Pristine, Supream, Crystal Belle, Bodacious, Zest sh2: Mariah, Challenger, Landmark, Sweeter Bi Far, Yankee Belle
cucumber	Fanfare, Salad Bush, Saladin, Gemini, Victory, Dynasty
muskmelons	Pulsar, Earliqueen, Supernova, Rising Star, Retor, Superstar
onions	Citadel, Flame, Guardian, Hustler, Progress, HXP 2614, Copra
peppers	North Star, Early Prolific, Crispy, Green Boy, Blackbird, Domino
potatoes	Russett Norkotah, Norgold Russet, Norland, Atlantic, Red Pontiac, Kennebec, Russet Burbank, Yukon Gold, Bintje, Yellow Finn, All Blue
pumpkins	large: Wizard, Spirit, October, Funny Face, Jumping Jack, Trick or Treat miniature: Munchkin, Babyboo
radishes	Fuego, Fancy Red, Red King, Comet, Red Prince, Scarlet Knight

raspberries	Redwing, Nordic, Heritage, Royalty, Fallgold (yellow)
strawberries	junebearing: Crimson King, Honeyoye, Glooscap, Kent, Sparkle everbearing: Fern, Hecker, Tribute, Tristar, Ft. Laramie
tomatoes	Baron, New Yorker, Earlirouge, Pik Red
turnips	Royal Crown (purple top), White Lady
winter squash	Sweet Mama, Delica, Cream of the Crop, Tivoli

5. At what temperatures can I seed my crops?

The minimum temperature for seed germination is...	for...
35 F	lettuce, onion, parsnips, spinach
40F	beets, cabbage, carrots, cauliflower, celery, peas, radishes, turnips
50 F	asparagus, sweet corn, tomatoes
60 F	beans, cucumbers, eggplant, muskmelons, peppers, pumpkins, squash, watermelon

Note: Generally, plant seed 4-5 times the lateral width of the seed. If the planting depth is too shallow, the seed may dry up, the seedling may have poor root development and stature, and may be significantly influenced by soil moisture fluctuations. If the planting depth is too deep, the seedlings may have poor or delayed emergence, and may be less competitive against weeds.

6. What are the optimum temperatures for crop growth?

The monthly temperature for optimum growth is:	for....
45-75 F	strawberries
55-75 F	chives, garlic, leeks, onions, shallots
60-65 F	beets, broccoli, Brussels sprouts, cabbage, carrots, cauliflower, Chinese cabbage, lettuce, parsnips, peas, potatoes, radishes, rutabagas, turnip
60- 7 5 F	sweet com

65-75 F	cucumbers, muskmelons, pumpkins, squash
70-75 F	sweet peppers, tomatoes
70-85 F	eggplant, hot peppers, watermelon

7. At what temperatures do crops freeze?

Freezing depends on the temperature and duration of the low temperature. In some cases, tissue damage will occur, but the plant may not be killed.

At...	the following crops freeze...
31.5 F	lettuce, spinach
31 F	beets, Brussels sprouts, cauliflower, sweet com, onions, peas, radishes
30 F	broccoli, cabbage, carrots, parsnips, rutabagas
-25 F	blueberries, raspberries (variety dependent)

8. How do I estimate crop yield?

The actual yield of your crops will depend upon the weather, the varieties you grow, the way the crops grow, etc. When your crops are fully mature, you can estimate your total yield by doing the following:

Measure a typical! 0 foot section of a row. If your rows are not uniform, choose and measure at least 3 10-foot sections.

Harvest the crop in the measured sections.

Weigh what you harvested or grade what you harvested and weigh what you would sell.

If you harvested more than one section, divide the sample weight by the number of sections you harvested.

Multiply the harvested weight by the number of rows of crop you planted and the number of l0-ft sections per row.

To convert to hundredweight per acre, multiply the sample weight by the conversion factor for row spacings found in *Knott's Handbook for Vegetable Growers*. Conservative estimates of yields for different vegetable crops is found in the same book.

IRRIGATION AND CULTIVATION

In this section, the questions we answer are:

1. Why should I rotate my crops?

2. How do I know what is and what isn't a weed?

3. When and how should I cultivate?

4. When do I use chemicals or mulches?

5. How do I use cover crops?

6. Why and when should I irrigate?

7. What irrigation method should I use?

8. What kinds of tools will I need?

1. Why should I rotate my crops?

IT PREVENTS DISEASE, INSECT, AND WEED PROBLEMS.

(what other reasons do you need?)

WHAT DO I NEED TO KNOW ABOUT CROP ROTATION?

what to use
- green manure (crop plowed into soil to add organic matter to soil)
- plant deep-rooted crops after shallow-rooted crops
- plant nitrogen-fixing legumes after crops that use a lot of nutrients (like tomatoes or com)
- rotate using crops from a different family (choose one from each group below)

Group A: cucumbers, gourds, melons, pumpkins, squash

Group B: broccoli, brussels sprouts, cabbage, cauliflower, collards, mustard greens, kale, kohlrabi, radish, rutabaga, turnip

Group C: eggplant, pepper, potato, tomato, tomatillo

Group D: beets, carrot, garlic, leek, onion, parsnip

Group E: Indian corn, popcorn, sweet com

Group F: chickpeas, green beans, lima beans, soybeans, wax beans

Group G: endive, escarole, lettuce, spinach, swiss chard

when to rotate
- repeat a crop group once every 2 to 5 years
- with short (2 year) rotations, plant sudan grass or some similar crop in the 5th or 10th cropping year to let the land rest

Note: rotation doesn't work if insects causing problems move over large areas **or** if they can feed on many different crops

2. How do I know what is and what isn't a weed?

A weed is any plant...

* growing where you don't want it to, like a tomato plant in your broccoli patch
* competing with your crops for nutrients, light, and water
* harboring insect pests and diseases
* keeping you from planting, irrigating, cultivating, or harvesting
* affecting crop quality, or is toxic to animals or people

HOW DO WEEDS SPREAD?

They spread through...

bird droppings
straw
mulch
wind
splashing or flowing water hoofs, paws, feet, shoes

WHAT SHOULD I KNOW ABOUT SPECIFIC WEEDS TO CONTROL THEM?

You should know their...

life cycle — Is it annual, biennial, or perennial?

An annual lives for only one year.
A biennial lives for two years.
A perennial lives more than two years.

type — Is it a broadleaf, grass, rush, or sedge?
A sedge is a grasslike plant, but with a triangular "stem".
A rush is a grasslike plant, but with a tubular, circular "stem".

WHAT ARE SOME COMMON WEEDS?

Note: There can be more than one common name for a weed, so the scientific name is written after the common name. The time it is seen and some features are given in the last column.

common name	scientific name	when seed production occurs, comments
annual grasses		
barnyardgrass	Echinochloa crusgalli	late summer or fall
giant foxtail	Setaria faberi	usually up to 3 ft. tall, but up to 7 ft.
green foxtail	Setaria viridis	leaves have no hairs
wild oat	Avena fatua	extensive roots
witchgrass	Panicum capillare	leaves covered with soft hairs
perennial grass		
quackgrass	Elytrigia repens	a primary noxious weed everywhere
annual broadleaves		
lambsquarters	Chenopodium album	June-October, leaves coarse-toothed
field pennycress	Thlaspi arvense	April-June, pods flat & round July-October
horseweed	Conyza canadensis	July-October, stem very leafy
marshelder	Iva xanthifolia	August-October, likes damp ground
knotweed	Polygonum aviculare	August-October, forms mats
redroot pigweed	Amaranthus retroflexus	July-September, stem often red
Virginia pepperweed	Lepidium virginicum	May-June, pods flat & round
wild buckwheat	Polygonum convolvulus	stems twining or creeping, seeds shiny & 3-cornered
annual or biennial broadleaves		
common mallow	Malva neglecta	June-October, flowers pink
hairy galinsoga	Galinsoga ciliata	
hoary alyssum (also perennial)	Berteroa incana	May-September, plants gray & hairy

ANNUAL GRASSES

Barnyardgrass

Flowering

Barnyardgrass

Leaf Blade

Green foxtail

Leaf Blade

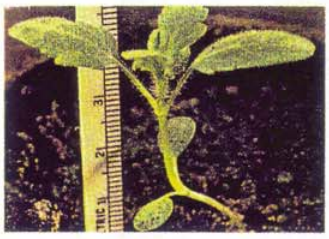
Green foxtail

Flowering

Marshelder

Flowering

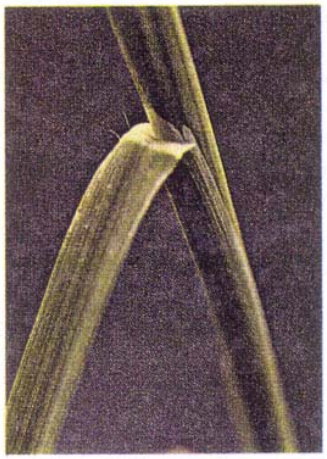
Marshelder



Seedling

ANNUAL GRASSES

Wild oats



Leaf Blade

Wild oats

Flowering

Witchgrass

Seedling

Witchgrass

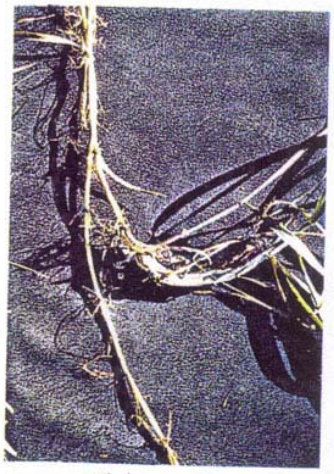
Flowering

PERENNIAL GRASS

Quackgrass

Flowering

Quackgrass



Rhizomes

ANNUAL BROADLEAVES

Wild buckwheat

Seedling

Wild buckwheat

Flowering

Lambsquarters

Seedling

Lambsquarters

Flowering

Mallow

Flowering

Milkweed

Seedling

Flowering

ANNUAL BROADLEAF

Redroot pigweed

Flowering

Redroot pigweed

Seedling

PERENNIAL BROADLEAVES

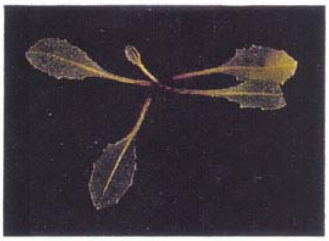
Canada thistle

Flowering

Canada thistle

Seedling

Dandelion



Seedling

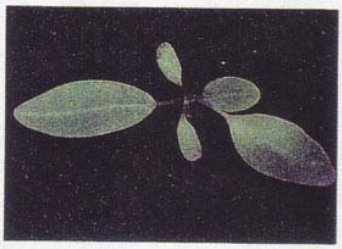
Dandelion

Flowering

PERENNIAL BROADLEAVES

Curly dock

Curly dock



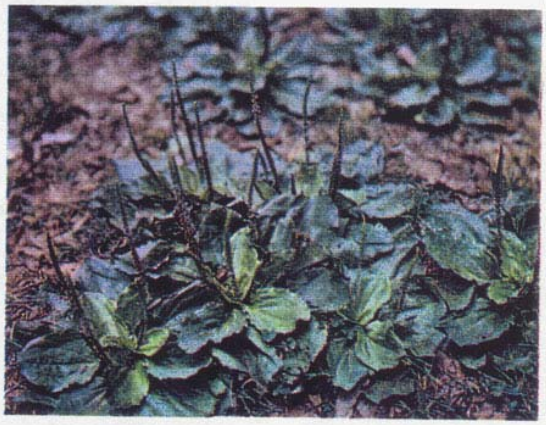
Seedling

Flowering

Prostrate knotweed

Spreading

Plantain



Flowering

Red sorrel

Seedling

3. When and how should I till or cultivate?

When	before seeding or transplanting when weeds are small and just emerging
How	shallowly, to loosen and aerate soil with clean tools to avoid spreading weed seeds **not deeply** or crop roots can be damaged, water can be lost, and deeply buried weed seeds can be brought to the surface **not** when really wet **not** when so dry that soil baked and cracked **not** too often or soil will be compacted

4. When do I use chemicals or mulches?

Use chemicals	to manage weeds, especially along fence lines to manage perennial weeds that are hard if labor is limited.

Note: READ THE LABELS!!! USE ONLY HERBICIDES THAT ARE REGISTERED FOR USE ON YOUR CROP AND AT RECOMMENDED, LEGAL RATES (see www.cdms.net/manufact.asp). Do not spray when it is windy or you can damage your and your neighbors' other crops.

See the Commercial Vegetable Pest Management Production Guide, Minnesota Extension Service bulletin AG-BU-1880-S (updated every year) for specific recommendations.

use mulches to control weeds:
- after weeds are removed
- when you want to conserve soil moisture
- when you want to heat soil (use black or clear plastic)
- to slow nutrient leaching

WHAT KINDS OF MULCHES CAN I USE?

straw grass clipping sawdust	These biodegrade. You should wood chips make sure they are free of weed seeds. They can keep soil temperatures low, harbor insects and diseases, and decrease available nitrogen.
plastic	These come in different colors to transmit different wavelengths of light to increase crop growth. They can be laid down mechanically. They may create a disposal problem.

5. How do I use cover crops?

cover crops	can add organic matter to soil and improve soil structure
	can reduce the threat of erosion
	can reduce soil surface and air temperature, slowing crop growth
	can harbor beneficial AND harmful insects, as well as rodents
	use water and nutrients, so can compete with crop plants
	can add nitrogen to soil if have low carbon to nitrogen ratio

Let the cover crop grow as long as possible. A cover crop is grown mainly to protect soil that would otherwise be bare (when no crop is being grown, or under orchards) from erosion. If not killed (by tillage, herbicides, or frost) it may reappear as a weed in a subsequent crop. If allowed to grow long enough, a cover crop can produce a large amount of organic matter to till under. This may mean not growing a crop for harvest on that part of your land that year, but this may make sense as part of a multiyear crop rotation. Be sure the tillage itself doesn't promote erosion or damage tree roots.

WHAT PLANT SHOULD I USE FOR COVER CROPS?

Use mixtures of:

cereals -	rye, barley, or oats	easy to start, seed is cheap, improve surface soil tilth
legumes -	vetches, pea, clover	fast-growing, fix nitrogen, may need inoculant (do not inoculate seed more than r day before use)
mustards -	rapeseed, mustard	fast-growing, have high nitrogen content, seed is cheap; may be toxic to some crops within 2 weeks of killing or mulching

Note: Be sure to purchase cover crops from a reliable source and that the cover crop seed does not include weed seeds.

HOW MUCH COVER CROP SEED DO I USE?

The rates you should use depends on your situation. The rates listed below are for cover crops that will be plowed under. If using cover crops as companion plantings or leaving them for spring growth, use lower seeding rates to conserve moisture.

vetches	50-60 lbs./acre
pea	80 lbs./acre
clover	20 lbs./acre
cereals	60-90 lbs./acre

6. Why and when should I irrigate?

WHY SHOULD I IRRIGATE?

To reduce the risk of droughty periods' impact on plant growth
To increase the plant survivability during germination or transplanting
To optimize the plant's soil-water growth environment through the season
To increase the uptake efficiency of production inputs like nutrients
To maximize produce yield and enhance produce quality
To provide your regular customers the assurance you will have product
To protect a plant canopy from an unexpected late spring frost like with strawberries (can only be provided by a solid-set sprinkler system)

WHEN SHOULD I IRRIGATE?

- Only after you have determined that the soil-moisture status of the active crop rooting zone is depleted of some soil-water and

you are very knowledgeable about the plants rooting depth, soil texture and water holding capacity, the plants' critical growth periods and soil-moisture thresholds, and how much soil-water the plants are using at each stage of growth.

- For sandy soils, the soil-moisture content during critical growth periods should not be allowed to deplete more than 30-40% of maximum soil-water storage in the active rooting zone (this might be equal to 0.3 to 0.6 inches of water depending on the soil's water holding capacity).

- During early plant development, avoid light and frequent irrigation as it may promote shallower rooting than expected and increase crop moisture stress during high water usage times and droughty periods.

- If using an overhead sprinkler system, irrigate in the early morning to allow plant foliage to dry off before evening so as to reduce the risk of leaf disease entry.

HOW CAN I DETERMINE THE SOIL-MOISTURE STATUS?

- Take a sample of the soil profile every 1 or 2 days with a soil-probe and estimate the soil-moisture status by its feel and appearance (see factsheet 1322).

- Install within the active rooting zone a shallow and deep soil-moisture sensor like a tensiometer or electrical resistance sensor and monitor the soil moisture readings on a daily basis observing the change in status as the plant uses soil-water and the soil profile receives rainfall and irrigate only when the level reaches a selected or critical level.

- Keep track of the daily crop water usage (evapotranspiration or ET) estimations and maintain a soil-moisture accounting balance sheet (also called a checkbook) that also includes rainfall and irrigation inputs and soil-water holding capacity.

WHERE CAN I GET MORE INFORMATION?

- Irrigation Scheduling–Checkbook Method. Un of Minnesota. J. Wright, 2002. Fact Sheet 1322: web site printing at http://www.extension.umn.edu/distribution/cropsystems/DC1322.html or can be purchased with a credit card at the University of Minnesota Extension Service - catalog web page at http://www.extension.umn.edu or by calling 1-800-876-8636 or 612-624-4900.

- Vegetable Crop Irrigation. North Carolina State University. D.C. Sanders, 1997. Fact Sheet at http://www.ces.ncsu.edu/hil/hil-33-e.html

- Basics of Vegetable Crop Irrigation. J.K. Kemble, 2000. Bulletin ANR-1169. Alabama Cooperative Extension Service. http://www.aces.edu/pubs/docs/A/ANR-1169

- Wisconsin – Minnesota daily Crop ET Estimations at http://www.soils.wisc.edu/wimnext/

7. What type of irrigation should I use?

Sprinkler and drip irrigation are the two most common methods used with vegetable and small fruit crops in Minnesota and upper midwest.

Depends on several factors such as:

field shape and topography
soil texture within field and water holding capacity
crop type and production system
water sources and amount availability
labor availability, and
need for frost protection

WHAT ARE THE MERITS AND LIMITATIONS OF DRIP IRRIGATION?

Merits:

- Uses less water and nutrients than sprinkler systems
- Does not apply water to plant foliage, less disease pressure
- Less weed pressure as do not apply water between plant rows
- Great for applying a portion of the N needs with the water to the plants
- The best choice when using a plastic mulched bedding systems
- It can be easily automated
- Can be easy to install by yourself

Limitations:

- Drip tubing very easily plugged so requires filters in the water lines
- Tubing can be easily damaged by rodents and others
- Installation cost and maintenance on the high side

WHAT ARE THE MERITS AND LIMITATIONS OF SPRINKLER SYSTEMS?

Merits:

- Several sprinkler system options available like, solid set, hand move laterals, traveling gun, center pivot and linear move.
- Solid set sprinkler system can provide some frost protection
- Sprinkler systems can fit many field shapes
- Self propelled systems like the center pivot, very low labor requirements
- The more acres under a system the lower the cost
- Nutrients can be applied with center pivot and solid set systems only.

Limitations:

- Spray patterns easily affected by wind.
- High initial capital outlay; may require engineering expertise to install
- Require higher pumping flow rates than drip irrigation
- Need larger power units to meet the higher operating pressures

DO I NEED A STATE WATER PERMIT?

In Minnesota if more than 10,000 gallons per day (equal to 7 GPM pumping for 24 hours) or 1 million gallons per year is needed for irrigation, a State Water Appropriation Permit is required from the Minnesota Department of Natural Resources (rules and application forms at website http://www.dnr.state.mn.us or 651-772-7910).

WHERE CAN I GET MORE INFORMATION?

Granberry, D.M. et al. 1994. Plasticulture for Commercial Vegetable Production. . University of Georgia Extension Service. Bulletin 1108. http://www.ces.uga.edu/pubcd/b1108-w.html

Harrison, K. 2002. Factors to Consider in Selecting a Farm Irrigation System. University of Georgia Cooperative Extension Service. Bulletin 882. http://pubs.caes.uga.edu/caespubs/pubcd/B882.htm

Lamont, W. J. et al. Irrigation for Fruit and Vegetable Production. Pennsylvania State University. http://pubs.cas.psu.edu/freepubs/pdfs/ua282.pdf

Scherer, T. 1998. Selecting a Sprinkler Irrigation system. North Dakota State University extension Service. Bulletin AE-91. http://www.ext.nodak.edu/extpubs/ageng/irrigate/ae91w.htm

8. What kinds of tools will I need?

Select good quality tools - they will outlast cheap tools and be more cost effective over time. Clean and store tools in a dry place after each use. Coat lightly with oil to protect against rust.

For.....	You may need....
site preparation	tractor and attachments: moldboard plow, disk harrow, spring-tooth harrow rototiller spreader for manure, fertilizer, lime, mulch
seeding or transplanting	seeds or transplants seed drill potato planter transplanter
cultivation	garden or spading fork spade hoe rake cultivator pruning shears
production	soil thermometer soil moisture gauge/lysimeter water sprinkler or drip irrigation pipes and tubing rain gauge cart or wheelbarrow sprayer or duster and protective clothing trellises, stakes, poles, fencing row covers or hot caps mulching materials shovel
scouting	plastic bags for soil samples identification books hand lens knife traps record book

tools, continued

harvesting	containers: bags, cardboard boxes, bins, etc. knives or pruning shears for cutting water to wash off soil water or ice to precool produce packing shed storage facility
marketing	truck table shading material material to make signs containers or bags water or ice to keep produce fresh scale to weigh produce

BEYOND HAND TOOLS, WHAT OTHER EQUIPMENT WILL I NEED TO START FARMING?

For growing more crops on more land, you will need heavy machinery like tractors, rototillers, and various implements.

This machinery will allow you to:

perform primary cultivation	plow soil on which crops are not currently grown.
conduct secondary tillage	smooth an already plowed area, removing large clods of dirt, or remove weeds from between crop rows.
spread fertilizer	apply either synthetic fertilizer, or distribute animal manure over a field.
planting	insert seeds into the soil in uniform rows, or place small transplants into the ground.
irrigation	apply water to the crop when rainfall does not provide adequate soil moisture.
harvest	picking or removing the crop from the field for processing or sale.

WHAT SPECIFIC MACHINERY WILL I NEED TO PERFORM THESE TASKS?

The machinery you need will depend on the size of the operation, and the types of crops you will grow.

For a small vegetable farm (less than 5 acres), you might need…

primary cultivation equipment	rototiller walk-behind tractor (such as a BCS™, or Gravely™) small riding tractor with moldboard plow
secondary tillage equipment	small "between row" rototiller walk-behind high-wheel cultivator small riding tractor with row cultivators
fertilizer spreader	walk behind drop spreader (turf type) hand crank fertilizer applicator small manure spreader (that can be pulled by a small riding tractor or ATV)
planting equipment	hand operated precision seeder (such as the Earthway™ models) small riding tractor with transplanter
irrigation	large plastic water tanks that can be moved by truck or small tractor impact sprinklers (with 1" hose and risers)
harvesting equipment	pick-up truck tractor with trailer to carry vegetables from the field small tractor with a "U" blade plow to lift root vegetables

For a larger vegetable farm (more than 5 acres), you might need…

primary cultivation equipment	tractor with moldboard plow (many old tractors made specifically for vegetable growers are still available, these include features like side-mount steering wheels, wide front axles, and high clearance)
secondary tillage equipment	spring-tooth harrow disk harrow

	tine weeder row cultivators
fertilizer spreader	side-dress fertilizer applicator manure spreader
planting equipment	seed drill passenger operated transplanter
irrigation	traveling gun sprinkler drip tape solid set aluminum pipes with impact sprinklers
harvesting equipment	pick-up truck trailer to carry fruit from the field specialty harvesters for various crops

Fruit growers might need…

site preparation equipment	mower sickle bar cutter
planting equipment	auger or post hole digger
fertilizer spreader	walk behind drop spreader (turf type) hand crank fertilizer applicator
irrigation	large plastic water tanks that can be moved by truck or small tractor traveling gun sprinkler drip tape solid set aluminum pipes with impact sprinklers
weed control	walk behind drop spreader (turf type) backpack or trailer-type sprayer
pest control	backpack or trailer-type sprayer tractor with fogger
harvesting equipment	pick-up truck trailer to carry vegetables from the field

See section 7 for a list of sources for some of these tools.

Dehn's Garden: From Truck Faring to Wholesale Herb Marketing

"I come from a long line of truck farmers and market growers," says Bonnie Dehn. "My father sold vegetables from a truck stand every day at the Minneapolis Farmers Market as did my grandfather and great-grandfather." Bonnie has carried on the family tradition since 1978 when she and her husband, Bob, purchased their farm. Since then, the Dehns have gradually grown their business and are now well known at the Minneapolis Farmers Market and around the Twin Cities as premier suppliers of fresh herbs and vegetables.

The Dehn family, which includes adult children Norah Beth and Jennelle as well as son-in-law Matt Eisinger, owns over 20 green houses and a total of 105 acres on which they grow more than 50 varieties of herbs, 20 varieties of vegetables, and 200 varieties of bedding plants.

Business Planning and Risk Management

"My husband looks at the farm as a small business," says Bonnie. While he shares her passion for growing, Bob also keeps a close watch on enterprise profitability, labor productivity, and cash flow. Record keeping is their number one business and risk management tool.

Bonnie and Bob maintain daily records about: weather conditions (daily temperatures, number of hours of sunlight, wind velocity, rainfall); work performed; crop yields; predator and pest damage; expenses; and sales. All of these records inform the Dehn's planting, marketing and human resource decisions. "From the weather and yield records we learn about which crops perform best under which conditions and which soils," says Bonnie. From the marketing and financial records, the Dehn family can identify "swells" in buyer activity and calculate break-even numbers for each crop enterprise. Typically, Bonnie says, they track a new crop enterprise for 3-4 years.

After years of growing, marketing and record keeping, Bob and Bonnie have learned to manage risks well. They utilize "best management practices" to deal with field pests and wildlife, communicate regularly with buyers to stay on top of trends, and carefully follow all farm safety and employment regulations.

Marketing

The Dehns have a well established reputation as high quality suppliers. But it took them a while to get here. In the late 1970's, they sold 20 acres-worth of vegetables and a handful of popular herbs such as dill and basil to mostly wholesale buyers who visited the Minneapolis Farmers Market. "Lunds [wholesale] buyers used to come to the market at 5:00 am with three trucks." Over the years, Bonnie became a regular supplier to the buyers by growing the varieties they requested. Lunds buyers and other wholesalers no longer travel to the market. Instead, growers like Bonnie deliver to the buyers.

Bonnie communicates with wholesalers daily. It is not uncommon for her to spend 8-9 hours on the phone to arrange sales and delivery. Wholesale deliveries are made Monday – Saturday. At

the retail level, the Dehn family markets direct to Minneapolis Farmers' Market customers four days a week.

During the winter when the fields are dormant, Dehn family members have more time to spend on promotion. Bonnie spends up to two days each week during the winter season sampling herbs and vegetables from the greenhouse to retail shoppers at Twin Cities retailers and food cooperatives. She also takes time out to lead educational workshops "to any group who wants to eat and cook healthy."

Production Management

Dehn's Garden soil is a mix of what Bonnie calls "Anoka county blown sand," black dirt, black loamy clay, and pure peat. She divides the farm into four distinct planting areas – each with its own unique soil type and crop tolerance. Lettuces and carrots do well in the peat, for instance, while rosemary and apples grown in sandy areas.

The Dehns practice strict organic management thought they aren't certified as such. Their packaging reads "Produced without pesticides." Bonnie and her family firmly believe in taking care of the soil and they practice what she refers to as her "grandfather's common sense farming" rather than relying on synthetic chemicals to control pests and improve fertility.

Bonnie and her family limit physical production risks, such as pest and disease, by planting a diversity of crops, by staggering their seeding dates, and by operating several smaller greenhouses in place of one large house. By utilizing several greenhouses, the Dehns are able to confine diseases and pests to one house rather than risking all of their indoor crops. Outside, Bonnie says "We don't plant all at once so that the bugs move on from one crop before the next one emerges." The Dehn's also use companion planting practices. Bait crops – like arugula – are planted to protect spinach from insects. "The bugs eat the arugula and leave the spinach alone," Bonnie explains. She also plants cilantro as a companion for many crops. "The cilantro overwhelms the scent of the main crop so much so that deer often pass by," explains Bonnie. Despite all their efforts, the Dehn's still lose approximately ⅓ to ½ their crops annually to wildlife. "We factor this in as one of our costs," says Bonnie. "There's just not much else we can do about it."

Crops are irrigated at the time of planting by water from a 490 foot well that was dug in accordance with a Department of Natural Resources guidelines. Otherwise, Bonnie says, they don't water very often. Instead, the Dehns have focused on planting more drought tolerant cultivars in the drier soils.

Postharvest handling is crucial. Freshly picked herbs and vegetables are "processed" on the farm. Processing involves washing freshly harvested herbs and vegetables, bundling, and in some cases, packaging in bags or clear plastic containers labeled with the "Dehns Garden" logo. Packaged herbs fall into a "gray area" as far as regulators are concerned. While herbs, like other fresh vegetables, technically are not considered a processed taxable product, the Dehns' salads are subject to food processing and handling regulations because of the mixing and packaging. The Dehns undergo on-site food safety and health inspections annually.

Once processed, all vegetables and herbs are stored in coolers and transported in a refrigerated truck. Refrigeration is important for maintaining freshness and quality. "Because our herbs arrive at the market looking fresh [not wilted], we are able to charge a little bit more," explains Bonnie. Refrigerated trucks are not cheap. For this reason, Bonnie says "We are one of very few growers at our market to use one."

Labor Management

Work continues year-round at Dehn's Garden. During the growing season "from April to October we hire anywhere from 10-15 people to harvest, plant, and weed the fields," says Bonnie. "They are working 8 hours each day, five days a week." On the weekends, however, Bonnie says it is family members who "take the brunt of the weeding, harvesting, hoeing and harvesting work." By this, Bonnie means that their *backs* bear the burden of field work: "There's a lot of bending over since the work is done by hand," Bonnie explains. "I wish we had more mechanization – our backs wouldn't be as sore."

The Dehns hire mostly college students for seasonal summer help although some employees, including one family of migrant laborers, have been with Dehn's Garden for over 15 years. When hiring high-school and college-age students for the summer, Bob and other staff interview each applicant and talk with applicants' parents before making a final decision. "We want parents to know what to expect. Their kids will be working odd hours and coming home really dirty," Bonnie explains.

"We believe in treating our employees well," says Bonnie. "In fact, they are like family." The Dehn's pay employees a wage that is well above the state minimum and provide paid sick-leave, family days, and holiday time off for full-time staff. Legally, the Dehns practice good employee-employer relations by carrying "a very good Worker's Unemployment Compensation policy and by doing the right thing" says Bonnie.

Words of Advice

After growing and direct marketing for more than 25 years, Bonnie and Bob recommends new commercial growers "take it slow" and work together with whomever will be involved. Most importantly, she says, ***"If you don't have a market for your product – don't grow it!"***

Nora Beth with Dehn's herbs

FARM SAFETY

In this section, the questions we answer are:

1. What kinds of hazards should I watch out for?

2. What protections can I take?

1. What kinds of hazards should I watch out for?

Hazard	
Machinery	Tractors can overturn onto the driver, causing injury or death Tractor fires cause over $20 million in property losses each year and millions due to lost time and downed crops during the harvest season. Fires also cause 40 or 50 serious injuries each year, and occasionally a person is killed because of a farm machinery fire. If not used correctly, a power take-off can rip off your arm, crush your skull, or sever your spine.
Environment	Repeated exposures to loud noise can lead to permanent, incurable hearing loss or tinnitus. People working outdoors must be extra sure to protect themselves from mosquitoes that can carry West Nile virus and deer ticks that can vector Lyme disease. People who work in the sun are more likely to develop skin cancer and cataracts.
Pesticides and chemicals	There are potential dangers involved in handling pesticides and anhydrous ammonia. Chemicals splashed into eyes can cause injury, and improperly stored chemicals can be fire hazards.

2. What protections can I take?

Get licensed — You must be licensed in order to spray pesticides in Minnesota. There are several ways to obtain private pesticide applicator training. See http://www.extension.umn.edu/pesticides/ for more information.

Wear protective gear. Chemical-proof goggles, rubber gloves, and a heavy-duty long-sleeved shirt are required attire for anyone handling anhydrous ammonia. Regular glasses provide virtually no protection. Another option is to wear an approved full-face respirator that combines eye and lung protection. Never wear contact lenses when working with ammonia. Anhydrous ammonia can get under the lens and cause permanent eye damage before the lens can be removed. For more information, see University of Minnesota Extension Service bulletin **Using Anhydrous Ammonia Safely on the Farm**, FO-02326, also available at http://www.extension.umn.edu/distribution/cropsystems/DC2326.html.

You should also use respirators when applying chemicals and sunglasses when working outdoors. See http://safety.coafes.umn.edu/ppe.html for more information.

Store chemicals in a separate, locked building (of approved design), not in the machine shed, garage, barn, or house (including the basement). Mark a chemical storage building with a distinctive, easily read sign clearly designating it as a chemical storage area. Never permit smoking or fires within the building. For more information, see University of Minnesota Extension Service bulletin **Fire Hazards of Stored Pesticides on Farms**, FO-00914-GO; also available at http://www.extension.umn.edu/distribution/cropsystems/DC0914.html.

Obtain material safety data sheets for any chemicals you use on your farm. These sheets provide information on the types of hazards a chemical may present and how to handle the chemical in case of a spill. Be aware of when you are feeling especially stressed out or tired, and avoid handling chemicals at these times. See http://safety.coafes.umn.edu/chemicals.html for more information.

PEST MANAGEMENT

In this section, the questions we answer are:

1. What can I do to minimize pest damage on my farm?

2. What do I need to tell insects apart?

3. What is scouting?

4. How do I know what disease my plants have?

5. How do I manage diseases?

6. What are some common pest problems in Minnesota?

7. What about animal pests?

1. What can I do to minimize pest damage on my farm?

Minimize pest damage by:

choosing good varieties	Many varieties are resistant to one or more pests. Some crops are especially well-suited for Minnesota.
using certified seed	These are of high-quality and ensure good vigor.
rotating crops	This is an excellent approach to minimize pest damage (particularly diseases).
choosing good planting sites.	Some diseases live in soil a long time avoid sites with past disease problems.
supplying plants with proper nutrition	Healthy plants survive pests better.
using good water management	Poor drainage or soil compaction can promote root problems. Splashing water can spread waterborne diseases.
keeping fields clean control weeds get rid of debris	Weeds can encourage insect and disease, build up food sources for pests, and can be pest hibernation and breeding places.
inviting beneficial insects	This helps you to minimize pesticide use. Grow plants beneficial insects like to live on.

2. What do I need to tell insects apart?

resources needed:	good identification book (see appendix) l6x hand lens for small insects and eggs (found at nature stores) sharp knife for cutting open damaged plants shovel to look at root damage containers to collect insects insect traps (light, colored sticky traps) can be very helpful

3. What is scouting?

Scouting means looking for pest problems on a regular schedule, such as 1-2 times per week.

what to look for	weak or undersized plants damaged leaves or fruits insect pests and eggs beneficial insects
where to look	plant tips base of plant underside of leaves under plant debris or soil at base of plant
when to look	early morning night with a flashlight

> **Note:** keep a record of the weather conditions and location of problems to help with future pest control.

The *Minnesota Fruit and Vegetable IPM Newsletter* (available on the Web at http://www.vegedge.umn.edu/MNFruit&VegNews/mnindex.htm) informs people of pest and disease infestations in a timely manner. See section 7 for a sample and subscription form. To subscribe, contact Jeanne Ciborowski at the Minnesota Department of Agriculture at 651-297-3217 or jeanne.ciborowski@state.mn.us.

WHAT DO I DO WHEN I FIND PESTS?

handpick them	This is useful for small, isolated infestations and is usable if insect pest can be seen.
put up barriers	Paper collars protect seedlings and new transplants. Floating row covers help against some beetles.
use biological control.	Beneficial insects must be released at the right time. Insecticides can kill helpful insects too.
spray pesticides	Use pesticides with care and only when they're needed. Read labels to check what safety measures are needed, the legal requirements, and registered uses.

4. How do I know what diseases my plants have?

do field monitoring	Look at as many affected plants as possible. Look for different stages of diseases.
take plants to a clinic	

WHAT ARE THE DIFFERENT TYPES OF PLANT DISEASES?

Plant diseases are broadly classified as "Biotic" or "Abiotic." Biotic diseases are those caused by living organisms, like fungi, bacteria, and even viruses. Abiotic diseases are the result of non-living causes like herbicides, pollution, salt, and too much or too little of certain nutrients that plants require for growth.

How can I tell if a disease has a biotic or abiotic cause?

Biotic Diseases:

- Usually appear on random plants throughout a field
- Affect different plants with different levels of severity
- Sometimes have visible signs of disease—like mold

Abiotic Diseases:

- Usually appear in a distinct pattern—like only alongside a road, for example
- Affect the entire crop similarly
- Often effect other types of plants in the area, including weeds, and other nearby crops

type	**caused by**	**examples**
biotic	fungi (these form threadlike or fluffy masses)	seed rot, damping off, rust, blights, mildew
	bacteria (require a wound or pore to enter plant)	leaf spots
	viruses (require contact between infected and healthy plants)	mosaics, yellows
	nematodes	root-knot

abiotic	nutritional problems	tipburn in cole crops (calcium deficiency) blossom end rot in tomatoes
	physiological problems	sunburn riciness in cauliflower hollow heart in potatoes wind, hail, cold injury
	pesticide injury	look for a location pattern field edges from drift in rows where residues left rows treated twice spotting or yellowing of leaves bleaching abnormal growth

The next few pages illustrate a diagnostic key for determining whether a biotic or abiotic problem exists in carrots.

Common Pest and Disease Problems of Carrots in Minnesota

FOR YELLOW LEAVES GO TO PART 1.

FOR WILTED, CURLED, SPOTTED, OR DEAD LEAVES GO TO PART 2.

FOR YELLOW OR GREEN PLANT "THREADS" TANGLED IN LEAVES GO TO PART 3.

FOR HAIRY ROOTS GO TO PART 4.

FOR DEFORMED ROOTS GO TO PART 5.

FOR ROOTS WITH BLACK SPOTS OR SUNKEN LESIONS GO TO PART 6.

FOR INSECT "TUNNELS" IN ROOTS GO TO PART 7.

PART 1: YELLOW LEAVES

Widespread throughout entire field.

-OR-

Appearing randomly, on individual plants, often accompanied by stunting, and "hairy" roots.

Cause: Possible nutrient deficiency.

Treatment: Contact the U of M Soil Test Lab for recommendations, at 612-625-3101

Cause: Aster Yellows, a microscopic bacteria-like organism spread by tiny leafhopper insects.

Treatment: Remove infected plants.

PART 2: WILTED, CURLED, SPOTTED, OR DEAD LEAVES

Wilting, curling, spotting, or dying leaves on individual plants distributed randomly in a field.

-OR-

Widespread browning or curling of leaves throughout the field, often in a "pattern."

Tan or brown spots on foliage, often with wilting and curling of leaf edges.

Cause: Cercospora Leaf Spot, a fungal disease.

Treatment: No fungicides are approved for this disease. Irrigate early in the morning so that foliage dries out by evening. Practice crop rotation, rotating the field out of carrot production for three years.

Browning of leaf edges, often appearing first on older leaves.

Cause: Alternaria, a fungal disease.

Treatment: Practice crop rotation, rotating the field out of carrot production for three years.

Cause: Possible herbicide, fertilizer, or pollution injury.

Treatment: Contact the U of M Plant Disease Clinic for recommendations, at 612-625-1275

PART 3: YELLOW OR GREEN PLANT "THREADS" TANGLED IN LEAVES

Cause: Dodder, a parasitic plant that obtains nutrients from the host plant rather than through an independent root system.

Treatment: Mow tops of infected plants.

PART 4: HAIRY ROOTS

Cause: Aster Yellows, a microscopic bacteria-like organism spread by tiny leafhopper insects.

Treatment: Remove infected plants.

PART 5: DEFORMED ROOTS

Forked, branched, or knobby roots—often in fields under frequent carrot production for several years.

-OR-

Misshapen, heavily branched roots—even in fields where carrots were not previously grown.

Cause: Root knot nematode, a microscopic roundworm.

Treatment: Rotate the field out of carrot production for at least one season. Crops like corn, garlic, and onions are all immune to this pest.

Cause: Poor cultivation. Roots were pushed around or broken during between row cultivation.

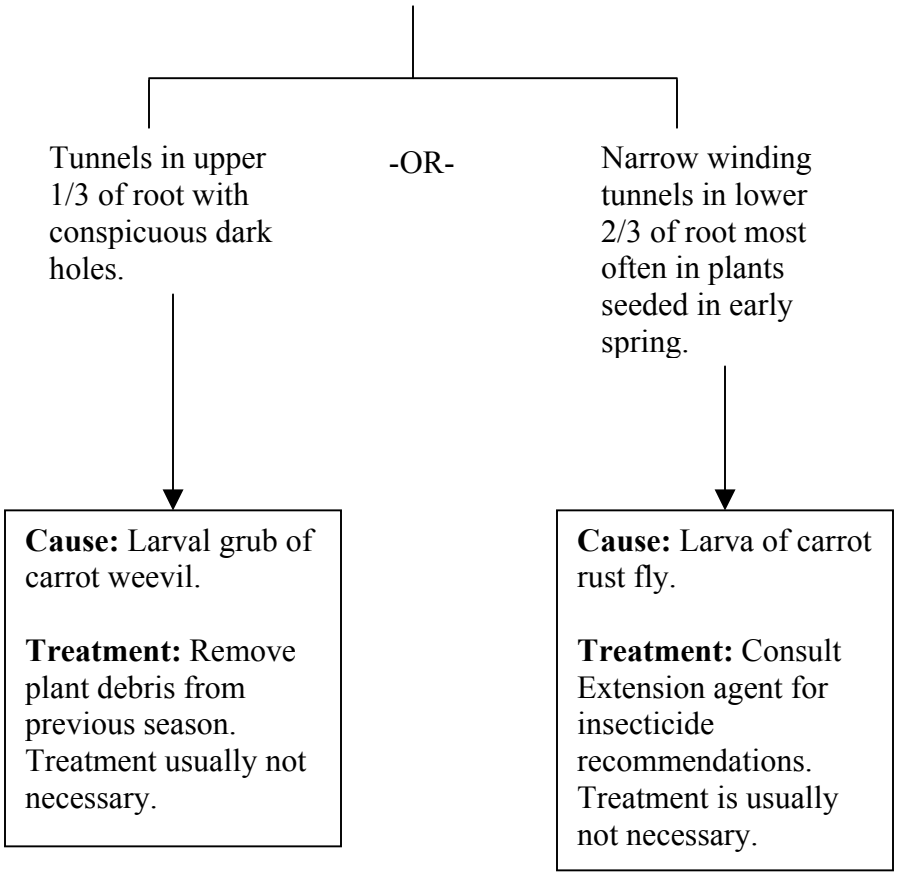
Treatment: adjust spacing or spade size on row cultivation equipment.

PART 6: ROOTS WITH BLACK SPOTS OR SUNKEN LESIONS

Cause: Carrot Crater Rot. Carrots in storage develop white fungal spots that turn into sunken black craters on the surface of the root.

Treatment: Avoid wounding carrots during harvest. Maintain cool temperatures storage humidity below 95%.

PART 7: INSECT "TUNNELS" IN ROOTS



5. How do I manage diseases?

prevent them	This is the best control measure; see question 1. This includes field monitoring, choosing good varieties, doing proper field selection, and using good cultural and sanitation practices.
use protective pesticides	They are generally more effective before than after diseases appear. They may not be economical for intermittent diseases.
use fungicides & bactericides	These can reduce damage from some diseases. Monitor fields and treat plants as soon as you see disease. Check labels for proper use. Be careful of drift

6. What are some common pest problems in Minnesota?

crop	insect pests	diseases
asparagus	asparagus beetles asparagus aphid cutworms	crown rot rot root rust
beans	aphids bean leaf beetle green cloverworm corn borer grasshoppers leafhoppers spider mites seed corn maggot	anthracnose bacterial blight Botrytis grey mold mosaic powdery mildew rust white mold
cole crops	aphids cabbage maggot cutworms flea beetles loopers	Alternaria leafspot blackleg clubroot downy mildew Fusarium Sclerotinia white rot wire stem
carrots	aphids aster carrot weevil cutworms	Alternaria leafspot leafhopper aster yellows cercospora Rhizoctonia crown rot
cucumbers	aphids cucumber beetles cutworms squash vine borer wireworms	Alternaria leaf blight anthracnose bacterial wilt cucumber mosaic virus downy mildew powdery mildew
lettuce	cabbage looper cutworms	aster yellows big vein downy mildew mosaic Rhizoctonia bottom rot Sclerotinia drop tip burn

common pest problems in Minnesota – continued

melons	aphids cucumber beetle cutworms seed corn maggot squash bug squash vine borer	Alternaria leaf blight anthracnose bacterial wilt cucumber mosaic virus downy mildew powdery mildew
onions	onion maggot onion thrips	bacterial soft rot Botrytis leaf blight downy mildew Fusarium basal rot pink root purple blotch Sclerotinia drop smudge smut
peppers	aphids corn borer	Alternaria leafspot anthracnose bacterial spot mosaic
potatoes	aphids Colorado potato beetle cutworms flea beetle leafhoppers	early and late blights pink rot Pythium leak Rhizoctonia canker scab white mold
pumpkins and squash	aphids cucumber beetle cutworms seed corn maggot squash bugs squash vine borer	Alternaria leaf blight anthracnose bacterial wilt black rot downy mildew Fusarium wilt gummy stem blight powdery mildew scab
radish	cabbage maggot flea beetle	Fusarium wilt Rhizoctonia crown rot

common pest problems in Minnesota - continued

sweet corn	aphids	com leaf blight
	armyworm	dwarf mosaic
	cutworms	rust
	corn earworm	smut
	wireworms	
tomatoes	aphids	anthracnose
	cutworms	bacterial spot
	flea beetle	Botrytis grey mold
	spider mites	early and late blights
	tomato hornworm	grey leaf mold
		Fusarium wilt
		Septoria leaf blight
		Verticillium wilt

See the following pages for pictures of some of these pests.

Insect Pests

alfalfa bug on Asparagus

spotted asparagus beetle

common asparagus beetle

Bean leaf beetle

black cutworm on beans

Cabbage armyworm

Cabbage looper

imported cabbageworm

cabbageworm adult

zebra caterpillar on cabbage

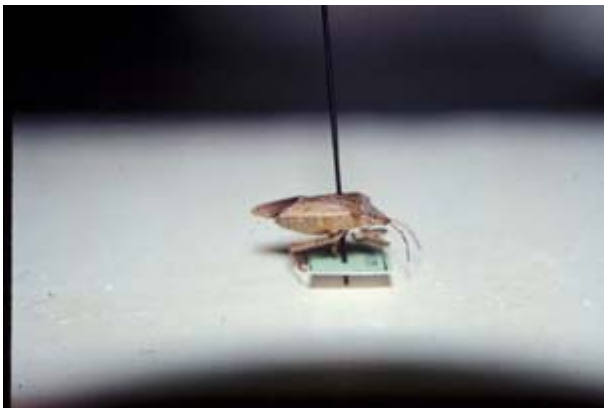
aster leafhopper nymph on carrots

carrot root knot nematode damage

spotted cucumber beetle

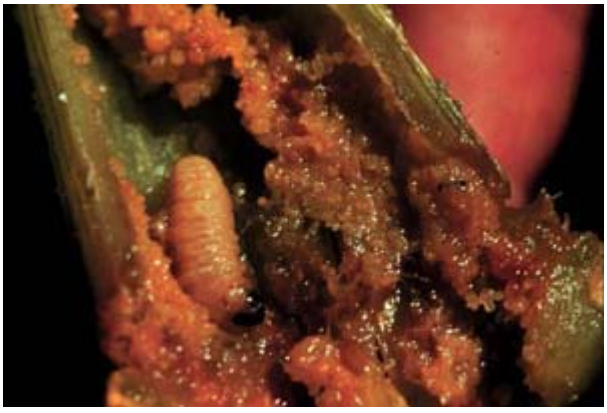
striped cucumber beetle

squash bug



squash bug damage

squash vine borer



squash vine borer adult

squash vine borer damage

Onion maggot damage

onion maggot adult

onion thrip damage

alfalfa caterpillar on peas

army cutworm larva in peas

army cutworm pupa

army cutworm adult

green cloverworm on peas

green pea aphid

speckled green fruitworm in peas

spotted cutworm

velvet bean caterpillar on pea

radish flea beetle damage

Solanaceae (peppers, potatoes, and tomatoes)

black cutworm on tomato

European corn borer on pepper

European corn borer on tomato

Colorado potato beetle adult

Colorado potato beetle eggs

flea beetles on potatoes

green peach aphid on potato

potato aphid

potato leafhopper

potato white grub

Tomato hornworm larva

tomato hornworm adult

whitefly

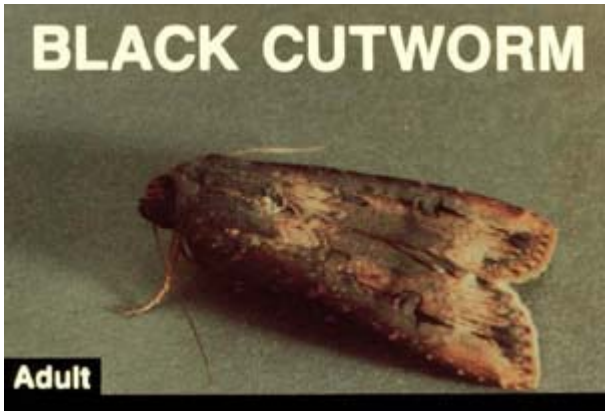
Spinach leafminer

spinach leafminer damage

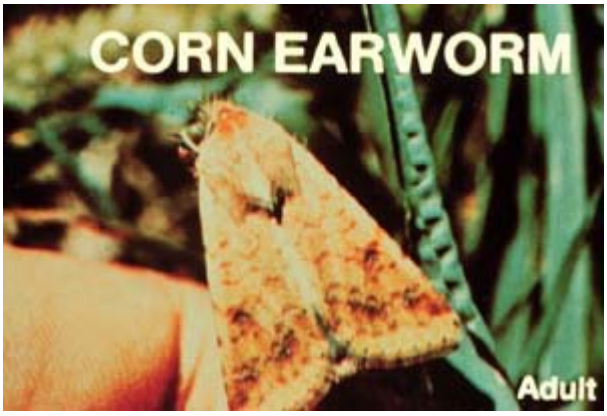
Sweet corn

armyworm

black cutworm

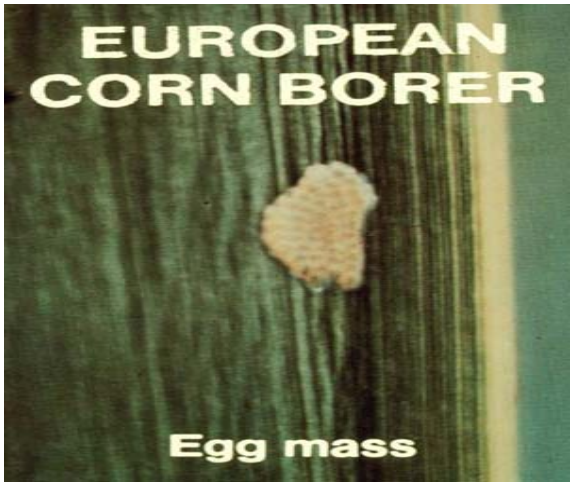


corn earworm



cutworm

European corn borer



European corn borer adult

hop vine borer

seedcorn maggot

Western bean cutworm on corn

white grub

wireworm

Diseases

Asparagus rust on leaf

on stem

Basil fusarium

Bean anthracnose

Bean downy mildew

Bean halo blight

Bean rust

Bean white leaf spot

Bean white mold

Beet carcospora

Cabbage alternaria

Cabbage black rot

Carrot aster yellow

Carrot cercospora

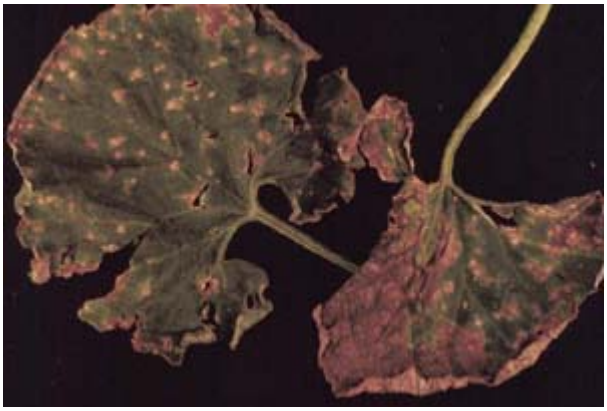
Carrot rhizoctonia

Carrot root rot

Carrot white mold

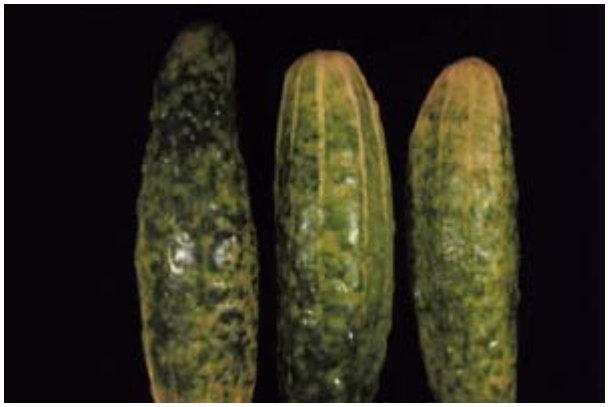
Cucurbits (cucumbers, melons, pumpkins, and squashes)

anthracnose



bacterial wilt

mosaic virus



mycosphorerelle

pythium

phytophthora

powdery mildew

scab

septoria

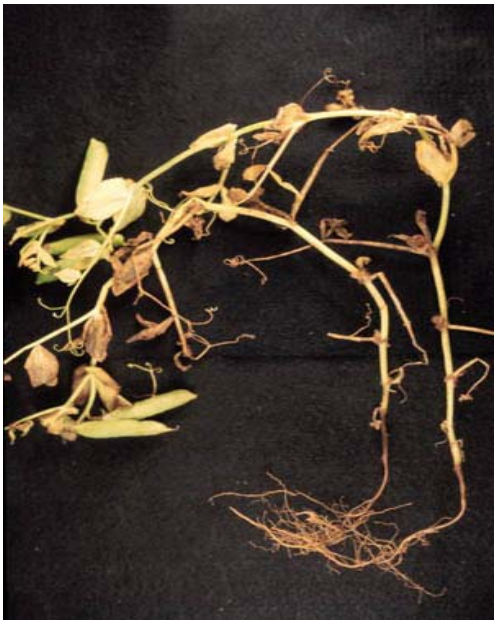
watermelon mosaic virus

Lettuce aster yellows

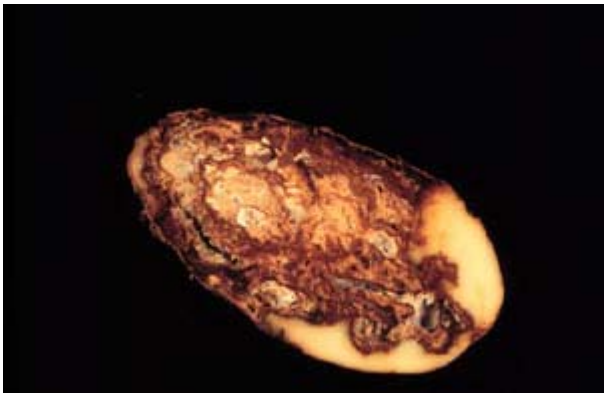
Onion aster yellows

Onion botrytis soft rot

Pea rhizoctonia



Potato dry rot



Potato early blight

Potato hollow heart

Potato late blight

Potato pit scab

Potato rhizoctonia

Potato silver scurf

Radish black root

Radish frost damage

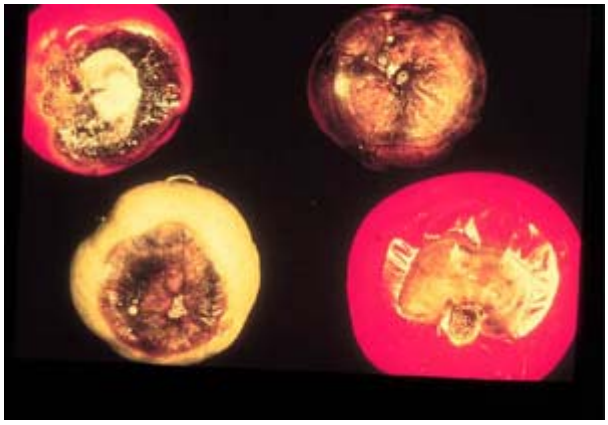
Solanaceae (peppers, tomatoes, and tomatillos)

Alternaria

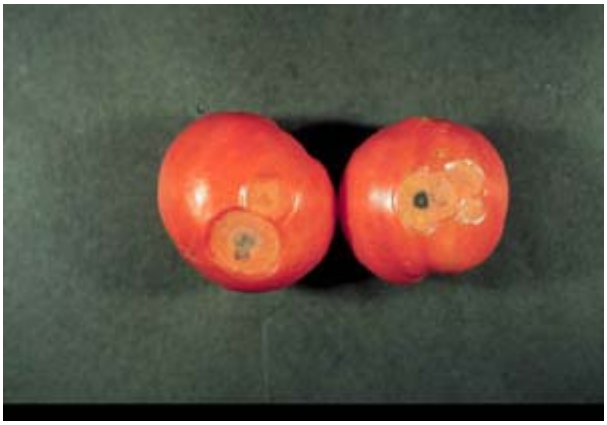
bacterial leaf spot

bacterial xanthomonas

blossom end rot



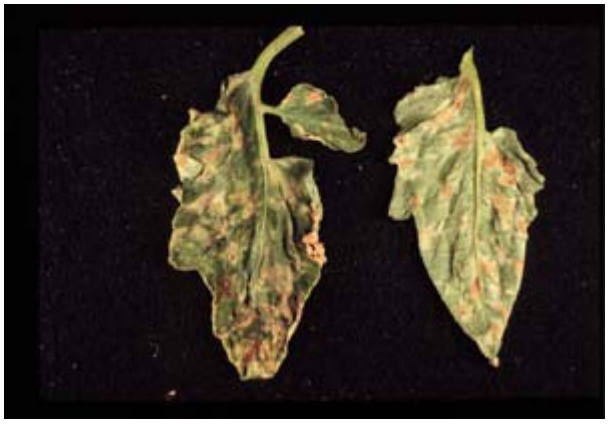
Colletotrichum



early blight

late blight

leaf mold



septoria

slime mold

tomato spotted wilt

turnip alternaria

7. What about animal pests?

To protect against animal pests, you can:

put up barriers	Do this BEFORE you expect animal pests. Examples: fencing - consider height, depth, electrical floating row covers nets tree guards gravel
use repellants	These don't always work. Examples: odor or sound repellants flashing, moving, or sonic devices gum for moles - they like the smell of gum but can't digest it. lights - deters raccoons black or hot pepper powder
set traps	Set these in sheltered areas. Conceal them. Mask any of scent you may have put on it. includes trap crops - not useful for every pest

McDougall's Apple Junction: Marketing More Than Apples

Gary and Alice McDougall had always dreamed of managing a "Mom & Pop" apple orchard during retirement. "We envisioned selling pre-picked apples on the weekends," explains Gary. They hadn't planned on growing a business that would employ 17 seasonal pickers and baggers. They hadn't planned on inviting customers to pick their own apples and pumpkins. And they certainly hadn't planned on becoming *the* source for premium quality Honeycrisp apples. But that's just what has happened over the past 18 years as the McDougalls gradually transitioned from backyard fruit producers to full-time commercial growers with over 4,000 apple trees, six acres of pumpkins and a greenhouse for starting chrysanthemums.

Business Start-Up

Gary and Alice started out growing apples around their home south of Hastings. "We planted 200 trees in our yard," recalls Alice. "We experimented with direct farm marketing – selling to our friends and neighbors." After several years of experimentation Gary and Alice decided they were ready for commercial production. In 1986 they purchased 100 acres of "good land in a high traffic area."

Apple Junction Orchard is nestled amongst rolling hills two miles north of Hastings and about 20 miles south of St. Paul off a busy highway. "High traffic" was critical since the McDougalls planned to direct market from the farm. And "good land" for apples meant south facing slopes with plenty of "air drainage" for the fruit trees (as protection against late spring frost) and suitable soils (well-draining loam is best for apples).

The McDougalls planted approximately 800 semi-dwarf trees that first year. "We chose the top sellers back then," explains Alice. "These were the Haralson and Regent varieties." Gary and Alice researched "top sellers" by talking with other growers they met through the Minnesota Apple Growers Association.

During that first year, Gary and Alice were hit hard by drought and deer. "Our daughter saved the orchard," says Alice. "She hand watered each tree with a bucket while Gary and I were working." The next year, the McDougalls installed a trickle irrigation system. The trickle system, which has worked well, relies on buried irrigation hose with emitters that are uniformly spaced. The hoses emit approximately two gallons of water/hour/tree.

Gary addressed their deer problem by enclosing the orchard with high-tension electric fencing. The irrigation equipment and fencing "were expenses we hadn't counted on," says Gary. Looking back, he says, 10-foot woven wire fencing (rather than electric) "would have worked just fine, cost less, and required less maintenance."

Production Management

After tackling these unforeseen obstacles during their first few years in business, Gary and Alice were able to establish a regular management plan for the orchard. They work year-round, despite the limited marketing season (September – November). Their production year begins in mid-to-late February when trees are ready for pruning. Brush removal and grafting follow. Beginning in May and June, blossoms are thinned (to encourage fewer, larger apples) using available growth regulators. Grassy strips between each row of trees are mowed every 1-2 weeks to control weeds throughout the summer.

Trees and fruit are also treated with pesticides as needed. Gary and Alice practice Integrated Pest Management practices which means they spray only when they have to. "We use pheromone traps to catch insects," Gary says, explaining how IPM works on their farm. "Once we have crossed a certain threshold – trapped a particular number of insects – we know it's time to spray." The McDougalls also practice preventative spraying for disease when conditions are right. They use a Spectrum weather monitor to track humidity, rainfall, wind, and temperatures every 15 minutes. Information from this electronic monitor can be downloaded into Spectrum computer software. This software compares information collected from the field to model pest and disease conditions. With this information, the McDougalls are able to predict the likelihood of disease outbreaks, such as scab or fire blight. If conditions are right for one of these outbreaks to occur the McDougalls begin treating the trees as a preventative measure.

Once fall rolls around and apples ripen, the McDougalls' real work begins. They hire 15-20 part-time helpers to pick, process and manage the retail store (most helpers are adults from neighboring communities). Apples are picked at their peak of flavor and loaded into 11-bushel wooden bins. Once full, the bins are hauled five at a time on a trailer back to the processing barn where they are loaded with a forklift to an apple washer. Gary welded the washer himself – designing it after a system he'd seen at other orchards. Apples are submerged into water and passed through a Greefa sizing machine which can sort approximately 30 bushels/hour. From there, the apples are transferred to packing tables where they are hand sorted for quality and packed in clear bags as either premium, second, or utility apples. Packaged apples are sold through the McDougall's retail store for $1.00 to $1.60 per pound.

Once employees and customers have gone for the day, Gary and Alice begin their recordkeeping work. Gary handles the production reports – he records information about field work and downloads weather data from their Spectrum monitor. Alice tracks daily receipts (income) and sales tax (collected on non-food items), balances their business account, and places orders for pre-made food items, such as frozen pies, cider and jam.

During winter, Gary spends time "in the barn repairing tractors, maintaining equipment and making improvements." Like most farmers, he is innovative and skilled with tools. Gary has designed and built all of his own outbuildings, trailers, automated washing equipment, wooden packing crates, and walk-in storage coolers.

Marketing

"Any fool can grow apples," says Gary with a smile. "But not everyone can market them. Marketing has always been our biggest challenge." The challenge, he explains, is that wholesale

profit margins are extremely slim – making it necessary to grow very large volumes "if you want to stay in business." The McDougalls weren't interested in high volume production and for this reason they decided to concentrate their marketing efforts on retail buyers. "We have some of the best retail prices for apples in the country," says Gary. "People from Michigan or Washington would kill for these prices." But, he warns, price premiums don't come for free.

The McDougalls have spent years building a list of regular clientele, responding to customers' requests, adapting to competition, and taking risks. During their first two years at the new farm, Gary and Alice marketed apples from other orchards as a way to establish markets. "We purchased apples for resale on our farm," says Alice, explaining that they had no apples of their own to sell until the trees matured. "We wanted to make sure that by the time our trees were producing fruit, we would plenty of customers to buy them." The McDougalls advertised in local newspapers, erected signs along the highway, built a retail storefront and "grossed $500 during our first year in business," Alice says with a chuckle. Net income was negative and remained so for the first three years.

Gradually, as the McDougalls' customer list grew, Gary and Alice began turning a profit. But it wasn't until the early 1990s that business really took off. "We took a big risk back in 1991," says Gary, "when we planted 200 Honeycrisp trees." The Honeycrisp variety was a new release that year from the University of Minnesota and the McDougalls were one of the first growers in the area to plant it. "Honeycrisp made our business," says Gary. "All of a sudden people wanted Honeycrisp and we were one of the few who had any – it was like a garage sale. People lined up outside our store before we opened. They were waiting to buy Honeycrisp." It was during these initial "Honeycrisp years" that Gary and Alice built their reputation as a high quality, friendly supplier. They now market 13 varieties of apples and have more than 2,500 households on their mailing list – most of whom visit the orchard at least once during picking season.

In addition to marketing first, second and utility-grade apples, Gary and Alice offer U-Pick pumpkins and squash, potted chrysanthemums, apple-inspired foods (the apple brats and apple cider doughnuts are not to be missed), frozen apple pies, cider, other locally produced foods, apple peelers, and agra-entertainment. Agra-entertainment, Gary explains, means providing visitors with activities you only find in the country: tractor rides, chickens and goats to feed, cows to milk, and a full-fledged playland for young visitors. Originally, "we hadn't planned on offering U-Pick activities or the agra-entertainment," Alice says. When asked about the shift in plans, Alice answered "competition." There are four other apple orchards located within two miles of Apple Junction. Most of these orchards offer U-Pick activities.

Being a U-Pick manager requires flexibility. "It's hard to have people go out into your orchard; you can count on a fair amount of waste and some damage to trees," Gary warns. His advice for others considering U-Pick: plant dwarf variety trees. Because the dwarf trees grow to only (number) feet tall, most pickers can reach the apples without having to climb the trees. "That way, you don't have as much damage to the trees."

An activity unique to Apple Junction is the educational tours offered by Gary and Alice. "We're retired teaches," says Alice, "So we always try to teach the kids something during their visit to the Orchard." Younger children (pre-K) are taught about nutrition and given the chance to "taste-test" different varieties. Older kids (K-2) are shown around the orchard, taught about pollination, photosynthesis, and the "proper way to pick an apple." All the kids go home with a

pumpkin, apple and coloring book to remember their visit. "Our tours are very popular with teachers," says Alice.

Although most of their customers hear about Apple Junction word-of-mouth, the McDougalls budget almost $5,000 for marketing expenses (not including labor) and spend a "considerable amount of time" getting things just right. Alice updates the mailing list database, notifies newspapers to arrange paid advertisements, updates signage, writes the newsletter, and coordinates mailings. The Apple Junction newsletter includes information about variety and availability, picking hours, a map to the orchard, tours, coupons, and of course, a telephone number for the store. Customers include families, school children and neighbors who come to pick their own or who simply dash in to grab a half-peck of fresh, Honeycrisp.

Risk Management

Like most farmers, Gary and Alice worry about the weather. "I worry about hail more than anything else," says Gary. "Thirty seconds of hail can wipe us out. And it has happened a couple of times."

The McDougalls monitor the weather regularly and limit their risk through the use of Federal Crop Insurance for apples and NAP for pumpkins. In addition to crop insurance, they hold a whole farm insurance along with a liability rider to protect themselves financially should visitors become injured while at the orchard.

Gary and Alice use computer software to help with recordkeeping and to produce W-2 forms required for each of their employees. These forms, along with Workers Compensation Insurance and social security payments are submitted for all employees.

Words of Advice

Gary and Alice have successfully grown their business through reinvestment. During their first ten years in business, when they still worked full-time off the farm as teachers, Gary and Alice were able to reinvest their income from Apple Junction back into the business. Today, they say, it would be hard to get started without some off-farm income because the investments required for trees, irrigation, and equipment. Their advice to others: choose a good location for trees, know your markets, and take it slow. "You don't really learn about a business until you get your hands dirty," says Gary. "By taking it slow, you can learn as you grow."

Gary McDougall in his apple orchard

HARVESTING AND STORING

In this section, the questions answered are:

1. Why should I care about storage conditions?

2. What do I need to know before I harvest my produce?

3. When do I harvest my fruits and vegetables?

4. How should I handle my produce?

5. Why should I store my produce right away?

6. How do I package my produce?

7. What if I can't afford refrigerated storage?

1. Why should I care about storage conditions?

Because...

fruits & vegetables are still alive after you harvest them.

They...

breathe	and produce carbon dioxide, as we do.
produce other gases	such as ethylene, which speeds up tomato ripening, makes leaves fall off greens, turns leaves yellow, makes carrots bitter, makes asparagus tough.
grow	examples: potatoes, onions, and garlic will sprout

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Note: The rate of dry weight loss is directly related to a fruit or vegetable's respiration rate. The faster a fruit or vegetable respires (breathes), the faster it dies.

The list below groups some fruits and vegetables by their respiration rates.

very high	asparagus, mushrooms, parsley, peas, spinach, sweet corn
high	broccoli, Brussels sprouts, carrots with tops, cauliflower, green onions, lettuce, radishes with tops
moderate	blueberries, cabbage, carrots without tops, cucumbers, muskmelons, radishes without tops, summer squash, tomatoes
low	apples, beets, celery, garlic, onions, potatoes

2. What do I need to know before I harvest my produce?

WHAT FRUITS AND VEGETABLES KEEP RIPENING AFTER HARVEST?

These keep ripening: sweet peppers, plums, and tomatoes

These stop ripening: apples, berries, beans, broccoli, cabbages, carrots, cauliflower, corn, leafy greens, melons, onions, potatoes, and pumpkins

WILL I NEED TO WASH, TRIM, GRADE, WEIGH, COUNT, AND PACKAGE MY CROP?

Almost every fruit and vegetable needs to be washed, graded, and packed.

WILL I NEED TO STORE MY PRODUCT?

You will, if your market may not be ready when your produce is.

Examples:

Potatoes are harvested in June to September, sold from June to next May.
If you can't sell it all just after you harvest it, you might need storage.
You might want to harvest produce the night before you sell it but nights are too warm to let them sit outside.

WHAT KIND OF QUALITY DO MY BUYERS WANT?

Pick a type of quality you want you want to be known for, and stick with it.

If your market is #1 choice, don't sell it for less than it's worth.
Don't undercut your market and yourself.

If you want to be known for low prices, sell #2s or 3s.

Ask your buyers what they want.

Some people want green tomatoes, but some want red ones.

Some people want small apples for their children, but some want big apples.

Some people want melons they can store, but some want juicy ones they can eat right away.

3. When should I harvest my fruits and vegetables?

When you harvest depends on what your buyer ~ants. Some buyers won't know what good quality is and will want you to know. The table below lists the desirable qualities for some produce.

CROP	DESIRABLE HARVEST QUALITY
asparagus	spears tender, 6-9 in. long
basil	leaves tender, fresh
beans, snap & pole	seeds immature, pods blemish-free
beets, without tops	firm red bulbs, 1.5 - 3 inches in diameter
broccoli	tight, green flower buds
cabbage	firm, compact heads
carrots, mature without tops	crisp, sweet, deep orange roots
cauliflower	white, compact curds
corn, sweet	plump, tender, milky kernels
cucumbers	crisp & green; 6 in. long for slicing
muskmelon, full slip	breaks off at blossom-end easily from vine, netting even, skin tan, fruit firm
onions, dry	tight necks, dry scales, firm bulb
peppers, sweet	crisp, firm fruit
pumpkins	hard shells, heavy fruit
radishes, without tops	firm, bright red roots, up to 1 1/4 in. diam.
tomatoes, green	solid, light green fruit with mature seeds and jellied locules
pink or red, firm ripe	solid, uniformly pink or red fruit

4. How should I handle my produce?

GENTLY!!!

when harvesting	trim fingernails remove jewelry wear gloves so you don't scratch your produce keep harvesting tools (pruning shears, clippers, or knives) sharp (so that produce packed next to each other don't damage each other)
when packing	try to pack in the field (less handling) cut and put product directly into selling containers put small containers into a larger box or onto a movable cart shade harvested produce
if shed packing	put produce into small baskets, bags, buckets, or plastic containers first transfer produce into larger bins try not to bounce the produce put cardboard liners inside large bins to soften the impact of the drop use canvas curtains to slow product drop into larger bins
use a water wash	if your produce can withstand water to transfer from bin to conveyer belt and packing line
when sorting	get rid of decayed produce to keep it from spreading disease

5. Why should I store my produce right away?

The faster fruit and vegetables respire, the faster they fall apart

cooling	slows respiration slows deterioration

Example: in I day, com stored at

room temperature (70 F)	loses 50% (half) of its sugars to starch
low temperature (32 F)	loses 5% of its sugars to starch

> **Note:** basil, beans, cucumbers, melons, tomatoes, peppers, and pumpkins, are sensitive to cold, and should not be refrigerated.

high humidity	slows shrinkage

> **Note:** onions, potatoes, and winter squash, need to stay drier or they will develop diseases and decay.

condensation	encourages disease

You should know the proper storage conditions for your products (see the appendix bulletin "Produce Handling for Direct Marketing").

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precooling cools faster

precooling method	**produce precooled this way**
dunk or spray produce with clean, 40 F water	asparagus celery greens (NOT cabbage) spinach
cover with ice	beets carrots radishes turnips
force cold, humid air past	berries cauliflower herbs melons peppers

6. How do I package my produce?

WHAT IS GOOD QUALITY PACKAGING?

Good packaging should:

protect produce	
keep produce from rolling around or knocking into each other	
be strong	Use cardboard triangles in box comers.
allow air circulation	Look for holes that are 5% of box side area.
be easy to work with	Use stacking tabs on boxes.
hold together if wet	Use waxed cartons.

WHAT HARM CAN PACKAGING DO?

Packaging can...

be a vapor barrier and prevent air circulation or
raise the humidity in the container and encourage disease problems.

WHAT PACKAGING DO I USE FOR MY CROP?

Use...	for...
burlap bags	onions, potatoes
cardboard boxes	most anything
plastic trays	berries
waxed boxes	anything that will get wet, like broccoli
wooden crates	asparagus, sweet com, winter squash
woven bags	onions, potatoes

7. What if I can't afford refrigerated storage?

Use.....

underground storage	Use this for potatoes, onions, rutabagas, parsnips, or turnips.
a separate building	Choose a building shaded by trees or other buildings. Paint the outside white or silver to reflect sunlight. Paint the roof white or silver to reflect sunlight. Put evaporative cooler at the top of the building. Put vents at the bottom of the walls that can be opened at night and closed during the day. Put an exhaust fan at the top of building for air movement.
old refrigerated trailers or milk trucks	

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At the market or your stand	shade produce; spray water on produce; and ice beets, carrots, radishes, and turnips.

FARM PROFILE

Sandra Jean's: Guaranteeing Freshness for Local Gourmet Chefs

Sandra and Jim Anderson raise organic herbs, vegetables and flowers on 3 acres in South Haven, Minnesota. They market produce to two family-owned restaurants in Minneapolis and St. Paul with whom Sandra Jean's has a well-deserved reputation for quality and reliability. Seasonal garden income supplements part-time income earned off the farm year-round.

Business Start-Up

The Anderson's purchased 15 acres of wooded and rocky land 1992. "We started with nothing," says Sandra describing their land. "Basically, we bought a house in the woods." With the modest goal of feeding themselves and an idea of generating supplemental income from produce sales, Sandra and Jim cleared a small area of land near the house to plant an herb garden and began building the soil using composted manure and bedding from their four horses, free-ranging chickens, mulch and crop rotation.

That same year Sandra landed her first restaurant account for fresh vegetables. "It happened by accident," Sandra says, explaining that she had been tending plants for Plantscapes (an interiorscape company) in the warehouse district lobby that houses Café Brenda. "A 2-year old girl tumbled by and bumped into my watering tank," says Sandra. "Out of concern, her mother asked if there were any chemicals in the water. I said that I'd never use any chemicals on plants, there is no need, not in my job, not in my gardens," Sandra recalls. The little girl's mother was Brenda Langton – owner of Café Brenda. Langton, a strong supporter of organic agriculture, invited Sandra to supply the restaurant with fresh, organic produce for the upcoming season. "That opportunity was all the spark we needed," says Sandra. "Brenda's offer motivated us to transform rough ground into fertile, productive garden beds."

Sandra and Jim knew they could not make the transition to commercial production without serious investments of time, labor and money. Jim quit his job to construct a modest but highly functional 20'x26' greenhouse and to prepare garden beds. Jim designed the greenhouse and built it from a combination of new and recycled materials. He used insulated Poly-Gal panels for the greenhouse roof and for south and west facing walls. Several recycled windows were installed along the east wall. A large wood burning stove was put in place to heat the greenhouse and to make use of fallen trees on the property. Sandra kept her day job with the interiorscape company and began working in the greenhouse at night and on weekends.

The Andersons started thousands of seedlings indoors that first spring. Some seedlings were transplanted to the gardens, but the majority of seedlings were sold at the farm via word-of-mouth to friends and family. "The seedling business took on a life of its own," Sandra says. "Within the first two years, we had 70 seedling customers whom became regular visitors each spring."

When it came time to prepare the garden beds "We first started with what meager tools we could afford: a shovel and wheelbarrow," explains Sandra. "Then with the assistance of a monstrous old 1958 International tractor Jim was able to work beds more effectively."

Sandra and Jim harvested “precious little” garden produce that first year. “We had ½ pound amounts of chives, basil, and a few other herbs and vegetables,” recalls Sandra. “It took a couple of years before we were able to deliver anything substantial [to Café Brenda].” Despite their small harvests, Sandra kept in touch with Langton. Regular communication and weekly deliveries helped Sandra build trust with her buyer and “get a feel for what she was looking for.”

By year three, Sandra and Jim were able to offer an assortment of common herbs and vegetables such as tomatoes, several kinds of beans, winter squash, and summer squash. At the same time, Sandra and Jim continued to market surplus seedlings at the farm. After ten years in business the Anderson’s had to make some critical decisions about their future. Both enterprises – restaurant produce sales and greenhouse seedling sales – wanted to grow. "We couldn’t maintain them both," recalls Sandra. "Since I wanted to keep my off-farm job we had to choose." For them, the choice was clear. Sandra and Jim’s primary interests are in actively gardening, tending their animals and working the land. "With the seedling enterprise, we were spending more time marketing to individual customers than working the gardens," says Sandra, explaining that there was constant “traffic” at the farm. By comparison, restaurant sales required only a weekly visit or phone call. Sandra and Jim chose to discontinue seedling sales and expand their fresh produce enterprise by marketing to two additional, local restaurants.

Marketing

Since 2002, the Andersons have begun supplying Ristorante Luci and Luci Ancora in St. Paul. Luci’s prepares authentic Italian dishes, always striving to utilize as much locally-grown in-season items as they can secure. "They genuinely appreciate the freshest basil, Italian flat-leaf parsley, chives, peppers, and above all, as many tomatoes as we can deliver," says Sandra. "Luci’s, like Café Brenda, are wonderfully flexible with what is available and adjust their menu to prepare for their customers the freshest in-season dishes."

Café Brenda is still a weekly customer. Café Brenda chefs utilize a wide assortment of herbs and vegetables as they come into season – everything from arugula and kale to winter squash and zucchini. And then there are the fresh cut flowers. "Sandra’s flowers are absolutely wonderful," says Café Brenda’s owner Brenda Langton. "She’s brought us amazing Zinnias, wildflowers, assorted herbs, and even blackberry cuttings for every table in the restaurant. They make us smile."

All restaurant produce is harvested, packaged, and delivered within 24 hours of harvest. Sandra delivers to restaurants weekly during the early spring and late fall. Deliveries double during peak harvest months. She packs the produce in 32-quart plastic bins. The bins are dropped off full at the restaurants in exchange for empty ones from the previous delivery. "We rotate. The restaurants return washed empty bins at each weeks delivery," Sandra says, "which allows for efficiency in delivery time, and keeping refuse generated by packaging to a minimum."

Asked about what’s most important in keeping restaurant buyers happy, Sandra replies that dependability, communication and quality are critical. "You have to have reliable transportation and a back-up if problems arise," Sandra explains. "Chefs are depending on you to get the produce there. They are counting on you to always deliver on-time fresh produce. They expect it, so they can deliver to their patrons, who know they can expect it. We all strive to provide the very best."

Regular communication is equally important for the Anderson's business. "We talk weekly from April through November," says Sandra. At delivery each week the restaurants are given a "forecast" of what will be available in the coming weeks. "They need to know in advance what I can bring to them the next week so they can plan their menus," Sandra explains. "This communication is mutually beneficial, to me as a grower, to the chefs in their planning, and ultimately benefits those who enjoy the food." In addition to timely deliveries and regular communication, Sandra supplies only the highest quality produce. "As I harvest, I keep in mind what I would like to be offered if I were the buyer," says Sandra. It's for this reason that Sandra and Jim don't intend to expand the business beyond what they can manage alone. "I couldn't hire anyone else to do the harvesting and packing because I want to know exactly what goes to my buyers." For the restaurants, she says "only the best" while Sandra and Jim enjoy the seconds. "Our animals consume all the rest. The chickens turn out the best eggs this way. Nothing ever goes unused," Sandra says.

Risk Management

Like many organic growers, Sandra's risk management strategy revolves around diversification. By growing a diversity of crops and more than is necessary, weather-related problems and garden-raiding creatures become tolerable. "Extra produce provides back-up protection in the marketplace," Sandra says, explaining "There will always be some crops that do better or worse than others … If one crop fails due to weather another crop will benefit from it. There's always a supply of produce, exactly what that will be depends on the [weather] conditions. In this business, diversity and flexibility are critical."

Labor and Production Management

The Andersons' growing season begins in late February. The first month requires 1-2 hours/day starting seeds in the greenhouse, preparing the right mix of soil in bins, filling seedling trays and planting about 12,000 individual seeds. Utilizing the greenhouse and an unheated 50'x14' plastic covered hoop house they are able to provide restaurants with greens and some herbs very early in the season. By late March when both the greenhouse and hoop house spill over with tender young seedlings, Sandra spends approximately 4-5 hours/day watering, and transplanting them to larger pots. Once the soil warms outside in early April, Jim is daily hard at work preparing the soil in each bed. He now uses a Cub Cadet tractor purchased in 2001. The new tractor has "been key" to boosting production. "The Cadet has allowed us to accelerate the composting process, develop the beds, and turn out much more produce," says Sandra. "We've created the soil from the ground up. A decade in the making."

After beds have been prepared, Sandra lays soaker hoses and begins transplanting individual seedlings. When laying out beds, Sandra focuses on crop rotation and companion planting to maximize space and to limit disease and pest problems. Transplanting is spread out over several months as a way to distribute the workload and the harvest. After seedlings are in the ground, row covers blanket sensitive crops for protection from weather extremes, insects, and their sometimes garden-raiding free-range chickens. The soaker hoses, supplied by well water, provide the most effective watering method in otherwise dry conditions. "We couldn't produce such high quality, clean produce without soaker hoses and row covers," Sandra says.

Come June, ceaseless summer weeding begins. "Because we garden organically and are surrounded by native vegetation, weeding is a constant process," Sandra says. "The wild plants play host for bugs and wildlife that might otherwise be tempted to invade our gardens, so the woodland and the gardens mutually benefit." Surrounding native woodland provides habitat for the wild birds to help with bug control, Sandra explains. "We don't seek to eliminate wild plant species from the gardens, only keep them in check." With plants well established, Sandra spends much of July hand picking any pests that might arrive, harvesting, and delivering early crops.

August and September mark heavy harvest time. "You have to love harvest and be motivated to get up at or even before dawn," says Sandra. "Morning is the best time for harvest because everything is rejuvenated and in its prime. You really do have to be a morning person to succeed in this business." Because freshness is critical to her success as a restaurant supplier, Sandra harvests everything within 24 hours of delivery. This includes flowers, which she cuts before dawn by yard light on the day of delivery. "Our neighbor who raises dairy cattle also rises before dawn – he noticed me in the flower bed at 5 AM and asked if I'm living in the garden," Sandra says with a genuine smile. "It does feel like that through August and September," when her time in the gardens doesn't end until dusk. "But it's that way by choice."

After several hard frosts in October, tasks turn to soaker hose removal, clearing and hauling spent plant material to the compost pile, adding new compost and tiling it into the beds in preparation for the next growing season. Every year the Andersons try to add new crops, incorporate new ideas, start a little earlier, and extend the growing season a little longer. "It is a constant learning and growing process," Sandra says reflecting on the past 12 years.

Words of Advice

As an experienced, small-scale grower and marketer, Sandra offers the following advice for new producers: "Know yourself and know what you enjoy. If you like working directly with customers, perhaps a garden center or the Farmer's Market may be good outlet for you. But if you prefer working alone, concentrate your efforts in finding a market in that direction. Be honest with yourself about your interests and priorities to avoid potentially costly mistakes before they happen." Though she direct markets and produces top quality organic produce, Sandra has found there's not a lot of money in this. "For us it's all about enjoying this quality of life, and earning some extra income, doing what we love."

Sandra harvesting arugula grown under row cover

MORE INFORMATION

The questions answered in this section are:

1. Where do I find more detailed information?

2. Where do I get supplies in Minnesota?

3. Who sells seed?

1. Where do I find more detailed information?

Get information from...

University of Minnesota Extension Service (MES) your local county office

specialists:
Entomology, call 612-624-3636
Horticultural Science, call 612-624-5300
Plant Pathology, call 612-625-8200
Soil Science, call 612-625-1244

bulletins: see www.extension.umn.edu

Commercial Vegetable Pest Management Production Guide, AG-BU-1880-S, updated annually
Nutrient Management for Commercial Fruit & Vegetable Crops in Minnesota, AG-BU-5886-F
Irrigation Scheduling - Checkbook Method, AG-FO-1322
Irrigation Water Management Considerations for Sandy Soil in Minnesota, AG-FO-3875

other written materials

Produce Handling for Direct Marketing, NRAES-51
Facilities for Roadside Markets, NRAES-52
Alternatives in Insect Management, NCR-40 1
*North Central Weed Control Guide for Vegetable Crops, N*CR-330

Books:

Knott's Handbook for Vegetable Growers, Wiley & Sons
USDA Handbook 66 *The Commercial Storage of Fruits, Vegetables, and Florist and Nursery Stocks*
Weeds of the North Central States, North Central Regional Research Publication 281

2. Where do I get supplies in Minnesota?

Listed below are some suppliers in Minnesota. No company is being endorsed to the exclusion of others. Mention of the suppliers is not intended to be an endorsement of their product or a preference over other suppliers. *Use of trade names and equipment does not constitute endorsement by University of Minnesota nor is a criticism applied of products not mentioned.*

Buildings
Winkelman Building Corp., 340 Highway 10 S, St. Cloud 56304, 320-253-2411
www.winkbuild.com

Containers
Agri-Pack, 870 Louisiana Ave., Minneapolis 55426, 800-818-2698
Berg Bag Co., 410 3rd Ave. N, Minneapolis 55401, 612-332-8845
Packaging Corp. of America, 7953 Beech St. NE, Fridley 55432, 763-784-8591
Stone Container, 3075 Long Lake Rd., Roseville 55113, 651-633-9801
Stone Container, 888 Industrial Blvd., Waconia 55387, 952-442-8670
Stone Container, 655 41 Ave. N, St. Cloud 56303, 320-252-3660
Ultra Pac Inc., 21925 Industrial Blvd., Rogers 55374, 800-999-9001 www.ultrapac.com

Equipment
AgTec, 5720 Smetana Dr., Suite 100, Minnetonka 55343, 800-704-4292
www.agtecsprayers.com
Carbonic Machines, Inc., 2900 5th Ave. S, Minneapolis 55408, 612-824-0745
Central Landscape Supply, 4026 Co. Rd. 74 S, St. Cloud 56301, 800-772-3888
DeVries Implement, RR 1, Box 184, Hollandale 56045, 507-889-8801
Greenberg Implement, 19745 Northern Blvd. NW, Anoka 55303, 763-441-3555
Ingleside Engineering & Construction, Inc., 4920 Hwy 55, Loretto 55357, 763-479-1869
Loftness Specialized Farm Equipment, 650 South Main St., PO Box 337, Hector 55342, 800-828-7624
The Hitching Post, 103 Concord Exchange N, South St. Paul 55075, 651-451-2521
www.hponline.com
Montana Tractors, 479-872-2020, www.montanatractors.com
Olson Power & Equipment Inc, 39500 14th Ave., North Branch 55056, 651-674-4494
Park Equipment Co., 20104 Hwy 10 W, Big Lake 55309, 763-263-6595
Tull Bearings Inc., 2530 2nd St. N, Minneapolis 55411, 612-588-1185
Uni-Hydro Inc., 310 East Gemini Ave., Cosmos 56228, 800-328-0036
www.unihydro.com
Woller Equipment, 4054 50th Ave., Bowles 56382, 320-573-2341

(small walk behind tractors---primarily Italian BCS models)
Arrow Mower, 141 Wentworth Ave. E, West St. Paul 55118, 651-455-5100
Beheng Implement, 204 Main Ave., Box 68, Carlos 56319, 320-852-7111
Hanson Mower, 214 Jackson St., Red Wing 55066, 651-388-2541
LTG Power Equipment, 4320 Centerville Rd., White Bear Lake 55127, 651-429-9297
Nicolai Repair, 23449 Lewiston Blvd., Hampton 55031, 651-437-4660
Thermo King, 2317 Consul St., Albert Lea 56007, 507-377-1631

Fruit Stock
La Crescent Orchard Supply, 101 Chestnut St. S, La Crescent 55947, 507-895-2103

Irrigation	Ag Resources, Inc. (drip tubing, sprinklers, soil sensors, and accessories) 35268 State Highway 34, Detroit Lakes 6501, 218-847-9351, dgbari@tekstar.com Jordan Seeds (drip tubing and accessories), 400 Upper Afton Rd., Woodbury, 55125, 651-738-3422 MIDC Enterprises (drip tubing and accessories) 1450 W. City Rd. C, Roseville 55113, 651 - 633-9416, http://www.midc-ent.com/
Insurance	Farm Bureau Insurance, 7984 University Ave. NE, Fridley 55432, 763-784-4443 Midland Insurance Group, 131 6th St. N, Winsted 55395, 320-485-3800
Mulch	Conwed Plastics, 2810 Weeks Ave. SE, Minneapolis 55414, 800-426-0149 www.conwedplastics.com Strout Plastics Inc, 9611 James Ave. S, Bloomington 55431, 800-328-4556
Pesticides	Cenex, 5500 Cenex Dr., Inver Grove Heights 55077, 651-306-6000 DuPont Agr. Products, 35274 551 Ave., Lafayette 56054, 507-228-8200
Refrigeration	St. Cloud Refrigeration, 604 Lincoln Ave. NE, St. Cloud 56304, 320-251-6861
Seeds	Green Barn Seed Co., 18855 Park Ave., Deephaven 55391, 951-476-0324 Hennepin Co-operative Seed Exchange, Inc, 5135 Oak St., Maple Plain 55359, 763-479-2123 www.hennepincoop.com Jordan Seeds, 6400 Upper Afton Rd., Woodbury 55125, 651-738-3422 www.jordanseeds.com Tessman Seed Inc., 1300 Sylvan St., St. Paul 55117, 651-487-3850
Supplies	JR Johnson Supply Inc., 2582 Long Lake Rd., Roseville 55113, 651-636-1330 www.jrjohnson.com

Irrigation Suppliers Outside Minnesota

TRICKL-EEZ Company (drip tubing, sprinklers, soil sensors, and accessories)
4266 Hollywood Rd, Saint Joseph, MI 49085, 269-429-8200, http://www.trickl-eez.com

Berry Hill Irrigation (drip tubing, soil sensors, accessories)
3744 Highway 58, Buffalo Junction, VA 24529, 1-800-345-3747 http://www.berryhilldrip.com

Submatic Irrigation Systems (drip tubing and accessories)
P.O. Box 3965,,Lubbock, TX 79452,1-800-692-4100, http://www.submatic.com/

GEMPLER'S (soil probe, tensiometer, soil sensors and accessories)
P.O. Box 44993, Madison, WI 53744-4993, 1-800-382-8473, http://www.gemplers.com/

Irrometer Company (soil sensors and accessories)
P.O. Box 2424, Riverside, CA 92516, 951-689-1701, http://www.irrometer.com

M. K. Hansen Company (soil moisture data monitor - logger and soil water sensors)
2216 Fancher Boulevard, East Wenatchee, WA 98802, 509-884-1396, http://www.mkhansen.com/

Spectrum Technologies, Inc (tensiometer, soil sensors, data monitor and accessories)
23839 W. Andrew Rd. , Plainfield, IL 60544, 800-248-8873, http://www.specmeters.com/

3. Who sells seed?

The following is a list of seed producers m the United States and Canada. See also the list of Minnesota suppliers

Asgrow Seed Co., Kalamazoo, MI 49001
Abbott and Cobb, Inc., Box 307, Feasterville, PA 19047
Agway, Inc., PO Box 1333, Syracuse, NY 13201
American Sunmelon, PO Box 153, Hinton, OK 73047
Aristogenes, Inc., 23723 Fargo Rd., Parma, ID 83660
Agri Seed & Chem. Co., 850 Dryden Rd., Metamore, MI 48455
American Takii Inc., 301 Natividad Rd., Salinas, CA 93906
George 1. Ball, Inc., W. Chicago, II.., 60185
Bakker Bros. of Idaho, Inc., PO Box 1964, Twin Falls, ID 83303
Baer's Best Seed, 154 Green St., Reading, MA 01867
Brinker-Orsetti Seed Co., Inc., 771-A Freedom Blvd., Watsonville, CA 95076 Burpee Vegetables, 622 Town Rd., W Chicago, II.., 60185-2698
Bruinsma Seeds b.v., PO Box 1463, High River, Alberta, Canada TOL 1BO Bodger Seed Ltd., 1800 N Tyler Ave., S El Monte, CA 91733
Castle, Inc. 190 Mast St., Morgan Hill, CA 95037
Country Garden, PO Box 3539, Oakland, CA 94609
Alf Christianson, PO Box 98, Mt. Vernon, WA 98273
Clause Semences Professionnelles, 100 Breen Rd., San Juan Bautista, CA 95045 The Cook's Garden, PO Box 535, Londonderry, VT 05148
Crookham Co., PO Box 520, Caldwell, ID 83605
Daehnfeldt Inc., PO Box 947, Albany, OR 97321
Denholm Seeds, PO Box 1150, Lompoc, CA 93438-1150
DeRuiter Seeds, Inc., PO Box 20228, Columbus, OH 43320
Ferry-Morse Seed Co., PO Box 1010, San Juan Bautista, CA 94045
German Seeds, Inc., PO Box 398, Smethport, PA 16749-9990
Gloeckner, 15 E 26thSt., New York, NY 10010
Goldsmith Seeds, Inc., 2280 Hecker Pass Hwy, PO Box 1349, Gilroy, CA 95020 G.S. Grimes Seeds, 201 W Mam St., Smethport, PA 16749
Gurney's Seed & Nursery Co., 110 Capital St., Yankton, SD 57079
Harris Seeds, 60 Saginaw Dr., PO Box 22960, Rochester, NY 14692-2960 Hollar & Co., Inc., PO Box 106, Rocky Ford, CO 81067
Harris Moran Seed Co., 60-A Saginaw Dr., Rochester, NY 14624
Holmes Seed Co., 2125 46th St. NW, Canton, OH 44709
Johnny's Selected Seeds, Foss Hill Rd., Albion, ME 04910-9731
Krummrey & Sons, Inc., PO Box 158, Stockbridge, MI 49285
Liberty Seed, PO Box 806, New Philadelphia, OH 44663
Mollema & Sons, Inc., Grand Rapids, MI 49507
MarketMore, Inc., 4305 32nd St. W, Bradenton, FL 34205
Martin Rispens & Sons, Inc. 3332 Ridge Rd., PO Box 5, Lansing, II.., 60438

Musser Seed Co., Inc., Twin Falls, ill 83301
Neuman Seed Co., 202 E Main St., PO Box 1530, El Centro, CA 92244 L.L. Olds Seed Co., PO Box 7790, Madison, WI 53707-7790
Park Seed Co., PO Box 31, Greenwood, SC 29646
Peter-Edward Seed Co., Inc., 302 S Center St., Eustis, FL 32726
Pure Line Seeds Inc., PO Box 8866, Moscow, ill
Pan American Seed Co., PO Box 438, W. Chicago, IL 60185
Petoseed Co., Inc., PO Box 4206, Saticoy, CA 93007-4206
Reed's Seeds, RR 2, Virgil Rd., S. Cortland, NY 13045
Rogers Northrup King, PO Box 4727, Boise, ill 83711-0727
Royal Sluis, 1293 Harkins Rd., Salinas, CA 93901
Rupp Seeds, Inc., 5-17919-B, Wauseon, OH 43567
Sluis & Groot, 124A Griffin St., Salinas, CA 93901
Siegers Seed Co., 8265 Felch St., Zeeland, MI 49464-9503
Sakata Seed America, Inc.,. San Francisco, CA 94083
Seeds of Change, PO Box 15700, Santa Fe, NM 87506-5700
Shamrock Seed Co, Inc., PO Box 410, Churchville, NY 14428
Sun Seeds, Inc., PO Box 315, Nampa, ill 83657
Stokes Seeds, Inc., 737 Main St., PO Box 548, Buffalo, NY 14240 Seedway, Inc., PO Box 1333, Syracuse, NY 13201
Twilley Seeds Co., Inc., PO Box 65, Trevose, PA 19047
Vesey's Seed Ltd., York, Prince Edward Island, Canada
Vaughan's Seed Co., 5300 Katrine Ave., Downers Grove, IL 6051504095 VTR Seeds, PO Box 2392, Hollister, CA 95024
Willhite Seed Co., PO Box 23, Poolville, TX 76076

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