



The evidence is clear. Consumers are demanding more and more healthy alternatives in the supermarket. Witness the explosive growth in the organic foods sector, one of the fastest growing segments of the U.S. food industry. And that demand is not confined to the aisles of up-market health food emporiums. Natural foods are big business.

As you know, your growth and your success are due, in part, to how well you anticipate market demand and segmentation; it's a challenge you grapple with every day. We can help. The American Humane Association (AHA) and its affiliate nonprofit Farm Animal Services (FAS) has instituted an exciting program that will help you differentiate your product and further establish yourself as a leader in your industry:

The Free Farmed Program.



ing Edge

ed farm
next
in the food
w humanely
producing
Increasingly,
sured that the
ultry they're
d under
they are
ed be for

distinguished
tion found that
l pay 5% more
ducts labeled as
over, a similar
mid-1990s
ained rapid
d market
ster of 4,000
nd processors.

That translates to 19 million-plus farm animals in the U.K. benefiting from improved standards.

The Free Farmed Program is dedicated to using the marketplace to improve the lives of farm animals. When you become a participant in the program, you're telling consumers that you are compassionate and caring, a message they want to hear . . . from you, backed by a credible, independent body.

Why the American Humane Association?

The American Humane Association is the oldest, most prestigious national humane organization in the United States. Founded in 1877, we are the only national charity dedicated to protecting both children and animals.

Over those many decades, we have developed considerable experience and expertise working with both industry and government to improve the lives of animals. Importantly, we understand the real-world, practical concerns and considerations you face as a business person. And, we work hard to meet your needs, as well as the needs of the animals. Our goal is to work with you to improve the lives of farm animals and, at the same time, improve your bottom line.

How? In close collaboration with veterinarians, animal scientists, and producers like you, the AHA has set standards of practice that guide the humane treatment of farm animals. FAS administers those standards and certifies producers, processors, and related product handlers that meet AHA's guidelines. Certification takes the form of a Free Farmed label that program participants may use on their farm animal products—a label that tells consumers that this product was reared, cared for, and slaughtered in the most humane way possible. The Free Farmed Program certification process is verified by the U.S. Department of Agriculture/Agricultural Marketing Service.

In addition, we work hard to

publicize the Free Farmed Program so that consumers will look for the label and use it to guide their purchasing decisions in the grocery aisle.

Free Farmed at a Glance

The Free Farmed labeling program establishes a traceable supply chain of inspected and accredited producers and processors, backed by a trusted organization, empowered by a message that has universal appeal. In short, it is a program built upon credibility and consumer confidence.

Free Farmed certification currently encompasses producers. Standards are being developed for processors, packers, slaughterhouses, and trucking companies—in short, any industry segment handling farm animals. In order to be certified Free Farmed, they must have passed inspection by our trained personnel, and to stay certified, pass periodic follow-up inspections. Free Farmed status is lost when the animals and their products fall outside the certified chain of supply.



Tapping a Win-Win Market

The Free Farmed Program is a value-added proposition. Consider this: In the last five years, sales of organic foods (most closely related in public perception to Free Farmed foods) have gone from \$3 billion per year to \$7 billion. A 1998 survey by Lake, Sossin, Snell, Perry and Associates reports that 31% of food purchasers bought organic food at least once or twice a month. The consumer demand is there. The potential market is enormous.

This program is a way to establish yourself as an industry leader in this fast emerging market of health-conscious, conscientious consumers who want to buy your products and feel good about consuming them. Farm animals win. You win. Consumers win.

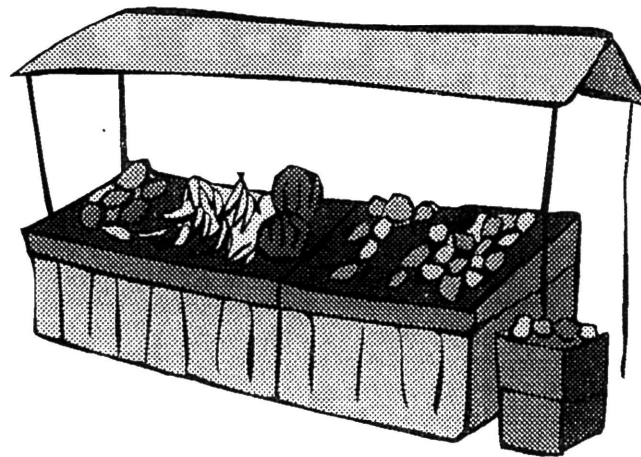


Additional Information

This overview of the Free Farmed Program is intended to acquaint you with the program's highlights. More detailed information about how you can become the newest member of the Free Farmed family is available from Farm Animal Services at 202.543.2335. Check our website at www.freefarmed.org. The more you learn, the more you'll understand why we say—

Free Farmed Foods:
*Good for Animals.
Good for Business.
Good for Everyone.*

Organic Herbs and Vegetables



In the Beginning. . .Was a Philosophy

- ★ *Organic Agriculture* is a production system based on healthy soils that are in chemical and biological balance. The system provides health for plants, animals, farm families and communities.



“ORGANIC”

The Legal Definition

Defining “Organic”

State and federal laws and rules define what can be labeled as
“organic”

USDA definition: The Organic Foods Production Act and the Rule

Organic Speak Just like any other industry, organics uses acronyms and abbreviations the titles of the many groups and regulations that are involved in certification and regulation.

Acronyms:

OFPA: Organic Foods Production Act
NOP: National Organic Program
NOSB: National Organic Standards Board
TAP: Technical Advisory Panel

Abbreviations:

National List: The list of approved synthetic and prohibited natural materials for organic production, as determined by NOSB
The Rule: The USDA Organic Standard
The Secretary: The US Secretary of Agriculture

Organic Regulations

Organic Foods Production Act

- Passed in 1990 as part of the Farm Bill
- Purpose: to establish a consistent national standard for what can be labeled “organic”
- Creates requirement, standards, practices and a list of allowed or prohibited materials for what can be labeled “organic”
- Establishes a civil penalty for misuse of the organic label
- Establishes a National Organic Standards Board
- Directs the Secretary to create an accreditation program for certifiers
- Directs the Secretary to establish an appeals procedure

Small-Scale Farming*

Efficiency of land, labor, and time; Appropriate Tools; and Enjoying the *Craft* of Farming
Wisconsin School for Beginning Market Gardeners

Guiding Quotes

"One farmer is only capable of managing 2.5 acres of intensive vegetables" —Eliot Coleman

"After 7 years of seeing our farm grow in size from 2 acres to 28, we realize that we were at our maximum profitability at 6-7 acres!" —farmer unknown

"Where you are spending the most time is probably where you need to spend money capitalizing your operation." —M. Rossete

"Expand your farm because it is profitable, not to make it profitable." —Bart Hall, ATTRA

"I've seen more than a few farmers fail due to "Shinny Paint Disease" —MN dairy farmer

Guiding Principles that Provide a Context for Decision Making

1. I want to farm for a lifetime.
2. I want farming to provide as great a percentage of my household income as it can.
3. How can we keep balance in our lives - children, church, recreation, and other interests.
4. Stay debt-free at all cost. Pay your debts with hard work, ingenuity and creativity.
5. Start small, be realistic, and enjoy the work.
6. How many people can we manage?

Standards to Judge the Potential Purchase of a Tool or Implement

Tools are not time-saving devices in and of themselves. They can only be part of an overall time management plan that is well thought-through.

- | | |
|-------------------------------------------------|-------------------------------------------------------------|
| 1. Does it fit my scale? | 5. Is it easy to use? Can others use it? |
| 2. What does it cost? What is its resale value? | 6. Is it sustainable? |
| 3. Can I repair it myself? | 7. Do you <u>need</u> it, or <u>want</u> it? |
| 4. Is it durable? | 8. Does it fit within the context of my over-all farm plan? |

Learn to weld! Create your own tools.

Sustainable market gardening is a constant exercise in trying to determine the relationship between human inputs and mechanical inputs. Are the tools you're using helping your efforts to become more sustainable?

"Small scale farming is like a puzzle! We each have only one piece to the puzzle. The challenge for us is how to learn from each other and put the pieces together." —Eliot Coleman

Farm Scale and Appropriate Tools

Wisconsin School for Beginning Market Gardeners

	START SMALL	BE REALISTIC	ENJOY THE WORK
	1-3 Acres	4-6 Acres	7-10 Acres
Seed starting	Purchase plants, ?	1000 sq ft hoophouse, \$1200+	2000 sq ft hoophouse, \$2500
	Small hoophouse, \$500-1500	Germination chamber, \$200	Germination chamber, \$200
	Cold frames, \$100-300	2 Cold frames, \$300 ea.	Cold frames, \$300 ea.
	Light units in house	Field tunnels, \$1200	Vacuum seeder, \$200
Power source	Walk behind Tiller	35-45 horsepower tractor	45-60 horsepower tractor
	\$2500 (new) \$500 (used)	(wide front, 3pt hitch, PTO, hydraulics, high clearance)	
		\$2000-5000	\$5000-10,000
Tillage, primary	Custom hire plowing, \$20/acre	2 Bottom plow, \$150	3 bottom plow, \$250
		2 Shank chisel, 1000	3 shank chisel, \$1500
		5 foot Digger, \$300	6 foot Digger, \$400
Tillage, seed bed	Walk behind tiller	Roterra/Spader, \$5000	Roterra/Spader, \$5000
Direct Seeding	Earthway, \$60 or Planet Jr., \$50	Stanhay Precision, \$1500	Nibex, \$2000
		Earthway gang seeder, \$300	Earthway gang seeder, \$300
		290 JD, \$200	490 JD, \$300
Transplanting	By hand with Dibble	Water wheel, \$300	1-row Mechanical, \$800
	Roller Drum	1, 2, 3 row	2-row Mechanical, \$1500
			3-row Water wheel, \$300
Irrigation	Hoses, \$100	4-5 Sprinkler lines, \$250 ea.	Multiple sprinkler lines
	Drip lines, T-tape, Emitters, \$500	Big Gun, \$2500	2 Big Guns, \$2500 ea.
	Wobbler sprinklers, \$500	Drip, \$500	Drip, \$1000
Cultivation	Hoes	2 Wheel hoes, \$500	
	(diamond, \$35; Stirrup, \$25; Collinear,	Cultivating tractor: Allis G or B, Farmall A, Hefty G	
	Wheel hoe, \$250	Knives (\$300) Sweeps (\$300) Basket weeder (\$750) Lely (\$1500) Lilliston (\$400)	
Spraying	Backpack sprayer, 5gal., \$125	Walkover sprayer, \$800	3-point Boom sprayer, \$1000
		2 Backpack sprayers, \$250	
Harvesting	Knives, crates, Digging fork, \$30	Potato Digger, \$250	Carrot Lifter, \$300
Carts	1-wheel Cart, \$300	Table Cart, \$400	Flat racks, \$250
	2-wheel Cart, \$300	3-4 Harvest Carts, \$300 ea.	Pallet boxes, \$?
Post-Harvest	Shade canopy, \$300	Roller conveyer, \$200	Greens spinner, \$500
	Tables, \$100 ea.	2-3 Tanks; Barrel washer, \$500	Pallet jack, \$300; Fork lift, \$750
	150 gal Tank, \$200	Permanent shelter, \$7500	Cold storage, \$2000 or more
	Buckets, Crates, Knives, \$300	Refrigeration, \$2000	
Cover Crop	6 foot Van Brunt, \$100	6 foot Van Brunt, \$100	Flail chopper, \$750
Management	Broadcast seeder, \$25	Brush hog, \$500	Rolling coulters, \$500
		Cultipacker, \$300	Brillion? \$3000-5000
Transportation	Existing car/light truck, \$2-3000	Truck (\$2500); Van (\$4000) or	1-ton Van, \$6000
(Deliveries)		Enclosed Trailer (\$2500)	Refrigerated panel van, \$7500
Labor	80% Farmer(s)	40% Farmer	25% Farmer
	20% Volunteers/interns/hired help	40% Interns (2) (200 total hrs/wk)	50% Interns (3)
		20% Volunteers or hired labor	25% Volunteers or hired labor
CSA Shares	25 to 75	100 to 150	175 to 250
	Rule of thumb: 20 to 25 CSA shares per acre of production with 15-20% additional marketing		
Other Marketing	Farmers mkt, restaurants, coops,	Limited wholesaling, larger stores	Wholesaling, you-pick, road side
	you-pick, small grocery stores	you-pick, restaurants	stands, larger stores, institutions
Other	Flat rack, \$250	Welder, \$100	Fax machine, \$?
		Tandem axle trailer, \$600	
		Manure spreader, \$800	

Equipping a Small Scale Farm: Setting Capitalization Priorities*

Wisconsin School For Beginning Market Gardeners

All decisions regarding equipment and facilities should be based on the scale you want your farm to be. Strategic investments not only make growing vegetables more enjoyable, they also can make you more efficient which leads to increased net earnings. While staying debt-free is wise, delaying key investments as production and marketing is expanded can result in a loss of product quality. For example: it can be relatively easy to expand in terms of planting at the beginning of the year. But, without a good post-harvest handling system (washing and storage facilities) it may be difficult to manage such expansion later in the season - not to mention the increased labor needed to pick larger plantings.

Beginning investments when farming or gardening on a small scale

Purchase transplants or grow under lights	Hoes \$50
Custom hire field work as needed	Backpack sprayer \$125
Small cold frame (12' x 25') \$250-500	Harvest knives, crates, etc. \$200
Used Tiller \$500	Garden cart \$100-200
Earthway seeder \$50-60	Shade canopy \$200-300
Garden hoses \$100	Wash tank \$200
Sprinklers \$100	Broadcast seeder \$25
T-tape and emitters \$100-200	Use existing car for deliveries
Wheel Hoe \$250	

As scale increases the following investments enter the picture

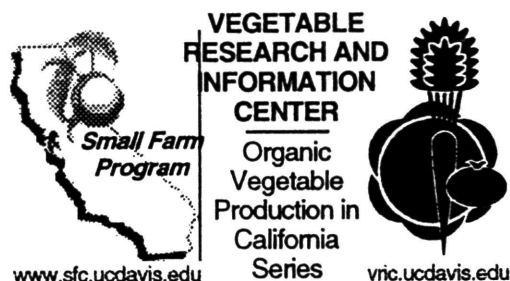
Small greenhouse \$1200-3000	Sprinkler lines \$250 each
Cold frames @ \$250 each	2 Wheel hoes @ \$250 each
35-45 horsepower tractor \$2500-3500	2 Harvest carts @ \$250 each
Tool bars, digger, shanks, welding \$750	Brush hog \$500
2 Bottom plow \$150	Used or homeade cooler unit \$500-1000
Water wheel planter \$300	

At even larger scales, consider:

2000 square foot greenhouse \$2500+	Harvest shed \$7500
45-50 horsepower tractor \$5000	Walk-in cooler \$2000
Lely Roter or Spader \$5000	Flail chopper, Field digger, transplanter, manure spreader, Flat racks, etc. \$10,000
Stanhay seeder \$1500	Cultivating tractor \$3000
4-6 Irrigation lines \$1500	Delivery van \$5000
Irrigation pump \$500-1000	
Pond for irrigation \$1500-3000	

*Prepared by Dan Guenthner, Common Harvest Farm and John Hendrickson, Center for Integrated Agricultural Systems, UW-Madison

INSECT PEST MANAGEMENT FOR ORGANIC CROPS



CALVIN FOUCHE, UC Cooperative Extension Farm Advisor, San Joaquin County; **MARK GASKELL**, UCCE Farm Advisor, Santa Barbara and San Luis Obispo Counties; **STEVEN T. KOIKE**, UCCE Farm Advisor, Monterey and Santa Cruz Counties; **JEFF MITCHELL**, UCCE Vegetable Crops Specialist, Kearney Agricultural Center, Parlier; and **RICHARD SMITH**, UCCE Farm Advisor, Monterey and Santa Cruz Counties

Specific information on organic vegetable production practices in California is scarce, and growers need sound information to guide their management decisions. The Organic Vegetable Production in California Series is made up of publications written by Farm Advisors and Specialists from the University of California's Division of Agriculture and Natural Resources. Each publication addresses a key aspect of organic production practices applicable to all vegetable crops.

Before planting a crop, an organic vegetable grower needs to understand the pests and beneficial organisms that usually occur in that crop and anticipate the pest problems that are likely to occur. Experienced growers act before problems reach devastating levels because they know that pests are more effectively controlled when their numbers are low. The major emphasis of insect pest management in organic vegetable production systems should be placed on the use of cultural and biological control methods.

By paying attention to crop rotations and crop residue incorporation, the grower can help prevent population buildup in many pest species. The practice of growing the same crop continuously, season after season, on the same piece of ground is an invitation to insect pests and diseases. In some locations, pest problems are so severe that it is not economically possible to grow certain crops organically using current technology. In areas of the San Joaquin Valley, for example, where lygus bugs migrate into fresh market bean fields, it is not possible to stop crop losses by using any of the available materials approved for organic vegetable growers. For the organic grower, the best solution to pest problems often will only come out of a thorough understanding of local conditions and a knowledge of what varieties or crops to grow and when to plant them in order to avoid the most severe problems. Good record keeping on pest problems—when they occur and what control strategies are effective—will help build a foundation for next year's pest control strategy.

MONITORING FOR PESTS AND BENEFICIALS

The correct identification of the pests and beneficials present in a crop is very important. Identification of the immature life stages such as eggs, nymphs, and larvae

will greatly aid the grower's efforts to prevent economic damage to the crop. Many of the key pests in vegetable crops are described in pest management manuals and literature available from the University of California's Division of Agriculture and Natural Resources (see Resources). An experienced pest control advisor can alert a grower to potential problems before any crop losses occur.

If pheromone traps are available for key pest species, they can help determine the timing of population cycles and predict local increases in pest activity. In some situations, pheromones can be used to confuse males and prevent them from mating, thus reducing next-generation pest populations and the feeding damage they would cause. Be careful, though, to recognize when biological control factors are beginning to influence the pest population. Often, growers are unaware that beneficial insects and microorganisms are working to control pests, and they end up treating crops when they do not need to. By understanding the life cycle and biology of both pests and beneficials, you can make the most of the insect community that lives in the crop field.

To follow the activity of pests and beneficials in the crop, it is important that the grower make regular weekly checks in the field with a hand lens, inspecting the underside of foliage for the first signs of insect activity. Many pest species are very small and so often go unnoticed until they have caused considerable damage. More frequent checks may be necessary during periods of rapid increase for pests such as spider mites. Using a sweep net in cover crops, field edges, and adjacent crops, you can check for insect activity and help determine which beneficials or pests may be developing nearby with the potential to move into the crop.

The grower must identify tolerable levels or action thresholds for the particular pest species and crop. If it

is a pest that feeds on the fruit or on a part of the vegetable that is sold, the tolerance for damage is generally lower. Pests feeding on portions of the plant that will not be sold, such as the leaves of a tomato plant, can often be tolerated at much higher levels.

CULTURAL CONTROL

You can coordinate the planting and harvesting dates to avoid certain pests that would otherwise build up in some crops. Sweet corn grown early in the summer, for instance, is subject to less danger of earworm damage than late-season corn. If aphid-transmitted virus diseases are a problem, successive plantings of the same crop will allow aphid populations to build up and damage late-season crops unless virus-resistant varieties are available. You may be able to reduce the spread of disease by planting later crops upwind of earlier-planted fields. In some areas, midsummer and late-season plantings must be located in isolated fields. Other pests such as lygus, flea beetles, squash bugs, and many caterpillar species can build up in early crops and cause extensive damage in later plantings unless they are controlled before they can mature and reproduce.

Vegetable growers need to provide optimum growing conditions for their crops. Many plants are able to withstand insect feeding if they are actively growing and are able to compensate for some loss of foliage and root tissues. Soil type and nutrient content can effect crop vigor. Poor water management (especially too little water) can predispose plants to certain pests such as spider mites. Cover crops planted prior to the main cash crop can improve soil fertility and provide a valuable source of organic matter. Proper rotation of pest-susceptible main crops with non-susceptible varieties and cover crops can keep pest numbers low. The incorporation of a grass species into a rotation is often recommended, as grasses tend to be resistant to most of the insect and disease pests of common cash crops.

Field borders or strips within the field that are planted to species and varieties different from the main crop can provide habitat for beneficial arthropods and can slow the spread of pest species in the field. Flowering plants along borders and edges of fields can provide habitat and food for beneficial insects. Research in Yolo County has shown that substantial numbers of beneficial insects can move up to 250 feet from hedgerows into adjacent vegetable fields. Weed management in borders can be a challenge, and the grower will need to check the borders to make sure that pest species are not building up there and migrating out into cropping areas.

Crops such as alfalfa that attract pests away from the main crop have been used in strawberries and cotton, and have potential for the organic vegetable grower. If the

alternate crop (or *trap crop*) is maintained in a vigorous state, the pest may never even leave the trap crop. If the pest population builds up and begins to leave the trap crop, the trap crop can be mowed or sprayed to prevent damage to the main crop. The trap crop can also serve as an additional reservoir of beneficial predators and parasites in the event the adjacent crop field has to be treated.

Many of the true bugs (such as squash bugs, lygus, and stink bugs) overwinter outside of the field, so efforts to control them can be directed toward their winter and early spring sites before they move into the crops for the growing season. Also check box piles, lumber, and storage buildings for over-wintering pest species.

MECHANICAL CONTROL

Soil tillage can destroy insects and expose them to birds and other predators (see UC ANR Publication 7248, *Soil Management and Soil Quality for Organic Crops*). It can also speed the breakdown of plant residues that harbor insects and plant pathogens. By either allowing the organic matter in a field to decompose completely before you plant the next crop or allowing a fallow period between crops, you can enhance control of cutworms, root maggots, and bulb mites.

Certain soil and nutrient conditions can be associated with pest problems. High organic matter content, for instance, can lead to an increase in problems with symphylans, springtails, cutworms, wireworms, and root maggots. Sandy soils will tend to support higher nematode and wireworm populations. Organic growers farming on lighter soils have to be more careful with crops such as tomatoes, cucumbers, and root crops such as carrots. Longer fallow periods or more frequent grass rotations are necessary to prevent a buildup of soil pests. You can help prevent damage by growing sensitive crops when soil conditions are not favorable to pests. Fall- and winter-planted vegetables may escape damage that would be severe for the same crops if they were planted in spring or summer. Mechanical control in the form of vacuuming and destroying lygus bugs in strawberries has proven effective when the program includes frequent passes through the fields during critical pest periods.

Pest barriers can be incorporated into high-value vegetable plantings. Floating row covers and plastic tunnels effectively reduce access by many pest species. Reflective mulches have been effective for prevention of early aphid infestations in row crops such as tomatoes, squash, and eggplant. Sticky barriers can be useful as monitoring devices, but they have seldom been effective in themselves for control of pest species.

BIOLOGICAL CONTROL

The organic farmer should strive to conserve the many naturally occurring beneficial organisms that are present in the crop. If it were not for the naturally occurring biological control factors, most crops would be inundated with dozens of pests. If you find it necessary to treat for a particular pest in order to prevent economic losses, choose a selective spray material and use only enough of it to keep damage levels within economically acceptable limits. Short-residual pesticides will allow beneficial insects and predator mites to return to the field and help control remaining or newly introduced pest species.

An organic farming system offers many opportunities for enhancing biological control factors. Since most organic farms apply little or no harsh pesticides, it is possible to build up large numbers of beneficial parasites and predators that help control pests in many crops. The introduction of biocontrol organisms to a field may be most cost effective when a grower is making the transition from conventional to organic production systems. Make sure that the introduced pest is well adapted to the particular climate or site and that it is the correct species for the pest that you wish to control. When purchasing biological control agents, buy from a reputable supplier. Multiple releases of the biological control agents may be required in order to bring pest populations to very low levels. Suppliers will often assist with suggestions for managing introduced biological control agents.

When pests such as aphids build to large populations, they will often be controlled by ladybird beetles, lacewings, syrphid flies, or wasp parasites. For many growers this control may come too late to prevent extensive damage to the crop. If alternate plants are allowed to support aphids in high numbers early in the season, the predators and parasites that develop on those aphids may later move into the crop. If the aphids are vectors of viral pathogens, it will only take a few of them to cause extensive losses. In this case, predators and parasites will not effectively prevent the spread of disease into or through the field.

Many caterpillar pests infest vegetable crops. *Trichogramma* wasps can be highly effective in preventing caterpillar damage. The wasps parasitize the eggs of pest species, killing the pests before any feeding injury can occur. When purchasing *Trichogramma* wasps, buy the species that is appropriate for the intended pest and make frequent releases of enough wasps to control the pest. In many situations, this will require multiple weekly releases of millions of wasps. When releasing live organisms, it often is wise practice to set some of them aside and check to make sure they are still viable

at the time of release. Heat, cold, time, and diseases all can affect the viability of biological control agents.

CHEMICAL CONTROL

A number of organically acceptable insecticides are available, and each may be useful to you in specific circumstances. For up-to-date information, see the UC IPM website listed in the Resources section at the end of this publication. If you do plan to use organically acceptable pesticides, several factors should be considered.

Low mammalian toxicity. The materials selected should not present a health risk to the applicator or the people who must work in the crop after application. Although most organically approved pesticides are relatively safe, their use does involve some risks. The highest level of risk is often present when the materials are in concentrate form and are being added to the spray tank. Materials such as sulfur can cause skin and eye irritation during application and for some time afterward. Some individuals may develop an allergic reaction to pesticides or the solvents used in the formulation process.

Minimal effect on beneficial organisms. While many selective pesticides are directly toxic only to pest species, their use can cause disruption to nontarget beneficial species by eliminating their insect hosts and thus starving the beneficial species or prompting them to migrate out of the field. This indirect reduction of beneficials may allow the remaining pest population to increase to higher levels if their reproductive potential exceeds that of the remaining beneficials.

Adequate coverage essential. Thorough coverage of the plant is important with almost all organically acceptable pesticides. For many pests, the young insect or mite can be found on the underside of the leaf surface and must have direct contact with the spray material for control to be achieved. In many cases, high volumes of water are necessary to get the pesticide to the target. As much as 100 or 200 gallons of water or more per acre may be required to achieve thorough coverage of the leaves of vegetable plants.

Often, the best sprayer nozzle configuration will direct the spray to the underside and interior of the plant, with as many as six nozzles for each row. Higher pressure at the nozzle tips will break the water up into smaller droplets, and often help the material reach the interior of the plant. The nozzle size should be matched to the application pressure to produce the desired droplet size for optimum coverage.

Many growers are finding that air blast and electrostatic sprayers can provide excellent coverage without requiring the high volumes of water needed by conven-

tional spray equipment. The initial cost for air-blast equipment is higher than for conventional sprayers, but the savings in time taken to refill the tank can allow a grower to treat more crops in a given period of time. Soil compaction can be reduced if less water is being carried across the field. Proper timing of the spray to intercept the pest in a susceptible stage is important no matter what equipment you use to deliver the product.

Many organically approved pesticides degrade rapidly in the environment. Control of a continuing pest problem may require repeated applications. Because insects can become resistant to pesticides that are used frequently, those pesticides will become less effective over time. This is not so common with short-residual pesticides as with materials that have a long residual activity. Pests are not likely to develop resistance to materials such as oils and soaps that use physical actions such as suffocation or physically dislodging the pest from the crop as their mechanism of control.

Here are some examples of pests that can be controlled by organically approved materials:

- Aphid populations can be reduced with oils, soaps and pyrethrum/rotenone combinations. If ants are protecting the aphids from predators and parasites, the best control is often achieved by controlling the ants and allowing biological control to resume in the crop. Ant colonies can be physically destroyed or treated with boric acid baits.
- Whitefly populations can be suppressed by multiple applications of soaps and oils. Since the pupal stage is resistant to control, it is important that you make at least two applications close enough together to prevent more pupal stages from occurring. Thorough coverage of the underside of the leaves is important, as this is where most of the whitefly nymphs will be feeding.
- Leafminer control may require several applications within a two-week period. Many of the pupae are in the soil and will not be controlled with short-residual materials. Sprays containing azadirachtin, pyrethrins, and rotenone will kill some of the adults and help to limit the population. Sprays for leafminers will slow the build-up of native wasp parasites.
- Leafhopper numbers can be reduced with applications of pyrethrins and rotenone if the nymphs come into contact with the materials. Adults and eggs that are inserted in the plant tissues will not be controlled very well with chemicals.
- If flea beetle numbers are high when young plants are in the cotyledon stage, you can reduce damage from adults by applying soaps and pyrethrin/rotenone combinations.
- Stinkbugs can be difficult to control, and only the first two instars are susceptible to soap sprays. If allowed to build up in the field to high levels, they cannot be controlled with organically approved chemical treatments.
- Russet mites can be controlled with sulfur sprays or dusts. Light mineral, vegetable-based, or neem seed oils can be effective against pest mites. Some damage to crop foliage or fruit can occur when you use oils. It is advisable to treat a test area first before applying the material to the whole field if you have not used the product before on that crop. Hot weather and higher oil concentrations can increase the toxic reaction in the plants.
- Worm pest control can be difficult in many crops. *Bacillus thuringiensis* (Bt) formulations are available that enable the organic grower to limit damage from worms. Smaller worms are controlled more easily by this method, and since the Bt must be ingested by the worm thorough coverage of all leaf surfaces is necessary. For best results, these materials should be applied early, as control will lag several days behind the application. Worms must be controlled before they enter into the fruits or go deep into foliage where they will not ingest the spray residues.

For each of the above pests and treatments, thorough coverage if necessary for effective control. The coverage obtained and the timing of the spray application can be more important than the choice of material. In many situations, a combination of materials will be more effective than a single product alone.

OTHER PUBLICATIONS IN THIS SERIES

Organic Certification, Farm Production Planning, and Marketing, UC ANR Publication 7247

Soil Management and Soil Quality for Organic Crops, UC ANR Publication 7248

Soil Fertility Management for Organic Crops, UC ANR Publication 7249

Weed Management for Organic Crops, UC ANR Publication 7250

Plant Disease Management for Organic Crops, UC ANR Publication 7252

RESOURCES

Beneficial Insects and Biological Control Agents

Cal/EPA, Department of Pesticide Regulation has the most complete and up-to-date resource list, available by phone or downloaded from their website. The title is *Suppliers of Beneficial Organisms in North America*, and the author is Charles Hunter
Phone: (916) 324-4100
Website: <http://www.cdpr.ca.gov/>

Equipment and Supplies

BioQuip Products, for field lenses and insect collecting, counting, and preserving supplies. Extensive list of books on insects
Phone: (310) 324-0620
E-mail: bioquip@aol.com

Gemplers, for insect monitoring tools, field lenses and safety equipment
Phone: 1-800-382-8473
Website: <http://www.gemplers.com>

Great Lakes IPM, for monitoring and field lenses
Phone: (517) 268-5693

Peaceful Valley Farm Supply, for insect monitoring tools, beneficial insects, biological control agents, floating row covers, and organically approved pesticides
Phone: 1-888-784-1722
Website: <http://www.groworganic.com>

Information

California Department of Pesticide Regulation
County Agricultural Commissioners

Local organic growers' association chapters

Local nurserys

Local UC Cooperative Extension Farm Advisors

Private pest control advisors (PCAs) and crop consultants

UC IPM website: <http://www.ipm.ucdavis.edu/>

UC Sustainable Agricultural Research and Education Program website: <http://www.sarep.ucdavis.edu/>

Publications

Long, R. 1998. Beneficial insects move from flowering plants to nearby crops. *California Agriculture Magazine*, September-October.

University of California Integrated Pest Management (IPM) manuals, including
Pests of the Garden and Small Farm,
UC ANR Publication 3332

Natural Enemies Handbook,
UC ANR Publication 3386

Integrated Pest Management for Tomatoes,
UC ANR Publication 3274

Integrated Pest management for Cole Crops and Lettuce,
UC ANR Publication 3307

Integrated Pest Management for Potatoes in the Western United States, UC ANR Publication 3316

An electronic version of this publication is available on the University of California ANR Communication Services website at <http://anrcatalog.ucdavis.edu>.

Publication 7251

© 2000 by the Regents of the University of California,
Division of Agriculture and Natural Resources. All rights reserved.

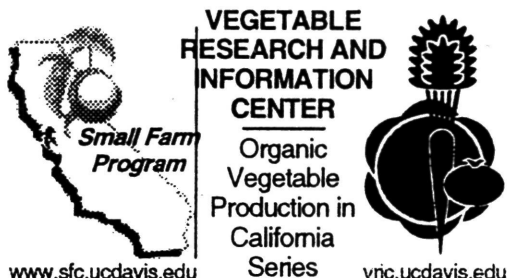
To simplify information, trade names of products have been used. No endorsement of named products is intended, nor is criticism implied of similar products that are not mentioned.

The University of California prohibits discrimination against or harassment of any person employed by or seeking employment with the University on the basis of race, color, national origin, religion, sex, physical or mental disability, medical condition (cancer-related or genetic characteristics), ancestry, marital status, age, sexual orientation, citizenship, or status as a covered veteran (special disabled veteran, Vietnam-era veteran or any other veteran who served on active duty during a war or in a campaign or expedition for which a campaign badge has been authorized).

University Policy is intended to be consistent with the provisions of applicable State and Federal laws.

Inquiries regarding the University's nondiscrimination policies may be directed to the Affirmative Action/Staff Personnel Services Director, University of California, Agriculture and Natural Resources, 1111 Franklin, 6th Floor, Oakland, CA 94607-5200 (510) 987-0096.

PLANT DISEASE MANAGEMENT FOR ORGANIC CROPS



STEVEN T. KOIKE, UC Cooperative Extension Farm Advisor, Monterey and Santa Cruz Counties; MARK GASKELL, UCCE Farm Advisor, Santa Barbara and San Luis Obispo Counties; CALVIN FOUCHE, UCCE Farm Advisor, San Joaquin County; RICHARD SMITH, UCCE Farm Advisor, Monterey and Santa Cruz Counties; and JEFF MITCHELL, UCCE Vegetable Crops Specialist, Kearney Agricultural Center, Parlier

Specific information on organic vegetable production practices in California is scarce, and growers need sound information to guide their management decisions. The Organic Vegetable Production in California Series is made up of publications written by Farm Advisors and Specialists from the University of California's Division of Agriculture and Natural Resources. Each publication addresses a key aspect of organic production practices applicable to all vegetable crops.

Plant diseases create challenging problems in commercial agriculture and pose real economic threats to both conventional and organic farming systems. Plant pathogens are difficult to manage for several reasons. First of all, plant pathogens are hard to identify because they are so small. The positive identification of a pathogen often requires specialized equipment and training, and in some cases accurate diagnosis in the field is difficult.

Plant pathogens are constantly changing and mutating, resulting in new strains and new challenges to growers. Also, given the local, regional, and international movement of seed, plant material, and farming equipment, new and introduced pathogens periodically enter the California system to cause new disease problems.

Disease management is complicated by the presence of multiple types of pathogens. For any one crop the grower must deal with a variety of fungi, bacteria, viruses, and nematodes. This situation is even more complicated for organic vegetable growers because they usually produce a wide array of vegetable crops and are prohibited from applying conventional synthetic fungicides. The world market continues to be extremely competitive and continues to require that growers supply high-quality, disease-free produce with an acceptable shelf life. Disease management is therefore a critical consideration in organic vegetable production.

In an organic system, it is appropriate to develop disease-control strategies that have an ecological basis. For example, insofar as possible the organic system should encourage the growth and diversity of soil-inhabiting and epiphytic (plant surface dwelling) microorganisms that have the potential to exert beneficial and pathogen-antagonistic influences. An increase in the genetic diversity of the crop host rotation is another management step that incorporates ecological

considerations. The integration of disease management decisions with insect and weed control and general production practices is another step consistent with this approach.

RESISTANT PLANTS AND CULTIVARS

One of the most important components in an integrated disease control program is the selection and planting of cultivars that are resistant to pathogens. The term *resistance* usually describes the plant host's ability to suppress or retard the activity and progress of a pathogenic agent, which results in the absence or reduction of symptoms. However, it is important to clearly establish a common definition of the term when discussing this quality with individuals from different sectors of the agricultural industry. Growers, researchers, plant breeders, and seed sellers may have slightly different understandings of the term. In addition, the word *tolerance*, which has a slightly different meaning, is sometimes used interchangeably with resistance, resulting in some confusion. By definition, tolerant plants can endure severe disease without suffering significant losses in quality or yield; however, these tolerant plants do not significantly inhibit the pathogen's activity, and disease symptoms may be clearly evident. Resistant plants usually suppress the pathogen in some fashion.

There are some distinct advantages to planting disease-resistant plant cultivars. Such selections are completely non-disruptive to the environment, and in fact their use enables growers to reduce and in some cases eliminate the application of chemicals used for pathogen control. The use of cultivars resistant to one disease is compatible with disease management steps taken to control other diseases. A final advantage is that for some host-pathogen systems the stability of the

resistance is long lasting and the cultivars can remain resistant for many years.

There are some disadvantages to the use of resistant cultivars. The greatest shortcoming is that resistance is not available for all diseases on all crops. For several of the most damaging plant diseases, such as tomato late blight (*Phytophthora infestans*) and white rot (*Sclerotium cepivorum*) of Alliums, acceptable no resistant cultivars are yet available. In addition, commercial seed companies and plant breeders rarely invest in efforts to develop resistant cultivars for specialty or minor crops. Hence there will be specialty commodities, many of which are popular choices for organic producers, that will continue to lack resistance to their disease problems. Even if resistant varieties are being developed, the long development time and high market demand for resistant cultivars will result in expensive seed, and that will affect farmer budgets.

Another shortcoming of some resistant cultivars is that some of these selections lack adequate horticultural characteristics in regard to appearance, quality, color, yield, and other important criteria. Celery resistant to *Fusarium oxysporum* f. sp. *apii* may not succumb to this *Fusarium* yellows fungus, but it may also be unacceptably ribby, short, or low-yielding. A cultivar that is resistant to one disease may be quite susceptible to another important disease or insect pest. A lettuce cultivar that is resistant to lettuce mosaic virus may be quite sensitive to corky root disease (caused by *Rhizomonas suberifaciens*); a lettuce selection that resists corky root may be very susceptible to downy mildew (*Bremia lactucae*). A final disadvantage to resistance is that, depending on the host-pathogen system, resistance is not long-lasting and new strains of the pathogen readily develop, making the crop susceptible once again.

Depending on the particular disease involved, the failure of plant resistance can be either a rare or a regular event. In most cases, resistance failure is attributed to the development of new strains of the target pathogen that overcome the resistance genes of the previously resistant cultivar. The downy mildew disease of spinach provides a good case study of this phenomenon. During the past 50 years in California, a new race of the spinach downy mildew fungus (*Peronospora farinosa* f. sp. *spinaciae*) would periodically occur in the state, causing significant damage to the previously resistant spinach cultivars. Plant breeders would counter with new cultivars with genes resistant to the new race. Growers would then enjoy several years of mildew-free spinach until yet another race developed. This back-and-forth dynamic has occurred for every one of the six races of the disease that have been confirmed in California.

Despite the challenges of developing resistant cultivars and the setbacks of resistance breakdown, resistant

plants remain among the most important weapons for disease control in organic systems. Organic growers are encouraged to actively and thoroughly investigate which resistant cultivars are available and to test to determine which cultivars perform best under their particular growing conditions.

SITE SELECTION

Before planting crops, a grower should carefully plan out planting and crop rotation strategies to avoid insofar as possible any known problem areas. A grower can incur significant losses if he or she plants susceptible crops in a field known to be infested with persistent soilborne pathogens. Plant-pathogenic fungi such as *Armillaria*, *Fusarium* (the wilt-causing species), *Plasmodiophora*, *Sclerotium*, and *Verticillium* are true soil inhabitants and will persist in soil for many years, even in the absence of a plant host. Because not all fields are infested with these fungi, the grower is advised to select a planting site away from such fields. Soilborne fungi such as *Phytophthora*, *Pythium*, and *Rhizoctonia* often are much more widespread, so site selection might be less of an option in avoiding these organisms.

There are also other planting situations that create risks that should be avoided. Pastures, foothills, riverbanks, grasslands, and other areas that support weeds and natural vegetation often are reservoirs of pathogens that cause virus and viruslike diseases. The vectors that carry such pathogens also can be found in these high-risk areas and often migrate into production fields. For example, the aster yellows phytoplasma and its leafhopper vector can be found in weedy grasslands in coastal California. Once the grassland vegetation dries up in the summer, the leafhoppers migrate into nearby lettuce or celery fields, resulting in aster yellows disease in these fields.

Consider pertinent environmental factors when selecting a planting site. Crops planted very close to the seacoast tend to be more at risk from downy mildew diseases as a result of the increased and persistent humidity. Just a few miles inland from the ocean, however, humidity can be significantly lower, decreasing the disease pressure for downy mildew. An understanding of soil factors is critical in avoiding some root and crown diseases. A site that has well-drained, sandy soil reduces the risk of damping-off and root rot for sensitive crops such as spinach.

For any site selection decision, careful and detailed record keeping is essential. As a grower, you should keep notes on previous soilborne disease problems associated with certain fields, the position of fields in relation to other key areas (weed reservoirs), the environmental characteristics of importance for each loca-

tion, and the nature of soil, water, and other physical features of each site.

EXCLUSION

The practice of keeping out any materials or objects that are contaminated with pathogens or diseased plants and preventing them from entering the production system is known as *exclusion*. For some diseases, seedborne pathogens are a primary means of pathogen dissemination. Growers should purchase seed that has been tested and certified to be below a certain threshold infestation level or that has been treated to reduce pathogen infestation levels. Note that the designation "pathogen-free seed" really is not a valid term because it is not possible to know whether a seed lot is, in its entirety, absolutely free of all pathogens. Seed tests only examine representative samples, but in most cases the tests are accurate enough to give a true picture of the risk of diseases initiated by seedborne pathogens. If a grower produces or purchases transplants, they too should be as free as possible of pathogen contamination (where the pathogen is present on the plant but has not yet caused visible symptoms) and from disease (where symptoms are actually visible).

For greenhouse crop production or the production of transplants, all materials should be clean and free of pathogens. By using clean or new pots, trays, and soil-less potting mix, a grower can prevent the introduction of soilborne pathogens into the greenhouse system. The recycling of potting mixes is strongly discouraged, and pots and trays should be reused only if they are properly cleaned with steam, bleach, or other disinfectants.

Soil and water can harbor pathogens as well. Take care to see that no infested soil or water is introduced into uninfested areas. Tomato bushy stunt virus of lettuce, tomato, and other crops is found in river, flood, and runoff waters. Growers who have dredged up soil from ditches and dispersed it onto fields have found that their fields can become infested with the virus and subsequent plantings can be severely diseased. Water draining from fields can carry a number of pathogens, and growers should not recycle or reuse it without carefully considering potential risks and then taking appropriate safety precautions. Soil adhering to tractor equipment and implements can spread soilborne pathogens from infested fields into clean fields. It is a good idea to reduce the off-site movement of these infested materials as much as possible.

APPLYING CONTROL MATERIALS

Once vegetable crops are in the field or greenhouse, it will sometimes be necessary to apply some sort of pro-

tectant or eradicant spray or dust material for disease control, if one is available. Unfortunately, the selection of effective, proven materials approved for organic use is limited.

Inorganic disease control materials, primarily copper- and sulfur-based fungicides, have been used for centuries. These inorganics are generally inexpensive and widely available, and they constitute minimal threats to the environment. However, their efficacy for disease control varies. While protectant copper fungicides have some activity against a wide range of fungal and bacterial pathogens, they are not extremely effective, and sole reliance upon them probably will not result in excellent disease control. Sulfurs also exhibit some activity against many pathogens, but they usually provide excellent control against only certain pathogens, such as powdery mildew fungi. Both coppers and sulfurs can burn sensitive vegetable crops under some environmental conditions.

Oils, plant extracts, and other natural plant products are being investigated for use as disease-control sprays. Such products should be compatible with organic production practices, but reliable disease control has yet to be demonstrated.

Bicarbonate-based fungicides have recently become available for control of plant diseases. Bicarbonates have demonstrated acceptable activity against powdery mildew and a few other diseases. It is not known, however, whether bicarbonates alone will provide season-long protection for an organically grown crop.

Disease control using microorganisms (biocontrol) or chemical by-products made by microorganisms is generating a good deal of interest. However, the history of successful biological control of plant diseases is not encouraging. Very few effective, economically feasible biological control materials are commercially available. Much research and development remains to be done.

For the best results possible with any of these materials, appropriate application technique (proper equipment, spray volume, and plant coverage) and timing are essential. Most materials do not perform well if the disease is established, so applications should be made prior to extensive infection. Before applying a product, a grower should confirm that the material is approved for use in organic production. Consult product labels, UC Cooperative Extension farm advisors, pest control advisers, and your local Agricultural Commissioner's Office for product use information and restrictions.

CULTURAL PRACTICES

There are a number of cultural practices that a grower should consider when designing an integrated disease control system. As a general approach, growers should

take steps to grow vigorous, high-quality plants using the best farming practices possible. Listed below are some specific cultural practices that can help to manage diseases.

Crop rotation is an important consideration in disease management. Rotation using diverse crops, inclusion of cover crops, and appropriate use of fallow (host-free) periods all can contribute to the reduction of inoculum levels for soilborne pathogens and the increase of diversity in soil microflora. In contrast, consecutive plantings of the same crop in the same field often lead to increases in soilborne pathogens. Too little crop rotation in a given area can also simulate a monoculture effect that might increase foliar diseases.

Recent research has shown that certain plants, besides being revenue-generating crops, also have a suppressive effect on diseases. For example, after broccoli and other crucifer crops are harvested and the plant residue is plowed into the soil, the decomposition of the broccoli stems and leaves releases natural chemicals that can significantly reduce the number of *Verticillium dahliae* microsclerotia. This broccoli effect can be an important consideration in crop rotation strategies. Some cover crops (mustards, sudangrass) might also share this beneficial effect and could be considered in the crop rotation scheme. It is important to remember that while rotations with non-susceptible plants and cover crops may help reduce soilborne pathogen numbers, significant decreases in such populations are likely to take many seasons.

When devising a crop rotation strategy, a grower should also be aware of which crops and cover crops might increase disease problems. A vetch cover crop, if planted into a field with a history of lettuce drop, can greatly increase the number of infective sclerotia of *Sclerotinia minor*. Vetch is a known host of root-knot nematode (*Meloidogyne* species) and also might increase soil populations of *Pythium* and *Rhizoctonia* damping-off fungi. While oilseed radish could be a potential trap crop for cyst nematode (*Heterodera* species), as a cover crop it is a host of root-knot nematode and the clubroot fungus (*Plasmodiophora brassicae*).

There are many factors to consider in regard to planting a crop. Timing can be an important question. If cauliflower is planted into *Verticillium*-infested fields in the spring or summer, it is likely to experience disease and possible crop loss. However, if cauliflower is planted into the same fields in the late fall or winter it will exhibit no *Verticillium* wilt symptoms, presumably because the soil temperatures are too cool to allow the fungus to develop and cause significant disease.

Disease can also be influenced by steps taken prior to and during the planting process. Tillage procedures should reduce plant residues left from previous crops.

Proper preparation of the field and the subsequent raised beds should reduce problems in areas that are subject to poor drainage, pooling of water, and other conditions that favor pathogens. Soil and bed preparation should result in good soil tilth so that seed or transplants are placed in a soil that favors plant development. Planting depth for seed or transplants should be tailored to enhance seed emergence or transplant establishment. Poor soil preparation can result in stressed and exposed plants and increased damping-off problems due to soil fungi.

Irrigation management is clearly an important factor when it comes to disease control. Regardless of the irrigation method a grower chooses (furrow, sprinkler, or drip), timing and duration of irrigations should satisfy crop water requirements without allowing for excess water. Overwatering greatly favors most soilborne pathogenic fungi. For most foliar diseases, overhead sprinkler irrigation enhances pathogen survival and dispersal and disease development. Bacterial foliar diseases are particularly dependent upon rain and sprinkler irrigation. A grower should consider limiting or eliminating sprinkler irrigation if foliar diseases are problematic for a specific crop or field.

The selection and application of fertilizers, in a few documented situations, can significantly influence disease development. For example, the use of the nitrate form of nitrogenous fertilizers can increase the severity of lettuce corky root disease. The excessive use of nitrogen fertilizers can result in leaf growth that is overly succulent and more susceptible to some diseases. On the other hand, liming the soil to raise pH levels can reduce symptom expression for clubroot disease of crucifers. In general, however, fertilizer management is not directly related to disease control.

Field sanitation is the removal or destruction of diseased plant residues. In some field situations, sanitation is an appropriate step for managing diseases. Once lettuce has been harvested, for example, the remaining plants can act as a reservoir for lettuce mosaic virus. Sanitation in this case would include plowing down the old plants. Lettuce drop, caused by the fungus *Sclerotinia minor*, occurs when sclerotia develop on lettuce plant residues and remain in the top few inches of soil. One form of sanitation involves deep plowing in which moldboard plows invert the soil and bury sclerotia. Note that this procedure is effective only if sclerotia are low to moderate in number.

Sanitation measures are more commonly applied in greenhouse situations. The removal of dead or dying transplants can help reduce inoculum that could otherwise spread to adjacent transplants. The removal of senescent tomato or cucumber plants might reduce

(though not prevent) the spread of *Botrytis* spores. *Roguing* is a special form of plant sanitation that involves the physical removal of diseased plants from the field. While not applicable in many situations, researchers have shown that for sclerotia-forming fungi (such as *Sclerotinia minor* on lettuce) the regular removal of diseased plants can gradually reduce the overall number of sclerotia in fields.

The management of other pests is a cultural control that could greatly influence the development of plant diseases. In particular, virus disease management is more effective when weeds and insects are also controlled. Weeds are known reservoirs of a number of viral and bacterial pathogens.

Soil solarization is the use of plastic tarps placed on the soil surface to increase soil temperatures to a level that kills soilborne pathogens, weeds, and other crop pests. Soil solarization works best in areas with acceptably high summer temperatures. These temperatures generally do not occur in California's coastal regions. Soil solarization will not eradicate a pathogen from a field, but it may lower pathogen populations. Soil flooding is a related though seldom-used means of creating conditions—in this case, saturated soil over an extended period—that might result in a decline of soilborne pathogens.

Finally, the ability to manipulate environmental conditions in a greenhouse vegetable transplant or production system can be used to help control diseases. *Botrytis* diseases can be better managed if warm, humid air is vented out of the greenhouse. Because rain is not a factor in greenhouses, many bacterial foliar diseases can be virtually eliminated if drip irrigation or sub-irrigation systems are used.

COMPOSTS

Incorporation of composts into soils is a fundamental cultural practice in organic production. Composts benefit the soil's fertility and condition in a number of ways, and also undoubtedly benefit disease management in some way. However, research studies and empirical data that clearly document any disease control benefits resulting from field-application of compost are lacking. Despite this lack of information on disease control, composts should be added to farmed soils in order to increase soil microflora diversity and populations.

PLANT DISEASE DIAGNOSTICS

The first step in any management decision regarding disease control is to determine which diseases and pathogens are causing the problem. Accurate and timely diagnosis of plant diseases is an essential component of integrated disease control in organic and conventional systems. Disease diagnosis is enhanced when all professionals, including the grower, field personnel, pest control advisor, consultant, and extension personnel, work together to ascertain the cause of the problem. Often, field identification is impossible and samples must be submitted to a qualified laboratory for analysis.

Once a diagnosis has been determined, growers and other decision makers can settle on appropriate steps to take to manage the problem. Again, detailed record keeping will help the grower deal with the current problem and at the same time provide a database from which the grower can plan disease management steps for future crops.

For assistance with plant disease diagnosis, contact your pest control advisor, local Cooperative Extension Farm Advisor, or other professionals trained in plant pathology, pest management, or plant production.

OTHER PUBLICATIONS IN THIS SERIES

Organic Certification, Farm Production Planning, and Marketing, UC ANR Publication 7247

Soil Management and Soil Quality for Organic Crops, UC ANR Publication 7248

Soil Fertility Management for Organic Crops, UC ANR Publication 7249

Weed Management for Organic Crops, UC ANR Publication 7250

Insect Pest Management for Organic Crops, UC ANR Publication 7251

REFERENCES

Integrated Pest Management series. University of California Statewide Integrated Pest Management Project (available through UC ANR Communication Services)

Soil Solarization: A Nonpesticidal Method for Controlling Diseases, Nematodes, and Weeds. UC ANR Publication 21377

UC IPM Pest Management Guidelines. UC ANR Publication 3339

An electronic version of this publication is available on the University of California ANR Communication Services website at <http://anrcatalog.ucdavis.edu>.

Publication 7252

© 2000 by the Regents of the University of California,
Division of Agriculture and Natural Resources. All rights reserved.

The University of California prohibits discrimination against or harassment of any person employed by or seeking employment with the University on the basis of race, color, national origin, religion, sex, physical or mental disability, medical condition (cancer-related or genetic characteristics), ancestry, marital status, age, sexual orientation, citizenship, or status as a covered veteran (special disabled veteran, Vietnam-era veteran or any other veteran who served on active duty during a war or in a campaign or expedition for which a campaign badge has been authorized).

University Policy is intended to be consistent with the provisions of applicable State and Federal laws.

Inquiries regarding the University's nondiscrimination policies may be directed to the Affirmative Action/Staff Personnel Services Director, University of California, Agriculture and Natural Resources, 1111 Franklin, 6th Floor, Oakland, CA 94607-5200 (510) 987-0096.

pr-4/00-WJC



ORGANIC PLUG & TRANSPLANT PRODUCTION

HORTICULTURE PRODUCTION GUIDE

ATTRA is the national sustainable agriculture information center funded by the USDA's Rural Business -- Cooperative Service.

Abstract: This publication contains information on raising vegetable and ornamental plugs and transplants but is not intended as an introduction to the subject. Rather, it is written to serve as a complementary piece of information, focusing on organic production methods rather than conventional ones. The bulk of the document concentrates on containers, organic fertilization, and non-chemical growth regulation; but media, pest management, irrigation, and scheduling of plugs are also discussed. Although much of the research cited covers ornamentals, the information applies to vegetables as well.

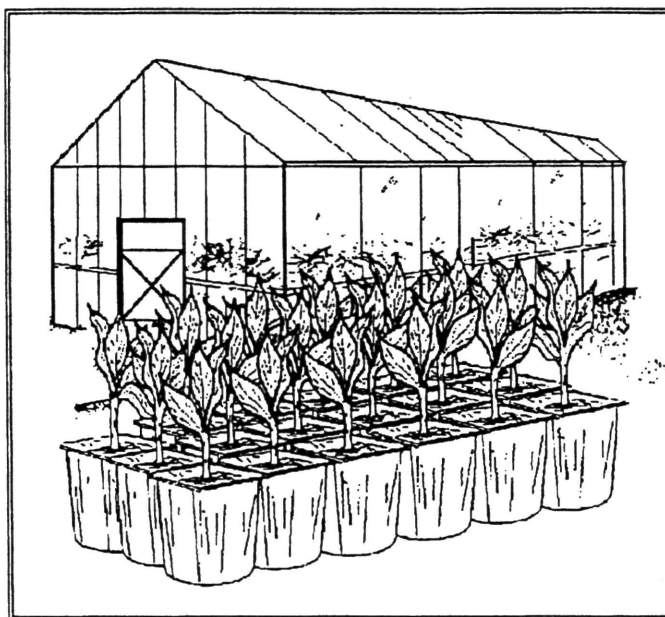
Prepared by Lane Greer
ATTRA Program Specialist
March, 2000

Introduction

The traditional way to raise numerous seedlings is to place seeds in rows in trays, then transplant these very fragile plants into larger packs or pots. This method is very labor-intensive and results in considerable mortality from transplant shock or root loss.

Since the 1980s, most seed germination has been done in plug trays. A plug is a containerized transplant with a self-enclosed root system (1). The advantages to growing seedlings from plugs are numerous: less time and labor to transplant, reduced root loss, more uniform growth, faster crop time and increased production. Eighty-one percent of annuals grown in 1998 were grown from seedlings initially grown as plugs (2).

There are disadvantages to growing plugs, too. Much more attention has to be paid to scheduling and cultural practices. While labor is decreased, the need for mechanization is increased. Also, specialized, well-trained labor is needed.



There are a number of pros and cons to consider when deciding whether to grow plugs from seed or purchase plugs and grow them to transplant size. The advantages of producing one's own plugs include rapid production, efficient use of greenhouse space, growing the desired species and cultivars, and self-reliance. The disadvantages can include extra labor to handle an exacting crop

and increased heating costs in winter (since plugs are quite sensitive to temperature fluctuations). According to Kessler and Behe,

Index

Containers.....	2
Media	4
Equipment: Seeders	4
Nutrition: Organic Fertilizers for Container Systems.....	5
Irrigation	7
Light.....	8
Growth Regulation	8
Scheduling: Holding Plugs.....	9
Pest Management.....	10
References.....	10
Further Reading.....	12
Web Sites.....	12
Suppliers of Trays.....	13
Suppliers of Seeders	13

"The decision should be based partially on market considerations, labor availability and expertise, the number of plants to be produced, the cost per plug, and the specialized equipment and facilities required. This investment is often not economically practical unless production is large or plugs are marketed to other growers. For most small to medium sized growers, especially [beginners], it is often more economical to purchase...plugs from specialized growers and concentrate on producing finished containers. The issue of grow versus purchase should be reviewed periodically as the needs and facilities of the grower change" (3).

The basics of plug production include:

- Container size
- Media
- Seeding and germination
- Nutrition
- Temperature
- Watering and moisture management (especially during germination)
- Light and supplemental lighting
- Growth regulation
- Scheduling
- Pest management, especially of fungus gnats, shore flies, and root rots

The book *Plug and Transplant Production*, by Drs. Roger Styer and David Koranski (1), contains the most extensive information on all the basics listed above and also addresses timely subject matter. Because it focuses on specifics, it is good for troubleshooting. The book comes with three pullout tables—one each for vegetables, bedding plants, and cut flower plugs. These tables provide extremely detailed information on specific crops. This publication should be on the shelf of every serious plug and transplant grower. See Reference #1 for information on how to obtain this book.

In 1990, and again in 1996, the editors of *GrowerTalks* magazine (4) compiled some pertinent articles on plug production into books titled *GrowerTalks on Plugs* (5) and *GrowerTalks: Plugs II* (6). The 1990 edition is no longer in print, but it may be available at your local library. The 1996 edition is available from Ball Publishing (see address in the References section). This edition focuses on the basics mentioned above, as well as automation (transplanters, shipping, boom irrigators), plug holding, stress, container size, growing your own vs. buying, seeds and germination, pest control, and culture by crop for eleven species of bedding plants.

Greenhouse Grower (7) and *Greenhouse Management and Production* (8) are periodicals that address plug production and related issues. *Greenhouse Grower* produces an annual bonus issue that targets plugs and propagation. *GrowerTalks* holds an annual plug conference that lasts for three days, usually in October. Although the conference is expensive (usually around \$550 for all three days), it would be worth the money to talk with growers from around the country to see what they recommend and discuss solutions to problems. For more information, contact Ball Publishing at the address listed in the References section.

Information on conventional bedding plant production is available from Bedding Plants International (9); they sell books, videos, and other educational materials. BPI also holds an annual conference. See their web site for more details.

Containers

Plugs are produced in multi-cell plastic trays, also called flats. The trays are available in a wide range of cell sizes and depths—anywhere from 50 to 800 cells are present in a single tray. The type of flat chosen will depend on the species being grown and the length of time spent growing it. Pansies, for instance, are most often grown in 288, 392, or 406 plug trays (3). The time from sowing to ready-for-transplant stage is usually about 6 weeks in 288 trays and 5 weeks in 392 or 406 plug trays. Larger cells provide more moisture and nutrients to the plant, but make

much less efficient use of greenhouse space than the smaller cells.

There are also rigid foam cell trays (such as Speedling® flats) which, though somewhat more expensive per unit, have the advantage of both greater durability and "stand-alone" ability. Foam trays, however, are quite bulky and will not nest for storage. Lightweight plastic trays, in contrast, are quite easy to store in the off-season, and cost less initially, but are less durable and usually require an undertray to maintain sufficient strength for convenient handling. Heavier, thicker-walled plug trays are better suited to automated equipment. Winstrip® trays have small slits down two sides of each plug, to improve aeration. There are also holes between each cell to allow air movement up through the tray (10). Plugs grown in Winstrips usually have less root spiraling.

Occasionally, growers choose a soil block system. Developed in Europe some years ago, soil blockers press a soil mix together into cubes that are handled in much the same manner as peat pellets. Commercial-scale blocking equipment is quite expensive, and many growers find the plants' tendency to grow their roots into adjoining blocks somewhat annoying. Small-scale blocking equipment is also available and has proven popular with some market gardeners. For more information on soil block methods, see the book *The New Organic Grower* by Eliot Coleman (11).

The table below gives some idea of the sizes, cell shapes, and major suppliers of plug trays. See **Suppliers of Plug Trays** at the end of this document for more information.

Table 1. Plug tray suppliers, sizes, and cell shapes.

Company	Sizes Available	Cell Shapes Available
Winstrip	50, 72, 72, 128, 162, 216, 288	Square
Dillen	72, 84, 98, 105, 128, 144, 162, 288, 512	Square, Round
Landmark	50, 72, 84, 98, 128, 144, 162, 200, 288, 384, 392, 406, 512, 648, 800	Square, Round, Octagonal
Blackmore	128, 144, 200, 216, 288, 338, 384, 406, 512, 648, 800	Star, Square Deep, Octagonal, Square, Octahedron, Waffle
Lerio	50, 60, 72, 84, 98, 112, 160, 200	Square
Summit Plastic	72, 128	Round
TLC Polyform	50, 55, 58, 72, 84, 98, 105, 128, 144, 162, 200, 273, 288, 338, 384, 392, 406, 512	Square, Square Deep, Round, Nova, Octagonal, Octahedron, Hexagonal
Growing Systems	51, 73, 96, 104, 135, 170, 198, 200, 273, 288, 400, 512	Square
Speedling	72, 128, 162, 200, 242, 288, 338, 388, 392, 595	Square

New Research on Containers

Research conducted at the University of Georgia during 1995 showed that copper-treated plug flats affected the root growth and flowering of three species of bedding plants. Armitage and Gross reported that root spiraling and seedling height were reduced in *Impatiens*, *Pelargonium*, and *Petunia*. The copper treatment delayed flowering for the impatiens and petunias by twelve days and 21 days for geraniums, but did not affect their mature heights (12).

Container size can affect transplant characteristics. Researchers at the University of Florida tested four sizes of Speedling flats and found that lettuce grown in the two largest sizes took longer to reach harvestable size, but yield was not affected. In the spring-grown lettuce, there was no difference in head weights, but fall-grown heads started in the larger cell sizes were heavier. The researchers also tested media compression and found that compressing the media in the cells was not justified because it was more costly and did not increase yields (13).

In research done at the University of Kentucky, marigold plugs were grown in 512, 406, and 288 plug flats over a 16-day period. Size did not affect seedling growth until the 13th day, but, after 16 days, seedlings grown in the 512 trays were about two-thirds the size of those grown in 288 flats. Container size also affected root branching: plants from the 288 trays had roots with fewer branches (14).

Of greatest importance to the end user and the plug grower, however, is whether yield after transplanting is affected by container size. Researchers have yet to prove that container size affects ultimate crop yield (15). However, studies conducted in England in the mid-1990s showed that organically grown vegetable transplants benefited from larger cell sizes (16). The larger cells held more media and larger quantities of nutrients.

Plug flat color has little effect on medium surface temperature, which is important when germinating seeds. Researchers in Tennessee tested black, gray, and white flats, and found no

significant differences among the three colors (17).

Grower Jay Martin in Maryland mixes Pro-Mix Lite® and compost in proportions ranging from 12:1 to 15:1 (mix:compost), depending on the crop (18). For example, brassicas, which are quick to finish, are grown in a mix with less compost; slower-growing solanaceous crops are raised in a mix with more compost.

Media

In organic production, plant health depends on the quality of the planting mix. Most producers opt for a soilless mix to reduce the risk of soil-borne diseases. The mix should, for organic production, contain sufficient amounts of the major nutrients to carry the young crop for the time it will be in the greenhouse.

Purchasing a commercially prepared organic mix is the easiest way to get started. However, most commercial potting mixes contain synthetic ingredients and do not meet the guidelines of certified organic programs. One alternative is to arrange a special order from a commercial supplier who agrees to exclude starter fertilizers and wetting agents. Or, since freight is often prohibitive, many growers may choose to mix their own. For more information on potting mixes, ask for ATTRA's publications *Organic Potting Mixes* and *Disease Suppressive Potting Mixes*.

Equipment: Seeders

Mechanical seeders are necessary when planting large numbers of plugs. Seeders are quite expensive, costing from \$1,000 to \$50,000. There are four types: 1) vacuum template (price range: \$1,000-\$5,000), 2) vacuum tips or needles (\$8,000-\$13,000), 3) vacuum cylinder or drum (\$18,000-\$50,000), and 4) electric eye (\$10,000-\$13,000). The least expensive type is the vacuum template. With this kind of seeder, the seed is scattered over a template that has small indentations on its surface. A vacuum holds the seeds in the indentations, while extra seed is knocked off. When the vacuum is turned off, the seeds drop into place in the plug tray, so the entire tray is

planted at once. There are also manual wand seeders that use the vacuum needle system to sow one row of seed at a time. They cost less than \$1,000 (1). For a list of suppliers of both kinds of seeders, see the end of this document.

It is possible to make a simple seeder out of plastic. Dr. Charles Marr developed a planting template in the early 1990s at Kansas State University (19). Here are his specifications for making a seeder:

Grower Profile — Henry's Plant Farm

Henry's Plant Farm in Missouri, owned by Marcia and Roy Henry, has been in operation for 16 years. The Henrys have eight greenhouses with almost 13,000 square feet of growing space and sell 80,000 plants a year. Marcia manages the operation of the greenhouses. Her best sellers are vinca, petunia, and impatiens. She also offers herbs, vegetables, and perennials, as well as other annuals.

Marcia uses a vacuum seeder with five plates to accommodate different seed sizes. Other things she has found helpful are pre-printed tags available from her seed company. Although the tags are expensive (\$1,000 in 1997), customers appreciate the extra information they provide. Marcia saved money by ordering her media by the truckload, which was 40% cheaper than buying it bagged. She also saves money on heating costs by contracting for propane gas each year.

Her production schedule is the result of many years of good record keeping (20). She begins December 1 with geraniums, begonias, and perennials. At the beginning of January, she plants pansies, snapdragons, and vinca. By the end of the month she is potting up geranium cuttings and transplanting seed geraniums. On February 1, she plants petunias. With most of the best sellers and with tomatoes, she plants again on February 15. She starts most of the other annual flowers and vegetables in March.

"The template consists of two sheets of 3-mm acrylic plastic cut to rectangular dimensions of the seed flat. The upper sheet has a 6-cm-tall 'wall' glued to the outside with a small opening in the wall at one end, so excess seeds can be poured out. The bottom sheet is held in place by four glued tabs on each side, so that the bottom sheet could slide laterally. The bottom sheet is left slightly longer with a slot cut as a handle."

Holes that are the same size or slightly smaller than the seed that is to be used should be drilled in the plastic. The method of operation is simple: The top and bottom sheets are kept out of alignment. Then the seeds are poured onto the top sheet and rolled around until all the cavities are filled. Excess seed can be poured off. The bottom sheet is then moved into line with the top, and the seeds fall through both sheets and onto the seed mix in the plug trays.

Nutrition: Organic Fertilizers for Container Systems

There are four basic ways to fertilize containerized plants: incorporate, topdress, liquid feed, and foliar feed. In bedding plant culture, fertilizer incorporation in the mix combined with liquid feeding should provide sufficient nutrition.

Organic fertilizers that can be incorporated to provide nitrogen include: alfalfa meal, blood meal, cottonseed meal, feather meal, hoof and horn meal, soybean meal, and animal manures, among others. Materials that provide phosphorus include oak leaves, bone meal, shrimp wastes, residues from raw sugar, and various forms of rock phosphate. Greensand, granite meal, soybean meal, ash from orange and potato skins, unleached wood ashes, Sul-Po-Mag®, and tobacco (stems, leaves, and stalks) all provide potassium. For more information on these and others, request ATTRA's *Nonconventional Soil Amendments* publication.

Unless a recognized organic soil mix recipe is used, several experimental batches that compare

different fertilizers and rates of incorporation should be tried on a test group of plants. The ATTRA publication *Organic Potting Mixes* provides numerous recipes for soil and fertilizer mixes.

Fertile Soil (21) by Robert Parnes is an in-depth publication on organic fertilizers. Parnes' book provides detailed tables on the nutrient content of various manures and plant and animal byproducts.

In liquid feeding, nutrients can be delivered by: 1) proportioning through drip lines, 2) proportioning through watering hoses, and 3) drenching (from a measuring cup or bucket). Soluble fertilizers may be applied at each watering (known as fertigation or constant liquid feed) in a diluted solution or on a seven to ten-day basis with a concentrated solution. Nitrogen is the main nutrient that is supplied through liquid feeding. Soluble organic nitrogen sources include fish powder, fish emulsion, bat guano, seabird guano, worm castings, and manure teas. Phosphorus is available for liquid feeding by using high phosphorus bat guano.

Foliar feeding can be used to supplement soil and liquid fertilization, especially where certain nutrients are deficient and must be incorporated into the plant quickly. Filtered solutions of manure, seaweed, fish powder, and fish emulsion can be used. Seaweed is an excellent foliar material because it contains growth hormones (auxins, gibberellins, and cytokinins) as well as trace elements. Research suggests that foliar feeding programs enhance plant resistance to pest and disease attack. Compost teas are gaining popularity as a foliar feed primarily for their disease-suppressive characteristics. For more information, request the ATTRA publication *Compost Teas for Plant Disease Control*.

New Research on Fertilization

A study conducted in 1998 at the University of Georgia found that nitrogen, rather than phosphorus and potassium mainly determined growth of plugs. The report recommended that growers focus their fertility programs on nitrogen and reduce phosphorus and potassium applications (22).

Often, there are seasonal variations in growth, and the fertilization system must take this into account. A recent study performed in Florida showed that spring-grown tomato seedlings respond linearly to increased nitrogen fertilizer (23). In other words, the more N applied, the more the plants grow. (The researchers used 15-75 mg/liter of N.) In fall-grown plants, however, the opposite is true. Researchers believe that increased light and temperatures in the fall were responsible for some of the differences in growth patterns. Other research has shown that anywhere from 75-400 mg/liter of N produces the largest tomato seedlings and often increases early yields (23). Too much nitrogen, however, attracts aphids.

In an English study, cabbage seedlings were fertilized with conventional fertilizer, dried blood (applied in a liquid form), and hoof and horn meal (incorporated into the potting media) (16). Dried blood applied at a rate of 3 grams/liter, three times a week, increased plant growth at about the same level as conventional fertilizer. The table below presents the rest of the findings.

Table 2. Fresh weight of cabbage plants at transplanting (16).

Fertilizer Regime	Fresh Weight (g) of 10 plants
Control (no fertilizer)	13.0
Conventional fertilizer	16.7
Blood 1 (1.5 g/liter 3x/wk.)	14.6
Blood 2 (3 g/liter 3x/wk.)	17.5
Blood 3 (15 g/liter 3x/wk.)	30.2
Hoof and horn (3 g/liter media)	21.7

In 1993, Premier Peat Moss in Canada conducted research on organic wastes from the agri-food industry and their ability to fertilize greenhouse tomato transplants (24). The researchers found that meal from blood, feathers, meat, crab shells, fish, cottonseed and whey by-products increased shoot weight by 57-83% over non-fertilized plants. The results of this study are shown below.

<i>Fertilizer</i>	<i>N-P-K</i>	<i>Shoot wt. (grams)</i>
Crab-shell meal	8.2-1.5-0.5	18.8
Blood meal	12.5-1.1-1.0	18.5
Dried whey sludge	5.3-2.5-0.9	18.3
Feather meal	13.6-0.3-0.2	17.3
Fish meal	10.1-4.5-0.5	17.1
Meat meal	7.7-3.1-0.7	16.3
Cottonseed meal	6.5-1.1-1.6	16.2
Fish- scale meal	10.0-3.7-0.1	15.8
Distiller's dried grains	4.3-0.9-1.1	14.5
Soybean meal	7.5-0.7-2.4	14.4
Wheat bran	2.9-1.4-1.3	13.5
Alfalfa meal	2.5-0.3-1.9	10.8
Canola meal	6.0-1.1-1.3	10.8
None (control)	0-0-0	10.3

Irrigation

Thorough, even watering is extremely important to plug and transplant production success. Water stress sets plants back and increases the chance that they will fare poorly once planted outdoors. Automatic or semi-automatic watering saves a great deal of work, but will not eliminate the need for "touch-up" watering by hand, on a regular basis. The plants will do best, especially when in plastic trays, if they are supported off the ground to allow good air circulation and prevent waterlogging. As a general rule they should not be watered in late afternoon, lest they remain overly wet through the night.

Plug cell size will also affect the watering schedule. According to Biernbaum and Versluys, "While in larger containers water must be added to thoroughly moisten the entire medium profile, in shallow containers a less than saturating amount of water can be added without detrimental effects to roots since the water will distribute adequately" (25).

One of the most common problems in greenhouses is overwatering. Not only does this contribute to poor plant growth and health, it also encourages the spread of pathogens that thrive in wet conditions. Overwatering is especially easy to do with young plugs; underwatering becomes a problem with older plugs.

There are five major ways to water plugs: 1) hand watering, 2) stationary sprinklers, 3) traveling boom sprinklers, 4) fog, and 5) subirrigation (25). Of these, hand watering and subirrigation are most appropriate for small growers. The biggest problem with hand watering is, of course, labor expense. It is also less uniform than mechanized systems. Subirrigation eliminates both of these problems but can result in overwatering

because of immediate saturation. Subirrigation is better when growing larger plugs.

New Research on Irrigation

A recent study at the University of Georgia showed that moisture stress tends to increase aphid populations on New Guinea impatiens and marigolds, but has little effect on spider mite or thrips populations (26). In the experiment, mite populations were lower on ageratum plants that were irrigated with an ebb-and-flow system, compared to overhead-irrigated plants.

Researchers at North Carolina State University found that environmental conditions, rather than plant growth, may dictate irrigation practices (10). Their other findings were:

- Plugs do leach fertilizer, sometimes heavily.
- Plug trays (288s) can take 500-1000 ml of water per tray at each irrigation, depending on environmental conditions.
- Winstrip trays used more water and dried out faster than conventional trays.

- Plants tended to be larger in Winstrip trays and finish earlier than in conventional trays.
- Plants may use less than 2% of the water applied to the tray.
- Water per tray may be affected more by air humidity than by temperature or plant condition.

Light

Although supplemental lighting can increase transplant quality, it is generally not needed for most operations. The exception to this rule of thumb is in winter, especially in northern areas of the U.S. Low light levels result in “leggy” plants, so growth regulation techniques are even more important in these kinds of situations. Most growers use high intensity discharge (HID) lamps to light their greenhouses. This topic is discussed at length in the resources recommended at the beginning of this publication.

Growth Regulation

Plugs and transplants can often elongate due to light competition, and growers end up with spindly, leggy plants. Conventional growers use chemical growth regulators to combat this problem. There are, however, other, non-chemical means to control growth. Brushing is a kind of mechanical conditioning whereby the grower uses a tool (like a broomstick, piece of paper, or PVC pipe) to brush the plant tops and reduce their height. According to Garner et al., “Research concerning the effects of mechanical stimulation on floricultural crops is considerably more limited than that on vegetable crops, probably due to the availability of chemical growth regulators approved for use on bedding plants” (27).

Researchers at Cornell studied the best ways to brush plants. They used a piece of polystyrene foam on tomato seedlings and found that ten strokes a day was enough to reduce the height by about 20% (28). Using more than about ten strokes a day was ineffective, and there was no difference between applying all the strokes at one time or spreading them out over a longer period. No matter what the seedling height was

when brushing began (6, 8, or 10 cm), the reduction in height was 3 mm per day.

In another study, researchers studied the effects of brushing on tomatoes and on four species of bedding plants (geranium, impatiens, petunia, and pansy) (27). For the tomatoes, they found that 10-20 daily strokes were enough for height control, that there was no difference between morning and afternoon brushing, and brushing did not affect yield. The best time to begin the brushing treatment was the first or second true leaf stage. Beginning later resulted in leaf damage. However, brushing the bedding plants had different effects. For geranium, impatiens and petunia, brushing adversely affected the plants and even resulted in significant damage. The pansy plugs, however, responded to brushing in much the same way as the tomatoes. The authors concluded that brushing is an effective method for controlling tomato and pansy plant size.

Cucurbits and eggplants respond well to brushing, but peppers are damaged by it. Cole crops respond fairly well and seem to do better if brushing is started at the second or third leaf stage (29). One study even showed that brushing helped to reduce thrips and mite populations (26).

Controlling temperatures is another way to control plant height. Cooler temperatures generally slow down growth, and warmer ones speed up growth. “Both root and shoot growth increase linearly with temperature between the general range of 50 to 85°F” (1).

Recently, research has concentrated on adjusting day and night temperatures to control plant “stretching.” A marked difference in day and night temperatures seems to promote internode elongation, and growers have found that keeping the day and night temperatures the same helps to prevent this from happening. Another strategy is to keep day temperatures below night temperatures. Although many species respond well to this kind of treatment, some react by producing chlorotic (yellow) leaves or stunted growth.

For a list of species and their response to this kind of treatment, see the 1995 article by Myster and Moe from *Scientia Horticulturae* (30).

In much the same way, adjusting moisture, nutrition, and light can slow down or speed up seedling development. For more information on these methods, see the publications mentioned at the beginning of this document.

Scheduling: Holding Plugs

Often, transplants are ready to be planted outdoors before the weather is conducive. This has prompted research to study the effects of storing or "holding" plugs at cool temperatures. An experiment conducted at the University of Georgia examined the effects of storing geranium plugs for 1-3 weeks at 5°C (31). Additionally, the researchers tested the effects of applying nitrogen just before storage. Below is the abstract of their findings:

"Pelargonium x hortorum L.H. Bailey 'Scarlet Elite' seedlings were grown in plugs from seed to transplant size. About 14 days before attaining transplant size, seedlings were exposed

to various fertility or temperature regimes (preconditioning treatments), then stored for 1 to 3 weeks at 5°C. Seedlings receiving 150 mg N/liter before storage flowered sooner and required less crop time (days to flower - days in storage) than those receiving 0, 75 or 300 mg. Temperature preconditioning at 10 or 15°C delayed flowering compared to preconditioning at 20°C. Final plant height and dry weight were not adversely affected by varying N levels or temperature during preconditioning. Preconditioning seedlings with 300 mg N/liter resulted in seedling mortality rates up to 16% after 7 days' storage. Low temperature or fertility were not effective preconditioning treatments. Preconditioning seedlings with 150 mg N/liter attained best results."

Research at Michigan State University showed that light above 5 foot-candles was beneficial for stored plugs (32). Researchers at Kansas State University tested several species to determine their holding abilities. Their results are presented in Table 3.

Table 3. Recommended cold storage time limits for selected species & cultivars, at 45°F and with light (32).

Species	Cultivar	Weeks of Storage
Fibrous begonia	Viva	1
Coleus	Multicolor Rainbow	2
Impatiens	Accent Lilac	2
	Accent Red Star	
	Super Elfin Orange	
	Scarlet Sophia	
Marigolds	Better Bell	5
Pepper	White Flash	2
Petunia	Double Mix	5
Portulaca	Red Hot Sally	5
Salvia	Red Pillar	4
	Better Boy	
Tomato	Showtime Mix	4
Verbena	Bright Eyes	4
Vinca	Grape Cooler	3
	Little Linda	
	Little Pinkie	
	Polka Dot	
	Pretty 'n' Rose	

Humidity and moisture management are important when holding plugs. Lower humidity is good for suppressing disease, but can lead to water stress. Plugs that have been given too much nitrogen tend not to store well, either.

Pest Management

For pest management problems, please consult the ATTRA publication *Integrated Pest Management for Greenhouse Crops*. Other publications in this series include *Greenhouse IPM: Sustainable Aphid Control* and *Greenhouse IPM: Sustainable Thrips Control*.

An excellent handbook is *Integrated Pest Management for Bedding Plants*, from Cornell University (33). This 112-page book thoroughly covers the practical aspects of implementing an IPM program for bedding plants. Topics include scouting, developing and implementing control strategies, case studies, use of biological controls, and descriptions and controls of prevalent pests and diseases. See Reference #33 for information on ordering.

Top Ten Pitfalls to Plug Production

Mark Bennett of The Ohio State University and Roy Larson at North Carolina State University describe the following as the ten things to watch for when raising plugs (34).

1. **Economics.** Should you grow or buy plugs? Do a cost accounting to make sure you are making the right decision for your operation.
2. **Poor equipment selection.** Choose equipment that best fits your growing and economic needs.
3. **Untrained employees.** You should not have only one person trained on plug equipment.
4. **Improper tray filling.** To achieve uniformity, don't fill plug trays improperly.

5. **Compaction.** Piling filled trays on top of each other leads to this pitfall.
6. **Poor fertilizer practices.** Avoid having a fertilizer program with little or no planning.
7. **Poor watering practices.** Same as #6.
8. **Waste.** Take precaution to avoid wasting seed as much as possible.
9. **Improper timing.** Keep everything on schedule.
10. **Technology gap.** Take full advantage of all available technology.

References:

- 1) Styer, Roger and David Koranski. 1997. Plug and Transplant Production. Ball Publishing, Batavia, IL. 400 p. Available for \$84.95 from:
Ball Publishing
PO Box 9
Batavia, IL 60510
888-888-0013
<http://www.growertalks.com/>
- 2) Erwin, John E. 1999. Young plant prefinishers – a new type of grower. Ohio Florists' Association. December. p. 3-5.
- 3) Kessler, J. and Bridget Behe. 1998. Pansy Production and Marketing. ANR-596. Alabama Cooperative Extension.
<http://www.aces.edu/departments/extcomm/publications/anr/anr-596/anr-596.htm>. 16 p.
- 4) GrowerTalks
Ball Publishing Co.
P.O. Box 9
335 N. River Street
Batavia, IL 60510-0009
630-208-9080
630-208-9350 Fax
<http://www.growertalks.com>
\$25/year for 14 issues
- 5) Hamrick, Debbie (ed.) 1990. GrowerTalks on Plugs. Ball Publishing, Batavia, IL. 184 p.

- 6) Hamrick, Debbie (ed.) 1996. *GrowerTalks: Plugs II* (2nd ed.) Ball Publishing, Batavia, IL. 214 p. *Available for \$29.95 from Ball Publishing (see address above).*
- 7) Greenhouse Grower
Meister Publishing Company
37733 Euclid Ave.
Willoughby, OH 44094
440-942-2000
440-942-0662 Fax
\$29/year for 15 issues
- 8) Greenhouse Management & Production (GMPro)
Branch-Smith Publishing
PO Box 1868
Fort Worth, TX 76101
800-434-6776
817-882-4120
817-882-4121 Fax
<http://www.greenbeam.com>
12 issues/year; free to qualified greenhouse growers; \$96/year for non-growers
- 9) Bedding Plants International
525 SW 5th Ave., Suite A
Des Moines, IA 50309
800-647-7742
<http://www.bpint.org>
- 10) Fonteno, William C. and Douglas A. Bailey. 1997. How much water do your plugs really want? *GrowerTalks*. Fall. p. 32, 34, 37-38.
- 11) Coleman, Eliot. 1995. *The New Organic Grower*. Chelsea Green, White River Junction, VT. 340 p. *Available for \$24.95 from:*
Chelsea Green Publishing Co.
PO Box 428
Gates-Briggs Bldg. #205
White River Junction, VT 05001
800-639-4099
<http://www.chelseagreen.com/>
- 12) Armitage, A.M. and P.M. Gross. 1996. Copper-treated plug flats influence root growth and flowering of bedding plants. *HortScience*. October. p. 941-943.
- 13) Nicola, Silvana and Daniel J. Cantliffe. 1996. Increasing cell size and reducing medium compression enhance lettuce transplant quality and field production. *HortScience*. April. p. 184-189.
- 14) Geneve, R.L. and J.W. Buxton. 1995. Marigold root development during plug production. *ActaHorticulturae*. Vol. 396. p. 345-350.
- 15) NeSmith, D. Scott and John R. Duval. 1998. The effect of container size. *HortTechnology*. October-December. p. 495-498.
- 16) Anon. 1995. Organic transplant production. *New Farmer & Grower*. Autumn. p. 28-29.
- 17) Faust, James E., Royal D. Heins, and Hiroshi Shimizu. 1997. Quantifying the effect of plug-flat color on medium-surface temperatures. *HortTechnology*. October-December. p. 387-389.
- 18) Byczynski, Lynn. 1993. Growing great transplants. *Growing for Market*. February. p. 1, 4.
- 19) Marr, Charles W. 1991. A planting template for plug flats. *HortTechnology*. October-December. p. 120-121.
- 20) Byczynski, Lynn. 1997. Customers flock to farm for plants. *Growing for Market*. February. p. 8-10.
- 21) Parnes, Robert. 1990. *Fertile Soil*. agAccess Agricultural Booksource, Davis, CA. 190 p.
- 22) Van Iersel, M.W. et al. 1998. Fertilizer effects on the growth of impatiens, petunia, salvia, and vinca plug seedlings. *HortScience*. July. p. 678-682.
- 23) Vavrina, C.S. et al. 1998. Nitrogen fertilization of Florida-grown tomato transplants: season variation in greenhouse and field performance. *HortScience*. April. p. 251-254.
- 24) Gagnon, Bernard and Sylvain Berrouard. 1994. Effects of several organic fertilizers on growth of greenhouse tomato transplants. *Canadian Journal of Plant Science*. Vol. 74, No. 1. p. 167-168.
- 25) Biernbaum, John A. and Natasha Bos Versluys. 1998. Water management. *HortTechnology*. October-December. p. 504-509.

- 26) Latimer, Joyce, and Ronald D. Oetting. 1999. Conditioning treatments affect insect and mite populations on bedding plants in the greenhouse. *HortScience*. April. p. 235-238.
- 27) Garner, Lauren, F. Allen Langton, and Thomas Björkman. 1997. Commercial adaptations of mechanical stimulation for the control of transplant growth. *ActaHorticulturae*. Vol. 435. p. 219-230.
- 28) Garner, Lauren and Thomas Björkman. 1996. Mechanical conditioning for controlling excessive elongation in tomato transplants: sensitivity to dose, frequency, and timing of brushing. *Journal of American Horticultural Science*. Vol. 125, No. 5. p. 894-900.
- 29) Byczynski, Lynn. 1993. Keep those transplants in shape – with a broomstick. *Growing for Market*. February. p. 4.
- 30) Myster, J. and R. Moe. 1995. Effect of diurnal temperature alternations on plant morphology in some greenhouse crops: A mini-review. *Scientia Horticulturae*. Vol. 62. p. 205-215.
- 31) Kaczperski, Mark P., Allan M. Armitage, and Pamela N. Lewis. 1996. Performance of plug-grown geranium seedlings preconditioned with nitrogen fertilizer or low temperature storage. *HortScience*. June. p. 361-363.
- 32) Gast, Karen L.B. and Alan B. Stevens. 1994. Cold storage for plug production. MF 1173. Kansas State University Cooperative Extension Service, Manhattan, KS. 2 p.
- 33) Casey, Christine (ed.). 1997. Integrated Pest Management for Bedding Plants. IPM No. 407. Cornell Cooperative Extension, Ithaca, NY. 112 p. *Available for \$12.75 from:*
Media Services Resources Center
Cornell University
7 B&T Park
Ithaca, NY 14853
607-255-2080
- 34) Anon. 1997. Top ten pitfalls to plug production. *Greenhouse Grower*. Mid-September. p. 31.

Further reading:

Gaston, Michelle (ed.). 1999. *Tips on Growing Bedding Plants* (4th ed.). Ohio Florists' Association

(OFA), Columbus, OH, 43215. 164 p. *Available for \$30 from:*

Ohio Florists' Association
2130 Stella Ct., Suite 200
Columbus, Ohio, 43215
614-487-1117

Other publications available from OFA include:
Tips on Growing and Marketing Garden Mums (\$22)
Tips on Managing Floriculture Crop Problems: Pests, Diseases, and Growth Control (\$15)
Tips on Growing Specialty Potted Crops (\$31)
Tips on Growing and Marketing Hanging Baskets (\$22)
Tips on Growing Poinsettias (\$12)
An Introduction to Greenhouse Production (\$40)
Tips on Growing Zonal Geraniums (\$12)

These publications focus on conventional production methods.

Holcomb, E. Jay (ed.). 1994. *Bedding Plants IV*. Ball Publishing, Batavia, IL. 452 p.

Available for \$56.95 from Ball Publishing.

Nau, Jim. 1999. *Ball Culture Guide*. Ball Publishing, Batavia, IL. 248 p.

Available for \$49.95 from Ball Publishing.

Pyle, Allen R. 1999. Planting the seeds of success. *American Nurseryman*. February 1. p. 52-54, 56, 58, 60.

This article details how to grow perennial plugs successfully. Included is a chart of dozens of perennial species, including number of weeks to finish, whether to cover the seed or not, and germination temperature. The article also discusses watering, media, and tray filling.

Web Sites:

<http://www.agric.gov.ab.ca/agdex/200/8183001.html>
Greenhouse Bedding Plant Production and Marketing web site from Alberta, Canada

<http://fbminet.ca/bc/pfp/flower.htm>
Enterprise budgets from British Columbia, Canada, for bedding plants, both purchased plugs grown out and self-propagated in flats and pots

<http://www.gov.on.ca/OMAFRA/english/crops/facts/94-061.htm>
Plug Transplants for Processing Tomatoes: Production, Handling and Stand Establishment

<http://www.msue.edu/msue/imp/mod21/master21.htm>
Commercial grower guides for bedding plants from Michigan State University

Suppliers of Plug Trays

Blackmore Co.
10800 Blackmore Ave.
Belleville, MI 48111
800-874-8660
<http://www.horticulture.com/blackmore/>

Dillen Products, Inc.
PO Box 738
Middlefield, OH 44062
440-632-0230
<http://www.dillen.com>

Growing Systems, Inc.
2950 N. Weil St.
Milwaukee, WI 53212
414-263-3131

Landmark Plastic Co.
1331 Kelly Ave.
PO Box 7646
Akron, OH 44306
330-785-2200
<http://www.horticulture.com/landmark/>

Lerio Corp.
PO Box 2084
Mobile, AL 36652
800-457-8112
<http://www.lerio.com>

Speedling
PO Box 7238
Sun City, FL 33586
800-426-4400

Summit Plastic Co.
PO Box 117
Tallmadge, OH 44278
800-814-3496
<http://www.summitplastic.com>

TLC Polyform, Inc.
13055 15th Ave. North
Plymouth, MN 55441
612-541-2240
<http://www.horticulture.com/TLC>

Winstrip
556 Jeffress Rd.
Fletcher, NC 28732
828-891-6226

Suppliers of Seeders

Blackmore Co.
10800 Blackmore Ave.
Belleville, MI 48111
800-874-8660
<http://www.horticulture.com/blackmore/>

Bouldin & Lawson
PO Box 7177
McMinnville, TN 37110
800-443-6398

Gleason Equipment by
Measured Marketing
395 N. Schuyler Ave.
Kankakee, IL 60901
815-939-9746

Growing Systems, Inc.
2950 N. Weil St.
Milwaukee, WI 53212
414-263-3131

Seed E-Z Seeder Inc.
E11290 Hwy. 12
Prairie du Sac, WI 53578
800-448-9371
<http://www.sezsdr.com>

Speed Seeder
Division of Carolina Greenhouses
PO Box 1140
Kinston, NC 28503

The electronic version of **Organic Plug & Transplant Production** is located at:
<http://www.attra.org/attra-pub/plugs.html>

**Prepared by Lane Greer
ATTRA Program Specialist
March, 2000**

The ATTRA Project is operated by the National Center for Appropriate Technology under a grant from the Rural Business-Cooperative Service, U.S. Department of Agriculture. These organizations do not recommend or endorse products, companies, or individuals. ATTRA is located in the Ozark Mountains at the University of Arkansas in Fayetteville at P.O. Box 3657, Fayetteville, AR 72702. ATTRA staff members prefer to receive requests for information about sustainable agriculture via the toll-free number 800-346-9140.



SUPPLIERS OF ORGANIC AND/OR NON-GE* SEEDS AND PLANTS

HORTICULTURE RESOURCE LIST

ATTRA is the national sustainable agriculture information center funded by the USDA's Rural Business -- Cooperative Service.

Abstract:: This list includes companies which can supply organic seed or have pledged not to knowingly sell genetically engineered seed. Some companies also offer a good selection of open-pollinated seeds and plants. A number of sources of organic grain seed are included.

Prepared by Katherine Adam

ATTRA Program Specialist

Kadam@ncatark.uark.edu

Updated February 2001

Introduction

For 2001 this list focuses on companies which can supply organic seed or have pledged not to knowingly sell genetically engineered (GE) seed. Although certified organic seed cannot be GE seed, many companies offer seed described as "substantially organic" or "raised by organic methods." Some offer seed from native plants that has been gathered from a "clean wild area." Most of the larger companies do not grow all of their own seedstock but rely on grower networks. Only one company advertises seed tested to make sure that it has not been contaminated by stray pollen from GE crops (see p. 5). It is ultimately up to the buyer to reach the level of assurance he desires by becoming familiar with the vendor's business operations.

Most companies can offer "untreated" seed, upon request. "Treated" seed usually applies to fungicide dusting of grains like corn, to facilitate earlier planting in cold soils.

Unlike hybrids, which may not produce plants true-to-type if seed is saved for the second year, open-pollinated seeds make seed saving for another year's crop easy for growers.

All but the smallest or most specialized seed vendors now utilize the internet, and more are coming on-line every year. ATTRA has made an effort, however, to find small, emerging and innovative seed suppliers that may not yet be on-line. Some websites that can provide more information on related topics are listed in **Additional Resources**.

The Safe Seed Pledge

"Agriculture and seeds provide the basis upon which our lives depend. We must protect this foundation as a safe and genetically stable source for future generations. For the benefit of all farmers, gardeners and consumers who want an alternative, we pledge that we do not knowingly buy or sell genetically engineered seeds or plants." (for full text, see contact below)

A coalition of seed companies from the U.S. and Canada has pledged not to knowingly buy or sell genetically engineered seeds. Signatories of the "Safe Seed Pledge" are so indicated. For more information please contact the individual company or see its catalog/website.

For information on Safe Seed Initiative programs on commercial biotechnology and the environment, contact:

Council for Responsible Genetics
5 Upland Road, Ste. 3
Cambridge, MA 02140
(617) 868-0870
(617) 491-5344 FAX
e-mail: crg@gene-watch.org
www.gene-watch.org

* Non-genetically engineered

Additional resources:

For an extensive database of species available from U.S. wholesale and retail sources, see <http://plantinfo.umn.edu/> (subscribe for full access).

For more seed vendors, search on <type of seed> with your browser. Sites will come up that are not directly accessible.

For a list which includes some additional seed suppliers (very small or specialized), see <http://www.cog.brown.edu/gardening/cat16/>

For comprehensive sourcing of propagation material for edible plants worldwide, see Facciola, Steven. 1998. *Cornucopia II: A Source Book of Edible Plants*. ISBN #09628087-25. 600+ p. (Contact trade and specialty publishers, especially on-line booksellers.)
This publication does not include websites.

For information on saving open-pollinated vegetable seed and grains, see Ashworth, Suzanne. 1991. *From Seed to Seed*. Seed Saver Publications, Decorah, IA. 222 p.
\$20 plus \$4 s/h.
Order from: 3076 N. Winne Road
Decorah, IA 52101

The American Open-pollinated Corn Breeders, a new organization, publishes *Corn Culture* for growers of open-pollinated corn :

Frank Kutka
ATTN: Corn Culture
127 Crownvetch Drive
Newfield, NY 14867
(607) 564-0278
e-mail: fk29@cornell.edu

For more information on perennial grain research, contact:

The Land Institute
2440 E. Water Well Road
Salina, KS 67401
(785) 823-5376
(785) 823-8728 FAX
www.landinstitute.org

(Also see Peters Seed and Research in the chart following – West region.)

Rural Advancement Foundation International provides news updates on genetic engineering and public policy at www.rafiusa.org.

Related ATTRA Publications

Suppliers of Plugs for Medicinal Herb Crops
Organic Plug and Transplant Production

The electronic version of **Suppliers Of Organic And/Or Non-GE* Seeds And Plants** is located at:
<http://www.attra.org/attra-pub/seedlist.html>

JS Seed Companies Offering organic and/or non-GE Seed

% seed organically grown	Rejects genetically engineered seed*	How to order	Catalog	Retail/ Wholesale	OTHER INFORMATION
Northeast					
Butterbrooke Farm, 78 Barry Road, Oxford, CT 06478, (203) 888-2000					
100%	Yes*	Mail	Send SASE for seedlist	Both	Non-hybrid hardy vegetable strains raised by cooperating farmers.
The Cook's Garden, P.O. Box 5010, Hodges, SC 29653-5010. (800) 457-9705 (orders, cust. Service) www.cooksgarden.com					
25-50%	Yes*	On-line, ph., mail	On-line, print	Both	Vegetable, flower, herb. Trial gardens in VT; order center in SC.
Dirt Works, 6 Dog Team Road, New Haven, VT 05472, (802) 453-5373, e-mail: jfmeshma@dirtworks.net www.dirtworks.net					
0%	Yes*	e-mail, ph., mail	On-line	Both	Grass seed for lawns, forages, and cover cropping
FEDCO Seeds, P.O. Box 520-A, Waterville, ME 04903, (207) 872-8317 (FAX), www.fedcoseeds.com					
11%	Yes*	Mail, FAX (no phone orders)	Request catalogs through website or send \$2.00.	Both.	Mainly wholesale seed co-operative. Separate catalogs for Moose Tubers division and Tree division.
Heirloom Seeds, P.O. Box 245, W. Elizabeth, PA 15088-0245, (412) 384-0852 (ph.&FAX), e-mail through website, www.heirloomseeds.com					
100%	Yes*	Mail	On-line, print \$1.00	Retail	\$1.00 refundable with order; free weekly internet newsletter.
High Mowing Organic Seeds, 813 Brook Road, Wolcott, VT 05860, (802) 888-1800, (802) 888-8446 FAX www.highmowingseeds.com					
100%	Yes*	On-line, mail FAX	On-line, print.	Retail	Biodynamically grown seed for the northeast and others; open-pollinated varieties.
Johnny's Selected Seeds, Foss Hill Road, Albion, ME 04910, (207) 437-4301, (207) 437-4395 (commercial), (800) 437-4290 FAX. E-mail: staff@johnnyseeds.com , www.johnnyseeds.com					
10%	Yes*	On-line, phone, mail	On-line, print.	Both	Medicinal herb section for commercial growers.
Landis Valley Associates, Heirloom Seed Project, 2451 Kissel Hill Road, Lancaster, PA 17601-4899, (717) 569-0401, (717) 560-2147 (FAX)					
—	Yes*	Mail, FAX	Print	Retail	Single packets of heirloom varieties of the PA Dutch. Newsletter.

New England Seed Co., 3580 Main Street, Bldg. 10, Hartford, CT 06120, (800) 783-7891 or (860) 724-1240, (860) 724-1273 FAX, E-mail: newenglsee@aol.com, www.neseed.com					
—	Yes*	Mail	Request catalog on-line or call	Both	Oldest seed company in the U.S. (before 1800). Very large selection of heirloom vegetable seeds.
North Wind Organic Seeds (formerly Arethusa Seed Farm), P.O. Box 175, Bakersfield, VT 05441, (802) 827-6580 (ph.&FAX), www.northwindorganicseeds.com					
100% (50% certified org.)	Yes*	mail	print	retail	Vegetables, flowers, herbs
Pepper Joe's, 1650 Pembroke Road, Norristown, PA 19403 (410) 628-0507 (FAX), e-mail through website www.pepperjoe.com					
100%	Yes*	On-line, mail	On-line, print (send SASE)	Retail	Heirloom seeds. Free newsletter Chile News & Views.
*Col. 2, denotes signatory of the Safe Seed Pledge					
Perennial Vegetable Seed Company, P.O. Box 608, Belchertown, MA 01007, (413) 529-0678, e-mail: EdibleForests@hotmail.com, www.perennialvegetable.com					
Some	Yes*	On-line, ph., mail	On-line, print	retail	Unique perennial vegetable seeds. Catalog \$1.00.
Pinetree Garden Seeds, P.O. Box 300, New Gloucester, ME 04260 (207) 926-3400, (888) 525-EEDS (order ph.), e-mail: superseeds@worldnet.att.net, www.superseeds.com					
T-5%	Yes	On-line, ph., mail	On-line, print	retail	Free catalog. Specializes in providing appropriate-size packets for home gardeners.
Pioneer Valley Seed Savers, 888 Shelburne Falls Road, Conway, MA 01341, (413) 369-4269, (413) 369-4299 FAX					
—	Yes*				
Thompson & Morgan, P.O. Box 1308, Jackson, NJ 08527, (800) 274-7333 (orders), (888) 466-4769 (orders), e-mail through website, www.thompson-morgan.com					
25%	Yes	On-line	On-line	Both	Note: separate catalogs for international and commercial; printed catalogs now available in UK only. Large selection, delivery worldwide (company based in UK).
Turtle Tree Seeds, Camphill Village, Copake, NY 12516, (518) 329-3038					
100%	Yes	mail	Supplier list	retail	Biodynamic. Catalog specifies location and identity of supplier for each variety.
WoodPrairie Farm, 49-29 Kinney Road, Bridgewater, ME 04735, (800) 829-9765 (order), (800) 631-8027 (cust. Serv.), (800) 300-6494 FAX, www.woodprairie.com					
100%	Yes*	On-line, e-mail, ph., fax, mail	On-line, print	retail	Organic seed potatoes.

South

Christopher Weeks Peppers, P.O. Box 3207, Kill Devil Hills, NC 27948, (252) 335-9353, e-mail: peppers@pinn.net

---	Yes*	mail	print	both	Large packs available; 10% discount orders over \$20.
-----	------	------	-------	------	-------------------------------------------------------

Florida Mycology Research Center, P.O. Box 18105, Pensacola, FL 32523, (850) 327-4378, e-mail: FMRC@webtv.net, www.mushroomsfmrc.com, www.fmrc.pensacola.com

0%	Yes*	mail	print	retail	5 sep. catalogs: \$10 ea. or all 5 for \$30.
----	------	------	-------	--------	----------------------------------------------

Garden Medicinals and Culinaries, P.O. Box 320, Earlysville, VA 22936, (804) 964-9113, (804) 973-8717, www.gardenmedicinals.com

0%	Yes*	On-line, mail, ph., fax	On-line	Both	Free catalog
----	------	-------------------------	---------	------	--------------

The Pepper Gal, P.O. Box 23006, Ft. Lauderdale, FL 33307-3306, (954) 537-5540, e-mail: peppergal@mindspring.com

---	Yes*	mail	seedlist	retail	200 varieties of hot, mild, and ornamental pepper seeds.
-----	------	------	----------	--------	----------------------------------------------------------

Seeds for the South, 410 Whaley Pond Road, Graniteville, SC 29829, (803) 232-1119, e-mail: seedsout@GroupZ.net

Unkno wn	Yes*	mail	Print catalog	retail	Heirloom seeds for the South.
-------------	------	------	---------------	--------	-------------------------------

Southern Exposure Seed Exchange, P.O. Box 460, Mineral, VA 23117, (540) 894-9480, (540) 894-9481 (FAX), e-mail through website, www.southernexposure.com

0%	Yes*	Mail	Search-able catalog on-line, print	Both	Print catalog \$1.00 (U.S. customers) if requested through website; otherwise \$2.00.
----	------	------	------------------------------------	------	---------------------------------------------------------------------------------------

Thomas Jefferson Center for Historic Plants, P.O. Box 316, Monticello, Charlottesville, VA 22902, (804) 984-9821, (804) 984-0358 FAX, www.monticello.org/shop/

Unkno wn	Yes*	On-line	On-line	Retail	Historic seeds, seed samplers, plants
-------------	------	---------	---------	--------	---------------------------------------

Tomato Growers Supply Co., P.O. Box 2237, Fort Myers, FL 33902, (941) 768-1119, (888) 768-3476 (order FAX), (888) 478-7333 (order ph.), www.tomatogrowers.com

0%	Yes	Mail, ph., FAX	On-line, print	retail	Heirloom tomato and pepper seeds.
----	-----	----------------	----------------	--------	-----------------------------------

Totally Tomatoes, P.O. Box 1626, Augusta, GA 30903, (803) 663-0016, www.totallytomato.com

0%	Yes	On-line, mail	On-line, print	retail	Free catalog.
----	-----	---------------	----------------	--------	---------------

North Central

Baker Creek Heirloom Seed Co., 2278 Baker Creek Road, Mansfield, MO 65704 (417) 924-8917 (ph. & FAX), e-mail: seeds@rareseeds.com, www.rareseeds.com

---	Yes*	mail	On-line, print	retail	Free catalog.
-----	------	------	----------------	--------	---------------

Borries Open Pollinated Seed Corn Farm, 16293 E. 1400 th Ave., Teutopolis, IL 62567, (217) 857-3377					
0%	Yes	phone	Info sheets	Both	4 var. O-P field corn; canteloupe, tomato
Companion Plants, 7247 N. Coolville Ridge Road, Athens, OH 45701, (740) 592-4643, (740) 593-3092 (FAX), e-mail: complants@frogn.net , www.companionplants.com .					
0%*	Yes	Mail, phone, fax, e-mail, on-line	On-line, paper (\$3.00 for 56-p.)	Retail	*Catalog states: Our beds were certified until 1995; without changing our practices, we have opted to forego certification due to the expense and paperwork.
Elixir Farm Botanicals, General Delivery, Brixey, MO 65618, (417) 261-2393, (417) 261-2355 (FAX), e-mail: efb@aristotle.net , www.elixirfarm.com					
100%	Yes*	mail	On-line, print	retail	Biodynamically certified organic seed of native and Chinese medicinal plants.
Island Seed and Supply, 19370 Hwy. G, Mineral Point, WI 53565, (608) 776-3414					
30%	Yes*	Mail, ph.	No catalog	Whole sale	Primarily wholesale or direct to growers. Experimental, works with growers around U.S., esp. Hawaii. Moving toward 100% organic.
Mellinger's Inc., 2310 W. South Range Road, North Lima, OH 44452, (800) 321-7444 (orders), (330) 549-9861, (330) 549-3716 FAX, e-mail: mellgarden@aol.com , www.mellingers.com					
0%	Yes*	On-line, mail, phone	On-line, paper	Both	
Morgan County Wholesale, 18761 Kelsay Road, Barnett, MO 65011, (573) 378-2655					
—	Yes*	Mail, phone	catalog	Retail & whole-sale	Vegetables, flowers. Supplies vendors at major farmers' market in NW Arkansas.
NC+ Organics, 3820 No. 56 th St., P.O. Box 4739, Lincoln, NE, (800) 279-7999, e-mail: organics@nc-plus.com , www.ncorganics.com					
some	Yes*	On-line	Check availability on-line	Whole -sale	Seeds tested for non-GMO verification. Some varieties of corn are certified organic; all other corn (plus grain sorghum, sudan, soybean, and alfalfa) are untreated.
Sand Hill Preservation Center, 1878 230 th St., Calamus, IA 52729, (319) 246-2299, (563) 246-2299 (after March 4, 2001).					
90%	Yes*	mail	print	retail	Ships January 1 to Aug. 15. (Please, no calls on Sun. or Mon. or after 9:45 p.m.). Good selection of sweet potato varieties in 2001.

Seed Savers Exchange/Seed Savers Heirloom Seeds & Gifts, 3076 North Winne Road, Decorah, IA 52101, e-mail: sse@salamander.com, (319) 382-5990 (orders), (319) 382-5872 (FAX orders), www.seedsavers.org .					
10%	Yes*	On-line, ph., FAX, mail	On-line, paper	Retail packets	Retail branch of largest US seed exchange.
Underwood Gardens, 1414 Zimmerman Road, Woodstock, IL 60098, e-mail: info@underwoodgardens.com , www.underwoodgardens.com					
0%	Yes*	Mail, e-mail, fax (no ph. sales)	Print, on-line (searchable)	retail	\$3 for catalog.
West					
Abundant Life Seed Foundation, P.O. Box 772, 930 Lawrence St., Port Townsend, WA 98368, (360) 385-5660, (360) 385-7455 FAX, e-mail: abundant@olypen.com . web: csf.colorado.edu/perma/abundant/					
Some	Yes*	Mail, ph., FAX, e-mail	On-line, print	Both	Catalog \$2.00. Seeds of the northwest Pacific rim. Publishes newsletter <i>Seed Midden</i> .
Bountiful Gardens, 18001 Shafer Ranch Road, Willets, CA 95490, (707) 459-6410, (707) 459-1925 (FAX), e-mail: bountiful@sonic.net . www.bountifulgardens.org .					
**	Yes*	Mail, phone, fax, e-mail	On-line, print	Both	**offers bio-intensive and Grow Bio-intensive "substantially organic" seed. Rare grains, herbs, compost crops, European heirlooms. Affiliated with Ecology Action.
Environmental Seed Producers, P.O. Box 2709, Lompoc, CA 93438, (805) 735-8798, www.espseeds.com					
0%	Yes*	phone	On-line	Whole-sale	Wildflower seed
Filaree Farm, 182 Conconully Hwy., Okanogan, WA 98840, (509) 422-6940, e-mail: filaree@northcascades.com , www.filareefarm.com					
100%	Yes*	mail	print	Both	Garlic. Wholesale is by contract.
Fungi Perfecti, P.O. Box 7634, Olympia, WA 98507, (360) 426-9292, (360) 426-9377 FAX, www.fungi.com					
100%	Yes*	On-line, Mail, fax	On-line, Print	both	Gourmet & medicinal mushroom technologies
Garden City Seeds, P.O. Box 204, Thorp, WA 98946, (509) 964-7000, (800) 964-9210 FAX					
30%	Yes	Mail, fax	On-line, paper	Both	Flower and medicinal herb seeds for the Far North
High Altitude Gardens and Seeds Trust, 4150 Black Oak Drive, Hailey, ID 83333, (208) 788-4363, (208) 788-3452, e-mail: mcdorman@seedsave.org , www.seedsave.org , www.seedstrust.com					
50%	Yes*	On-line, mail	On-line, print	retail	Specializes in varieties for high elevations/short seasons.

Horizon Herbs, P.O. Box 69, Williams, OR 97544, (541) 846-6704, (541) 846-6233 FAX, e-mail: herbseed@chatlink.com, www.chatlink.com/~herbseed/					
100%	Yes*	On-line, mail, ph, FAX	On-line, print	Both, plus line of store packets	Strictly Medicinal® line of herb seeds and plants
Irish Eyes, Inc., P.O. Box 307, Thorp, WA 98926, (509) 964-7000, (800) 964-9210, e-mail: potatoes@irish-eyes.com. www.irish-eyes.com.					
40%	Yes*	On-line, mail	On-line, print	Both	Now a division of Garden City Seeds
Mountain Valley Growers, 38325 Pepperwood Road, Squaw Valley, CA 93675 (559) 338-2775, www.mountainvalleygrowers.com					
100%	Yes	mail	On-line	Both	300 varieties herbs/perennials. Plants. 300 p. catalog free to US growers.
Native Seeds/SEARCH, 526 N. 4 th Ave., Tucson, AZ 85705, (520) 622-5561, (520) 622-5591, e-mail: nss@azstarnet.com, www.nativeseeds.org					
100%	Yes	FAX, mail	On-line, print	retail	Non-profit organization with native/traditional seeds of th Southwest. Newsletter and publications. Several seasonal catalogs.
The Natural Gardening Co., P.O. Box 760776, Petaluma, CA 94975-0776, (707) 766-9303, (707) 766-9747 (FAX) e-mail through website, www.naturalgardening.com					
	Yes	mail	On-line, print	retail	Organically grown tomato seedlings; seeds of heirloom varieties.
Nichols Garden Nursery, 1190 No. Pacific Hwy. NE, Albany, OR 97321, (541) 928-9280 or (800) 422-3985, (866) 408-4851, (800) 231-5306, (541) 967-8406 FAX, e-mail: nichols@gardennursery.com. www.nicholsgardennursery.com.					
0%	Yes*	On-line, mail, phone	On-line, print	Both	Large selection of herbs, unusual varieties, regionally adapted varieties. Some organic value-added products.
Paradise Gardens Rare Plant Nursery, RR 1, Box 488-B, Bionners Ferry, ID 83805, (253) 981-1506 FAX, e-mail: paradisegds@yahoo.com					
100%	Yes*	Mail, FAX, e-mail	print	retail	Catalog \$2.00 (free to members of certain plant societies), can't take credit cards. Mostly fragrant/rare/unusual perennials, but large stock of culinary herbs and unusual gourmet vegetables.

Peters Seed & Research, P.O. Box 1472, Myrtle Creek, OR 97457, (541) 874-2615, (541) 874-3462 FAX, e-mail: psr@pioneer-net.com.

—	Yes*	mail	On-line (under development) , print	Both	Wholesale by advance contract. Most seed produced on research farm. Co. aims to preserve and make available genetic material, especially perennial grains, that fills unique niches to make small farmers competitive.
---	------	------	-----------------------------------------------	------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Plants of the Southwest, Agua Fria Road, Route 6, Box 11A, Santa Fe, NM 87501, (800) 788-7333 (orders), (505) 438-8800 (FAX), (505) 471-2212 (customer service), e-mail through website, www.plantsofthesouthwest.com

90%	Yes	On-line, FAX, phone	On-line, print	Both	Website features 130 native wildflowers; also herbs, vegetables. Print catalog \$1.00.
-----	-----	------------------------	-------------------	------	----------------------------------------------------------------------------------------

Redwood City Seed Co., P.O. Box 361, Redwood City, CA 94064, (650) 325-7333. www.batnet.com/rwc-seed

0%	Yes	Mail only (no credit card or ph. orders)	On-line, free paper catalog	retail	Native seeds, open-pollinated vegetables. Pamphlets. EcoSeeds™.
----	-----	------------------------------------------------	--------------------------------	--------	-----------------------------------------------------------------

Seeds of Change, P.O. Box 15700, Santa Fe, NM 87506, (888) 762-7333 (orders), (505) 438-7052, e-mail: gardener@seedsofchange.com, www.seedsofchange.com

100%	Yes*	On-line (5% dis- count). Phone	On-line, print	retail	Some wildcrafted. Free catalog.
------	------	-----------------------------------	----------------	--------	---------------------------------

Sourcepoint Organic Seeds, 1349 2900 Road, Hotchkiss, CO 81419, (970) 872-4941.

100%	Yes	mail	seedlist	retail	Seedlist \$3.00. Cereal grains, legumes, vegetables, herbs, fruit, flowers, and trees. Some seeds gathered from clean wild areas. Seeds raised in a "highly charged matrix of energies" in the Intermountain West.
------	-----	------	----------	--------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Thunderfoot/Earthworks-Sow Organic Seeds, P.O. Box 527, Eugene, OR 97544, (888) 709-7333 (orders), e-mail: organic@organicseed.com, www.organicseed.com

100%	Yes	On-line, phone	On-line (no printed catalog)	retail	Recent merger. Primarily for Pacific NW.
------	-----	----------------	------------------------------------	--------	------------------------------------------

Sunnyland Seeds, P.O. Box 385, Paradox, CO 81429 (970) 859-7248

100%	Yes*	Mail	print	retail	Native seeds of the Southwest.
------	------	------	-------	--------	--------------------------------

Territorial Seed Co., P.O. Box 157, Cottage Grove, OR 97424-0061, (541) 942-9547, (888) 657-3131 (toll-free FAX), e-mail: tertrl@srvl.vsite.com, www.territorial-seed.com.

—	Yes*	On-line, fax	On-line, print	retail	Vegetable cultivars for the Pacific Northwest. \$1.00 for catalog plus SASE. 80% American cultivars, some Central American.
---	------	--------------	----------------	--------	--------------------------------------------------------------------------------------------------------------------------------

Threshold Seeds Sowing Circle, 95084 Cherry Ridge Lane, Myrtle Point, OR 97458, (541) 572-3317.					
100%	Yes	Seed exchange for biodynamic growers in the Pacific Northwest only.	No printed catalog.	Very small quantities.	Apply for membership. Non-members try Turtle Tree Seeds. Seeds available after February 2001.
Victory Seed Co., P.O. Box 192, Molalla, OR 97038, (503) 829-3126 (ph.&FAX), e-mail: safeseed@victoryseeds.com, www.victoryseeds.com					
0%	Yes*	On-line, mail	Print, on-line (searchable)	Retail	Catalog \$2.00. Newsletter.
Wild Garden Seed, P.O. Box 1509, Philomath, OR 97370, (541) 929-4068.					
100%	Yes*	mail	print	Both	2 free seedlists (50 var. for gardeners, native seeds), \$5 for full catalog. Specializes in breeding for organic farming systems, esp. salad greens and plant pigments. All business by mail or phone. No sales outside Pacific NW bioregion

THE ATTRA PROJECT IS OPERATED BY THE NATIONAL CENTER FOR APPROPRIATE TECHNOLOGY UNDER A GRANT FROM THE RURAL BUSINESS-COOPERATIVE SERVICE, U.S. DEPARTMENT OF AGRICULTURE. THESE ORGANIZATIONS DO NOT RECOMMEND OR ENDORSE PRODUCTS, COMPANIES, OR INDIVIDUALS. ATTRA IS LOCATED IN THE OZARK MOUNTAINS AT THE UNIVERSITY OF ARKANSAS IN FAYETTEVILLE AT P.O. BOX 3657, FAYETTEVILLE, AR 72702. ATTRA STAFF MEMBERS PREFER TO RECEIVE REQUESTS FOR INFORMATION ABOUT SUSTAINABLE AGRICULTURE VIA THE TOLL-FREE NUMBER 800-346-9140.

Medicinal plant could prove to be viable alternative crop in Illinois

URBANA, Ill. — With the right equipment, St. John's Wort could be a viable alternative crop for Illinois farmers, according to Donald Briskin, University of Illinois professor of plant physiology.

The perennial medicinal plant St. John's Wort has become increasingly popular as a dietary supplement to treat mild to moderate depression. More than 40 clinical studies show that compounds in St. John's Wort produce positive effects on mood enhancement with fewer side effects than synthetic antidepressants.

Most of the St. John's Wort used for dietary supplements is grown in Third World countries, although the plant is abundant in the United States. Many states consider St. John's Wort to be a noxious weed.

"It is easy to grow and grows in very marginal conditions, which is why St. John's Wort is potentially useful as an alternative crop," Briskin said. "Farmers could make money on land that they have to pay taxes on but doesn't normally yield any income."

Briskin is one of the few researchers nationwide looking at the environmental conditions that increase the desired medicinal compounds in the plants and the most effective post-harvest processing methods. When St. John's Wort is grown using a "food crop philosophy" — a lot of water, fertilizer and light the level of beneficial compounds in the plant is low.

Production of beneficial compounds in St. John's Wort and other medicinal plants is related to stress, Briskin said. The plants

produce chemicals as a defense mechanism to ward off biological pathogens or insects, or to attract pollinating organisms, such as birds and bees.

"Under stressed conditions, this plant will produce more chemicals to protect itself," Briskin said. "That's why if you grow a medicinal plant like a houseplant, it will look

beautiful with tons of plant material, but there may be very low levels of active chemicals because they are not needed when the environment readily supplies all the right conditions for plant growth."

When the plant reaches the flowering stage, it is chopped off at the base and dried. The typical drying method is sun drying. In his

laboratory, Briskin found that sun drying results in a 70 percent loss of the beneficial chemicals. The best drying method is oven drying in 70 degrees C. with air blowing to retain 99 percent of the chemicals, Briskin said.

Pharmaceutical companies will only purchase the extraction from dried plant material. If farmers

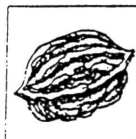
were to produce and sell St. John's Wort, they would need extraction equipment.

"We could give farmers instructions for growing conditions to get very high quality St. John's Wort, but they won't have anybody to sell it to," Briskin said. "We're trying to find a solution."

Specialty Crops



An odd-shaped corner or hillside may provide opportunities for income diversification through planting nut or fruit trees, Christmas trees, a maple sugar grove, floriculture, mushrooms or medicinal plants — if you have a local market for these crops. Help and advice from professionals is a must in order to be successful with specialty crops.



Nuts

Nuts in commercial demand include almonds, chestnuts, hazelnuts, heartnuts, hickory, pecans, and walnuts. Some nut tree species also have high value for timber and veneer use — an income bonus as trees are thinned or replaced.

Most commercial nut production is in the eastern, southern and southwestern states, where winter temperatures are moderate. Ideal sites include stream bottoms, flood plains, or odd corners of land. Many nut species are soil sensitive, preferring river terraces and other areas where silt has collected over the years. Some nut trees are susceptible to injury from herbicides, and care must be taken to avoid spray drift from nearby chemical use.



Christmas Trees

A wide variety of pine, fir and spruce are all popular as Christmas tree species. A successful Christmas tree plantation requires:

- Planting new trees each spring to produce sustainable crops year after year.
- Pruning trees annually until they are harvested (about six years minimum) to help them develop marketable shapes.
- Controlling weeds and grass, and minimizing rodent damage.
- Harvesting and marketing your trees in November and December of each year.

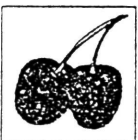
Before planting, check with your state forester or Christmas tree association about the market for Christmas trees in your area. Some local markets are saturated.



Maple Syrup

Black and sugar maples, native to the northeastern U. S. and parts of Ontario and Quebec, yield a sap prized for its flavor. A sugar maple grove needs many trees of tappable size (over 10 inches in diameter). Sap flow is triggered in early spring by days above freezing and nights below freezing, lasts about

4 to 6 weeks, and ends when buds swell and produce a less desirable flavor in the syrup. Each tap produces an average of 10 gallons of sap per season, which in turn yields about one quart of syrup.



Fruit

The best quality fruit is produced on relatively young trees. Modern orchard practice uses younger dwarf trees, often replacing them at age 40. In general, trees must be spaced far enough apart to allow sunlight to reach the lower branches, with enough room for spraying and cultivating equipment to work.

Good nursery stock is the foundation of a good orchard. For fruit varieties that are not self-pollinating, another variety in the same orchard may be needed for proper pollination.

STRAWBERRIES

BLUE BERRIES

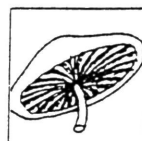
CUCUMBERS / GOURDS



Floriculture

Windbreaks, riparian filter strips, and odd pieces of land can sometimes be used to grow plant materials for the floricultural industry or plant stock for sale by nurseries. Some shrubs, such as pussy willow, corkscrew willow, and red osier dogwood, have branches that can be clipped off and harvested for use

by florists. Again, finding a local market is important before attempting crops for the floricultural industry.

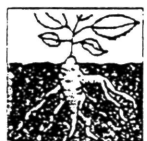


Forest Mushrooms

Shiitake, or "forest" mushrooms, are used by gourmet restaurants for their nutty flavor and unusual appearance. They are also valued for their medicinal properties, with some studies showing a decrease in cholesterol levels for persons eating them.

Originally from Japan, these mushrooms are grown on logs cut late in the winter from hardwood trees. The logs are drilled and the holes packed with pre-injected wooden dowels or sawdust filled with fungal spawn. The holes are then sealed with wax or foam and the logs are "incubated" in cribbed stacks so that the fungus can penetrate throughout the log. The mushrooms appear through the bark or ends of the log. Like most mushrooms, shiitake thrives in a cool, damp climate, and are grown most successfully at sites that provide shade and are relatively cool and damp all year. Low-lying woodlands near streams are often suitable.

Harvesting normally continues for weeks or months, and in some areas two crops per year can be produced. Associations have been formed in many states for marketing purposes.



Medicinal Plants

Existing hardwood timber stands can provide shade to grow native medicinal plants such as ginseng or golden seal for the growing traditional medicine market. Ginseng, used as a general health tonic for more than 4,000 years, generates more than \$5 million in Kentucky alone. Golden seal, widely used in Native

American medicine, is specifically used for eye ailments but is also used as a tonic and as a diuretic stimulant. Some medicinal plants require four to five years to reach maturity, but collecting and selling seed during the years prior to maturity can provide some interim income. While production is usually labor intensive rather than capital intensive, 1986 studies indicate that it is possible to gross \$6,000 from a one-tenth acre ginseng plot in four to five years.

Two Important Keys to Success

"Ya gotta know the territory"

Markets for these and other specialty crops can be fickle, and can vary widely in different regions of the country. Before embarking too far down the road on a specialty crop, be sure that a market exists.

Get help from those in the know

If you are considering any specialty crop, the help of experts will save much time and expense. Depending on the crop, enlist the assistance of a consulting forester, arborist, extension agent, a current grower, or specialists from nearby universities or colleges.

For technical assistance in planning Specialty Crops, contact your nearest State Forester, Soil Conservation Service, County Extension Service, or Soil and Water Conservation District office.

For your free *Conservation Trees For Your Farm, Family & Future* booklet, write



The National Arbor Day Foundation
Nebraska City, Nebraska 68410

1998

Pharmacia & Upjohn Company
Allergon Division
P. O. Box 693
Carthage, MO 64836

417-358-9710

Below is a list of species that are frequently used in the manufacture of allergy related products.
Most are Missouri natives or relatively common introduced species.

POLLEN SPECIES LIST

Scientific Name	Common Name	Flowering Dates (month)
<i>Acer negundo</i>	Box elder	4-5
<i>Acer saccharinum</i>	Silver maple	2-3
<i>Acer saccharum</i>	Sugar maple	4
<i>Acer rubrum</i>	Red maple	4
<i>Betula nigra</i>	River birch	4-5
<i>Corylus americana</i>	Hazelnut	3-4
<i>Fraxinus americana</i>	White ash	4-5
<i>Fraxinus pennsylvanica</i>	Green ash	4-5
<i>Juglans nigra</i>	Black walnut	4-5
<i>Juniperus virginiana</i>	Eastern red cedar	3-4
<i>Morus rubra</i>	Red mulberry	4-5
<i>Ostrya virginiana</i>	Eastern hop hornbeam	4-5
<i>Populus alba</i>	White poplar	4-5
<i>Populus deltoides</i>	Eastern cottonwood	4-5
<i>Quercus alba</i>	White oak	4
<i>Quercus rubra</i>	Northern red oak	4-5
<i>Salix nigra</i>	Black willow	4-5
<i>Tilia americana</i>	Basswood or Linden	5-6
<i>Ulmus americana</i>	American elm	2-3
<i>Ulmus pumila</i>	Siberian elm	2-3
<i>Amaranthus tamariscinus</i>	Common water hemp	6-8
<i>Ambrosia trifida</i>	Giant ragweed	8-9
<i>Melilotus alba</i>	White sweet clover	5-6
<i>Rosa multiflora</i>	Multiflora rose	5-6
<i>Sorghum halepense</i>	Johnson grass	6-7
<i>Xanthium commune</i>	Cocklebur	8-9

IRONWOOD

Hop Hornbeam

4-5

#1.90



United States
Department of
Agriculture

Cooperative State
Research Service

Office for
Small-Scale Agriculture



A Small-Scale Agriculture Alternative

Herbs

The term "herbs" here means plants not used solely as vegetables or ornaments. They serve partly or mainly for culinary, cosmetic, industrial, medicinal, landscaping, decorative, and incense or fragrance-emitting purposes.

They include vegetables such as garlic, flavoring items such as red peppers or mint, decorative flowers such as roses, various oilseed shrubs, ground cover such as lemon thyme or perennial chamomile, edible flowers such as nasturtiums, trees such as the linden or bay, and plants such as chrysanthemums that may be used in alternative pesticides.

Herbal processed products include fresh and dried flowers, leaves, barks, roots, and seeds, dried, ground, or dissolved powders; essential oils (as distinguished from petroleum or synthetic oils); and oleoresins, naturally occurring mixtures of oil and resin. Among products are condiments, spices, or food seasonings; teas; dyes; cosmetic products; and so-called health foods.

The competition is intense in producing and marketing herbs. Producers range from giant corporations to small-scale entrepreneurs and hobbyists.

One challenge facing producers is that no chemicals are authorized by the Environmental Protection Agency for use in combating pests on herbs. Producers should be familiar with pesticide-free farming methods. Unless they can certify their products to be chemical free, growers may find wholesalers don't want their products.

Overproduction or shortages can affect herb prices, sometimes dramatically, because herbs represent such a small proportion of total food consumption. Mark Blumenthal, editor of the quarterly *Herbalgram*, notes that enough tarragon could be produced on just 250 acres to take care of U.S. needs for a year. Excessive production of catnip once brought sharp price drops. On the other hand, shortages can arise overnight and escalate prices. That's what happened after the recent nuclear plant disaster in the Soviet Union.

There has been "an incredible upturn of interest" in herbs, says Portia Meares, former editor and publisher of *The Business of Herbs*, one of few if not the only U.S. herb-trade newsletter. (Published

every 2 months, by Paula and David Oliver, North Wind Farm, Route 2, Box 246, Shevlin, MN 56676, its subscription rate is \$20 a year.

Only 200 people were expected when a trade group, International Herb Growers and Marketers Association (IHGMA), was formed in 1986 at an Indianapolis, Indiana, meeting. More than 600 appeared. Note: The group picked a broker, not a grower, as president. Officers expect membership to climb considerably.

Blumenthal also has noted an upsurge in requests for information. His *Herbalgram*, (512-331-4244) (available for \$25 a year) is supported by the American Botanical Council and the Herb Research Foundation, P.O. Box 201660, Austin, TX 78720.

Julie Macksoud, executive director of the Herb Society of America, publisher of the annual *Herbarist*, says she receives 4,000 letters a year. About 20 percent of the writers want to grow and market herbs commercially. (The *Herbarist* is available for \$5 a year from the Society, nonprofit and educational in nature, at 2 Independence Court, Concord, MA 01742.)

Fresh-Cut Herbs

For the small-scale entrepreneur, the best chance of competing may be in the fresh-cut herb business. A market must be found and there are many, such as a major wholesale produce or farmers' market. A prospective producer might contact produce managers of supermarkets, salespeople handling such specialty items as potted plants, or the owners of gourmet or ethnic-background restaurants. What herbs do they buy? At what prices? On a long-term basis? Magazines, newspapers, and other media note food trends and interests.

A prospective producer might consider marketing through his or her own mail-order business. Many home gardeners and others buy that way.

An information source is Julie E. Stewart at the Produce Marketing Association (PMA) (1500 Casho Mill

Road, Newark, DE 19714-6036; telephone 302-738-7100). She can provide herb market bibliographies to nonmembers of PMA for \$20 (the search fee) plus \$10 for computer page printouts of up to 10 pages, plus \$1 per additional page.

Much about pricing and marketing fresh-cut herbs can be learned from the Agricultural Marketing Service (AMS) of the U.S. Department of Agriculture (USDA). The AMS Fruit and Vegetable Division's Market News Branch provides daily reports on some fresh-cut herb prices and shipment sizes, mainly from New York City, Boston, Miami, San Francisco, and Los Angeles, centers of greatest herb use. But herb greens also are sold in the other 15 AMS reporting centers: Atlanta, Baltimore, Buffalo, Chicago, Cincinnati, Columbia (SC), Dallas, Denver, Detroit, Honolulu, New Orleans, Philadelphia, Pittsburgh, Seattle, and St. Louis. (Write: W. H. "Bill" Crocker, Room 2503-S, AMS, USDA, Washington, DC 20250, for lists of other types of reports and subscription prices.)

AMS provides reports on prices and supplies of "miscellaneous herbs," which are fresh-cut and whose leaves are usually used for flavoring, such as arugula ("rocket salad," to the trade), basil, chives, cilantro (also known as coriander, parsley, and Spanish or Chinese parsley), chervil, dill, marjoram, mint, oregano, rosemary, sage, savory, sorrel, tarragon, thyme, lemon thyme, and watercress. Also listed as an herb is the confusingly named anise, which Green Grocer Joe Carcione says is a close relative of fennel, bulbous fennel, Florence fennel, or finocchio. It is generally boiled with its bulbous lower section like a vegetable and its leaves are not used for flavoring, as is the case with anise hissoop, a kind of mint. (A third anise, sometimes classed as an umbellifera because of its relationship to dill, angelica, and celery, is *Pimpinella anisum*, a flavoring seed producer.) Some herbs used for their roots, such as ginger, are listed by AMS as oriental vegetables, but the horseradish (root) is sometimes listed as an herb. Herbs such as garlic, onions, parsley, and hot peppers also are priced but are listed as plain vegetables.

A majority of the fresh-cut herbs in the

United States come from California, Texas, or Florida, but some items come from other States. Some are imported at very competitive prices.

Processed Herbs

Prices for processed herbal products vary widely. The import prices usually are so low that they readily compete with U.S. products. In 1986 there was no domestic competition for imported rose oil (attar of roses) at \$2,766 per kilogram (kg). Despite growing competition from synthetic oils, imports have been increasing for other essential oils. These include onion and garlic oil (imports from China run about \$100 per kg); cedarwood, clove, and nutmeg oil; and begmot, citronella, grapefruit, neroli, origanum, palmarosa, pine, patchouli, peppermint, petitgrain, and rosemary. But U.S. companies also export orange, lemon, peppermint, spearmint, and other essential oils. Most of their domestic production already is contracted.

Information on U.S. trade and the world situation for many processed products from herbs and spices may be obtained from *Spice and Essential Oil* circulars of USDA's Foreign Agricultural Service (FAS) at an annual subscription rate of \$5 for three issues. (Write to FAS, Information Division, Room 4644-S, Washington, DC 20250-1000.)

Dr. James A. (Jim) Duke, botanist of the Germplasm Introduction and Evaluation Laboratory, USDA's Agricultural Research Service, suggests study of the *Chemical Marketing Reporter* (Schnell Publishing Company, 100 Church Street, New York, NY 10007) for the latest continuing data on processed herb prices and dealers. The publishers also issue an annual, *Oil, Paint and Drug Chemical Buyers Directory*, listing dealers.

Varietal Selection

Among many challenges in the herb business is varietal selection. Some seeds do not produce the crop desired. That's one reason why many herbs should be started from cuttings rather than seeds, advise both Duke and Thomas DeBaggio, herb grower in Arlington, Virginia, and an editor of *The Herb, Spice and Medicinal Plant Digest*.

For example, "oregano" seeds sold by some companies may not produce

plants of culinary use quality. While many kinds of lavender may be grown from seeds, plants so grown will not produce quality oil. Cuttings should be obtained from a reliable dealer and useful plants distinguished from the useless.

Growing Methods

The Herb, Spice and Medicinal Plant Digest is a quarterly devoted mainly to improving growing methods. It also reports on postharvest handling. Besides DeBaggio, other co-editors are Dr. James E. Simon, an assistant professor in the Department of Horticulture at Purdue University (West Lafayette, IN 47907) and Dr. Lyle E. Craker, a plant physiology professor. (The digest is available at \$6 a year, with checks to be made payable to the University of Massachusetts, in care of L. E. Craker at the Department of Plant and Soil Sciences, Stockbridge Hall, University of Massachusetts, Amherst, MA 01003).

Although many herbs flourish outdoors, prospective producers should seriously consider a greenhouse. Construction costs from \$10 to \$40 per square foot, depending on location and equipment. Expert advice is essential.

Ginseng is an herb that can be grown outdoors in many parts of the country. More than 90 percent of the U.S. ginseng harvest is exported, mostly to the Orient, to become herbal tea, which in turn is shipped back to the United States. Several problems with growing ginseng are noted in a chapter of the 168-page publication called *ADAPT100*. (The book is available for \$12.95 including postage from P.O. Box 10652, Des Moines, IA 50336.) It was published by *Successful Farming* magazine as an outgrowth of its 1986 conference on agricultural diversification.

Other Information Sources

Other sources of information about herbs of all kinds include the Horticulture Information Center of USDA's National Agricultural Library (NAL), Beltsville, MD 20705; the nearest county Cooperative Extension Service office; and the State university and its horticulture specialists.

Persons wishing to see a great variety of living herbs might visit the U.S. National Arboretum, part of USDA's

Agricultural Research Service, Washington, DC 20002. There, Holly Shimizu is curator of the National Herb Garden. Sponsored by the National Herb Society in 1965, it is the largest such formal garden in the world. Shimizu regularly schedules workshops in cooperation with local herb groups.

To learn about herbs which also can be considered wildflowers, interested persons can contact the National Wildflower Research Center (not a Government agency), which has directories of wildflower suppliers and specialists for every State. (To obtain information, include a self-addressed, legal-sized envelope affixed with 56 cents in stamps to 2600 FM 973 North, Austin, TX 78725.)

Simon and Craker also are editors-in-chief of an annual review, *Herbs, Spices and Medicinal Plants: Recent Advances in Botany, Horticulture and Pharmacology*. Volumes I and II are available at \$65 apiece (clothbound). Volume III is to be available early in 1988 from Oryx Press, 2214 N. Central at Encanto, Phoenix, AZ 85004.

Simon also issues a bibliography of production information for commercial vegetable growers, which lists two books: *Herbs*, by J. V. Crockett and O. Tanner, Time-Life Books, Inc., from the Silver Burdett Company, Morristown, NJ 07960; and *How to Grow Herbs*, edited by P. Edinger, a Sunset book from Lane Books, Menlo Park, CA 94025.

The Purdue University Cooperative Extension Service's horticulture department also publishes *Guide to Production Information for Commercial Vegetable Growers* that has a list of other information sources on practical vegetable production. It is available to new as well as experienced producers.

Prepared by George B. Holcomb of the Office of Information, U.S. Department of Agriculture, for USDA's Office for Small-Scale Agriculture (Howard W. "Bud" Kerr, Jr., Program Director). The address is: Office for Small-Scale Agriculture, Cooperative State Research Service, USDA, Room 342-D, Aerospace Building, Washington, DC 20250-2200. (Telephone: 202-401-4640 or Fax: 202-401-5179)

Slightly Revised, October 1991

* U.S. G.P.O.: 1991-281-066: 40503/OPA

American Botanicals

Allen Lockard, President



Main Office

Missouri: 573/485-2300
P O Box 158 • Co Rd FF
Eolia, Mo: 63344
Mon - Fri — 8:00 - 4:00
Summer: Sat 8:00 - 12:00

Southern Missouri: 573/485-2303

P O Box 40 • 5 Mi. South on Hwy. 21
Ellington, Mo. 63638
Mon - Fri — 8:00 - 4:00
Summer: Sat 8:00 - 12:00

We Purchase Herbs Throughout the USA. — Contact Our Office For Dealers Near Your Area.

CHANGE OF ADDRESS OR CORRECTIONS

NOTIFY US IF YOU HAVE A CHANGE OF ADDRESS OR CORRECTIONS. WE MUST HAVE THE EXACT, COMPLETE ADDRESS (NAME - BOX NUMBER - STREET NUMBER - CITY - STATE - ZIP) TO ENSURE THAT YOU WILL RECEIVE A PRICE LIST.

RECOMMENDED PRACTICES FOR HARVESTING PLANTS

- I) OBEY THE LAWS OF NATURE, USE COMMON SENSE COLLECTING BOTANICALS.
- II) OBEY ALL FEDERAL, STATE, AND LOCAL LAWS REGARDING HARVESTING OF PLANTS.
- III) DO NOT TRESPASS, OBTAIN PERMISSION FROM LANDOWNERS AND PERMITS FROM LOCAL AUTHORITY. (IT SOMETIMES HELPFUL TO EXPLAIN TO LANDOWNERS MANY OF THE PLANTS WE HARVEST ARE CONSIDERED WEEDS AND MANY ARE PERENNIAL, THAT CAN BE HARVESTED EVERY YEAR.)
- IV)
 - A) WHEN HARVESTING HERBS, LOOK FARTHER FOR LARGER STAND FROM WHICH TO HARVEST.
 - B) HARVEST SMALL QUANTITIES AND REPLACE FOLLIAGE AND DIRT AROUND THE HARVESTED ARE.
 - C) LEAVE 20% OF THE PLANTS INTACT TO GROW AGAIN AND LEAVE MATURE SEED PRODUCING PLANTS TO SEED DOWN SHAPE.
- V) RESEED AS YOU HARVEST.
- VI) WHEN COLLECTING HERBS, DO NOT PULL THEM OUT OF THE GROUND, CUT THE MOFF AND LEAVE THE ROOT SYSTEM IN THE GROUND FOR REGROWTH.

ROOT CROPS WHEN DIGGING ROOT CROPS, LEAVE ROOTLETS AND BROKEN ROOTS IN THE GROUND. THE DIGGING AREATES THE SOIL AND THIS HELPS REGROWTH.

DO NOT DIG IN THE PATCH EVERY YEAR, ROTATE YOUR STANDS AND ALLOW REGROWTH. MANY PLANTS WILL REGROW IN THREE YEARS.

LEAVES

SOME SEASONS IT IS POSSIBLE TO COLLECT TWO CROPS OF LEAVES FROM THE SAME TREE OR BUSH PRUNING USUALLY INCREASES HEAVIER GROWTH FOR THE NEXT SEASON.

GOOD WILD CRAFTING PRACTICING INCREASES PLANT POPULATION INSTEAD OF DECREASING THEM.

1996 SPRING PRICE LIST

THE NUMBER IN BRACKETS () BESIDE EACH ITEM IS THE PAGE NUMBER THAT THE RESPECTIVE ITEM IS LISTED ON IN THE BOOK, "A GUIDE TO MEDICINAL PLANTS OF THE U. S.", WHICH SELLS FOR \$15.00 — POSTAGE PREPAID. THE NUMBER IN BRACKETS < > IS LISTED IN THE BOOK "PETERSON FIELD GUIDE EASTERN/CENTRAL MEDICINAL PLANTS", WHICH SELLS FOR \$18.00 — POSTAGE PREPAID.

THE ITEMS LISTED IN BOLD TYPE ARE IN GOOD DEMAND

PRICES ARE SUBJECT TO CHANGE WITH NOTICE			PER DRY LB.		PER DRY LB.
BAYBERRY RT. BK	(155)	<254>	2.50	POKE ROOT	(164) CUT/DRY-- 50
BETH ROOT	(22)	<138>	2.00	PRICKLEY ASH TREE BARK	
BLACKBERRY ROOT	(190)	<234>	.50	(NORTH) AMERICANA	(238) <238> --- 75
BLACK ROOT (Culvers)	(231)	<234>	8.00	(SOUTH) ZANTHOXUM	<238> --- 2.50
BLACK HAW BARK (Root or Tree)	(233)	<246>	1.50	QUEEN OF MEADOW ROOT	(100) <164> --- 1.00
BLACK COHOSH ROOT	(71)		1.10	QUEEN OF MEADOW HERB	(100) <164> --- .50
BLACK INDIAN HEMP RT.	(39)		1.50	QUEENS DELIGHT ROOT	--- (211) --- 2.50
BLOOD ROOT	(200)	<48>	5.00	RED CLOVER BLOSSOMS	--- (218) <158> --- 4.00
BLUE COHOSH ROOT	(61)		1.00	SASSAFRAS LEAF	--- (201) <278> --- 1.00
BLUE VERVAIN HERB	(229)		.50	SASSAFRAS ROOT BK (NAT)	(201) <278> --- 2.00
BURDOCK ROOT	(43)	<166>	1.50	SASSAFRAS ROOT BK (Select)	**ROSSED BARK - 4.00
BLUE FLAG ROOT	(168)		2.50	SASSAFRAS TREE BARK	----- .15
BUGLEWEED HERB	(70)		1.00	SARSAPARILLA ROOT	----- <154> --- 3.00
BUTTERNUT TREE BARK	(127)		.40	SENECA SNAKE ROOT	--- (174) <72> --- 7.50
BUTTON SNAKE ROOT-SPLIT			2.00	SCULLCAP HERB - TRUE	--- (203) <186> --- 3.50
CALAMUS ROOT= SWEET FLAG	(26)	<312>	1.50	SCULLCAP HERB - GERMANDER	--- <162> --- 1.00
CATNIP HERB	(157)	<70>	.75	SOLOMON SEAL ROOT	--- (174) <32> --- 1.50
CHICKWEED	(210)	<42>	.75	SPIGNET ROOT	--- (41) <54> --- 2.00
CLEAVERS HERB	(105)		.75	SQUAW VINE HERB	--- (150) <26> --- 2.50
CRANESBILL ROOT	(109)	<201>	1.00	SLIPPERY ELM BARK - ROSSED ONLY	----- 1.25
CRAMP BARK		<246>	5.00	STAR GRASS ROOT - ALETRIS	(31) <32> --- 10.00
DANDELION ROOT	(213)	<130>	1.50	STAR GRASS ROOT - HELONIAS	----- <142> --- 20.00
FEVERFEW HERB		<84>	1.00	STONE ROOT	--- (77) <112> --- .50
FRINGE TREE BARK	(69)	<270>	5.00	SUMAC ROOT BARK	--- (189) <250> --- .75
GINSENG WILD	(16)	- FALL MARKET		SUMAC TREE BARK	--- (189) <250> --- .75
GINSENG CULTIVATED	(16)	- FALL MARKET		SUMAC LEAF (Leaf Only)	----- <250> --- .20
GOLDEN SEAL ROOT	(123)	<50>MKT	32.50	VIRGINIA SNAKE ROOT	--- (45) <224> --- 20.00
GOLDEN SEAL HERB	(23)	<50>MKT	7.50	WAHOO ROOT BARK	--- (97) <244> --- 1.00
HOREHOUND HERB	(145)	<70>	.50	WAHOO TREE BARK	--- (97) <244> --- 1.00
INDIAN TURNIP ROOT	(44)		1.00	WALNUT LEAVES	--- (128) <276> --- .25
KANSAS SNAKE ROOT	(91)	<200>MKT	18.00	WHITE OAK BARK	--- (184) <278> --- .10
KANSAS SNAKE HERB	(91)		2.00	WHITE WILLOW BARK	--- (196) <268> --- .35
LOBELLA HERB	(139)	<184>	2.50	WILD CHERRY BARK - Thick	--- <290> --- .20
MAIDEN HAIR FERN HERB	(28)	<308>	1.00	WILD CHERRY BARK - Thin	--- <290> --- .50
MAYAPPLE ROOT	(173)	<46>	.25	WILD GINGER ROOT	--- (47) <138> --- 3.00
MAYPOP HERB = PASSION FLOWER	(WEST CON)		.75	WILD HYDRANGEA ROOT	--- (122) <242> --- 1.00
MISSOURI SNAKE HERB		<78>	.75	WILD INDIGO ROOT BAP. TINT	----- 7.00
MISSOURI SNAKE ROOT - DRY CLEAN		<78>	3.25	WILD LETTUCE LEAF	--- (134) <128> --- 1.00
MULLEIN LEAF	(228)	<114>	.40	WILD YAM ROOT	--- (88) <204> --- .75
NEW JERSEY TEA ROOT --- (CUT)			.50	WITCH HAZEL BARK	--- (114) <256> --- 1.20
PEACH TREE BARK			.50	WITCH HAZEL LEAF	--- (114) <256> --- 1.35
PEACH LEAF			.50	YELLOW DOCK ROOT	--- (192) <214> --- 1.00
PINK ROOT (True)	(208)	<148>	16.00	FRESH ROOTS / HERBS	DAILY MARKET PRICE
PLEURISY ROOT - (SLICED) -	(49)	<136>	1.50		

WE RESERVE THE RIGHT NOT TO PURCHASE MORE THAN 1,000 LBS. OR OVER \$200.00 TOTAL VALUE WITHOUT CONTRACT.
GINSENG: THE LAW AND OUR CONSCIENCE PREVENTS US FROM BUYING GINSENG BEFORE THE LEGAL SEASON OPENS. THE STATE AND FEDERAL LAWS WERE CREATED TO PREVENT THE EXTINCTION OF THE SPECIES. WE URGE YOU NOT TO DIG BEFORE THE BERRIES RIPEN AND FALL

SPECIAL FOREST PRODUCTS WORKSHOP

Monday, October 7, 1996

Sponsored by: Missouri Department of Conservation; Green Hills Resource Conservation & Development, (RC&D); Prairie Rose RC&D; Geode RC&D; Southern Iowa RC&D; USDA Natural Resources Conservation Service; U.S. Forest Service; and University of Missouri Extension

Workshop Speakers

Jim Anderson, *Horticulture Marketing Specialist, Missouri Department of Agriculture, 1616 Missouri Blvd. Jefferson City, MO 65102; phone 573-751-3394.*

✓ Larry Choate, *Owner, North American Habitat for Wildlife, 1202 Lincoln Street, Unionville, MO 63565.*

✓ Mark & Deb Damhorst, *Owner, Ohio Street Originals, 1001 Ohio Street, Quincy, IL 62301; phone 217-222-5003.*

✓ Dave Goering, *Plant Manger, Pharmacia & Upjohn, Allergon Division, P.O. Box 693, Carthage, MO 64836; phone 417-358-9710, FAX 417-358-1754.*

✓ Ron Heller, *Owner, NEMO Specialty Farms, Rt. 1 Box 18A, Ewing, MO 63440; phone 573-494-3608.*

✓ Stan Hildebrand, *Manager, Sandhill Farms, Rt. 1, Box 155, Rutledge, MO 63563; phone 816-883-5543.*

Jim Jones, *Vice President, Hammons Products Co., 217 Hammons Drive, Stockdon, MO 64738; phone 417-276-5181, FAX 417-276-5187.*

Shelby Jones, *Staff Supervisor, Resource Management & Utilization, Missouri Department of Conservation, P.O. Box 180, Jefferson City, MO 65109; phone 573-751-4115, FAX 573-526-6670.*

✓ Allen Lockard, *Owner, North American Natural Resources, Inc., Rt. 4 Box 94H, Eolia, MO 63344; phone 573-485-2300.*

Matt Nichols, *Agriculture Business Specialist, University of Missouri Extension, 503 E. Northtown Road, Kirksville, MO 63501-1999; phone 816-665-9866.*

Jack Slusher, *Extension Forester, University of Missouri, I-34 Agriculture Building, Columbia, MO 65211; phone 573-882-4444.*

Tim Smith, *Botanist, Natural History Division, Missouri Department of Conservation, P.O. Box 180, Jefferson City, MO 65109; phone 573-751-4115.*

Ed Tamerius, *District Forester, Missouri Department of Conservation, P.O. Box 428, Hannibal, MO 63401; phone 573-248-2530, FAX 573-248-2532.*

Bill Yoder, *Forest Nursery Superintendent, State Nursery, Missouri Department of Conservation, Rt. 2 Box 465, Licking, MO 65542; phone 573-674-3229.*

**ECONOMIC RESEARCH SERVICE**

United States Department of Agriculture


[ERS Home](#) | [What's New](#) | [Publications](#) | [Data](#) | [Briefing Rooms](#) | [About ERS](#) | [Search](#)
Table 11
Certified organic and total vegetable acreage, top States, 1997

State	Certified organic vegetables 1/	Total vegetables 2/	Certified organic/ total
	<i>Acres</i>		<i>Percent</i>
U.S. total	48,227	3,589,670	1.3
California	22,886	1,065,465	2.1
Colorado	3,716	42,854	8.7
Washington	3,140	204,746	1.5
Arizona	3,081	110,737	2.8
Oregon	2,345	154,362	1.5
Minnesota	1,684	218,800	0.8
New York	1,615	167,834	1.0
Illinois	1,160	64,655	1.8
Florida	1,017	226,366	0.4
Michigan	803	125,780	0.6
Vermont	677	2,866	23.6
Wisconsin	574	267,629	0.2
Utah	445	6,637	6.7
North Carolina	396	48,606	0.8
Pennsylvania	379	44,270	0.9
Massachusetts	375	15,855	2.4
Maine	362	11,701	3.1
Virginia	330	25,087	1.3
Missouri	283	20,781	1.4
Connecticut	271	9,738	2.8

1/ Excluding potatoes. 2/ Census of Agriculture, 1997.

Source: Economic Research Service, USDA.

[Organic Farming Issue Center](#) | [Previous Table](#) | [Next Table](#)
[Top of Page](#)Contact: [Cathy Greene](#)

**ECONOMIC RESEARCH SERVICE**

United States Department of Agriculture


[ERS Home](#) | [What's New](#) | [Publications](#) | [Data](#) | [Briefing Rooms](#) | [About ERS](#) | [Search](#)

Table 12
Certified organic fruit acreage, by State, 1997

State	Tree nuts	Citrus	Apples	Grapes	Unclassified/ Other	Total fruits
	<i>Acres</i>					
U.S. total	4,908	6,099	8,846	19,299	10,261	49,414
Arizona	71	595	3,178	47	470	4,361
Arkansas	-	-	12	-	9	21
California	3,542	3,012	1,883	18,467	5,677	32,582
Colorado	1	-	1,270	1	544	1,816
Connecticut	-	-	-	-	-	-
Delaware	-	-	-	-	-	-
Florida	-	2,296	-	8	321	2,625
Hawaii	190	-	-	-	124	314
Idaho	-	-	-	5	22	27
Indiana	-	-	-	-	7	7
Kentucky	-	-	-	-	30	30
Louisiana	-	5	-	-	32	37
Maine	-	-	24	-	124	148
Massachusetts	1	-	-	-	54	55
Michigan	-	-	228	-	109	337
Minnesota	-	-	202	-	158	360
Missouri	-	-	-	-	10	10
New Hampshire	-	-	8	-	31	39
New Jersey	-	-	-	-	7	7
New Mexico	87	-	59	90	-	236
New York	-	-	30	129	167	326
North Carolina	-	-	-	-	6	6
Ohio	-	-	-	-	3	3
Oklahoma	-	-	-	-	2	2
Oregon	80	-	9	112	1,030	1,231
Pennsylvania	-	-	139	-	121	260
Rhode Island	-	-	-	-	3	3
South Carolina	-	-	-	-	1	1

South Dakota	-	-	2	-	-	2
Texas	913	191	-	6	234	1,344
Utah	-	-	-	-	12	12
Vermont	-	-	-	-	56	56
Virginia	-	-	-	-	60	60
Washington	24	-	1,707	434	813	2,978
West Virginia	-	-	5	-	10	15
Wisconsin	-	-	90	-	15	105

Source: Economic Research Service, USDA.

[Organic Farming Issue Center](#) | [Previous Table](#) | [Next Table](#)[Top of Page](#)Contact: [Cathy Greene](#)

Updated: April 4, 2000

[ERS Home](#) | [What's New](#) | [Publications](#) | [Data](#) | [Briefing Rooms](#) | [About ERS](#) | [Search](#)
www.ers.usda.gov

**ECONOMIC RESEARCH SERVICE**

United States Department of Agriculture


[ERS Home](#) | [What's New](#) | [Publications](#) | [Data](#) | [Briefing Rooms](#) | [About ERS](#) | [Search](#)

Table 13
Certified organic herbs, nursery, and greenhouse, by
State, 1997

States	Cultivated herbs	Wildcrafted herbs 1/	Cut flowers	Mushrooms	Other	Total herbs & nursery	Total greenhouse 2/
	Acres					Square feet	
U.S. total	6,407	83,388	288	61	631	90,776	378,928
Arizona	40	-	-	-	-	40	20,000
Arkansas	-	-	-	32	-	32	-
California	1,062	-	145	-	475	1,682	11,730
Colorado	226	-	17	1	3	246	-
Connecticut	1	-	-	-	-	1	-
Florida	268	25,000	-	11	31	25,310	1,632
Hawaii	15	-	2	-	1	18	-
Idaho	35	52,388	1	-	-	52,424	-
Illinois	797	-	-	-	-	797	-
Iowa	48	-	-	-	-	48	-
Kansas	34	-	-	-	-	34	-
Kentucky	65	-	-	-	-	65	-
Louisiana	1	-	-	-	-	1	-
Maine	-	-	-	-	-	-	4,510
Massachusetts	12	-	5	-	-	17	-
Michigan	1	-	-	-	-	1	1,250
Minnesota	250	-	107	-	30	386	-
Missouri	263	-	-	2	-	265	-
Montana	-	-	-	-	-	1,189	-
Nebraska	25	-	-	-	-	25	-
New Hampshire	1	-	-	-	-	1	3,000
New Jersey	8	-	-	-	-	8	-
New Mexico	27	-	4	-	3	34	-
North Carolina	287	-	2	-	-	289	-
North Dakota	75	-	-	-	-	75	-
Oklahoma	1	-	1	-	-	2	-
Oregon	441	6,000	-	11	5	6,457	-

Pennsylvania	10	-	-	-	4	14	29,000
Rhode Island	-	-	2	-	8	10	-
South Dakota	9	-	-	-	-	9	-
Texas	22	-	-	-	20	42	28,976
Vermont	-	-	-	-	32	32	278,710
Virginia	34	-	-	-	-	34	-
Washington	846	-	-	4	-	850	-
West Virginia	21	-	1	-	20	42	120
Wisconsin	220	-	2	-	-	222	-
Wyoming	75	-	-	-	-	75	-
Regional 3/	1,189	-	-	-	-	1,189	-

1/ Includes St. John's wort in Idaho; saw palmetto berries, maypop, indigo, and polk in Florida; and lake algae and St. Johns wort in Oregon. 2/ Includes mushrooms, flowers, and other greenhouse products. 3/ Data not broken out by State.

Source: Economic Research Service, USDA

[Organic Farming Issue Center](#) | [Previous Table](#) | [Next Table](#)

[Top of Page](#)

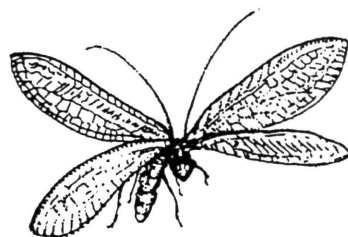
Contact: [Cathy Greene](#)
Updated: April 4, 2000

[ERS Home](#) | [What's New](#) | [Publications](#) | [Data](#) | [Briefing Rooms](#) | [About ERS](#) | [Search](#)

www.ers.usda.gov

S I N C E 1 9 5 0

CATALOG OF BENEFICIALS



RINCON-VITOVA

I N S E C T A R I E S , I N C .

www.rinconvitova.com

TOWARDS ECOLOGICALLY-BASED AGRICULTURE WHERE BENEFICIAL
ORGANISMS ARE RELEASED AND ENCOURAGED TO CONTROL PESTS





Resources on Web



Rincon-Vitova Insectaries - world's oldest commercial insectary announces online catalog

Features:

How to select biocontrol organisms ☞ **PEST** index to catalog

Catalog of most of the biocontrol organisms available in US ☞ **CATALOG**

Detailed information on beneficial insects, nematodes, and mites, ☞ **BULLETINS**

Habitat enhancement to improve biocontrol ☞ **HABITAT SEEDS** from **CATALOG**

Biocontrol strategies to increase effectiveness of beneficial insects ☞ **DIETRICK PAPERS**

Emphasis on programs to solve pest problems vs. one-shot products

What's in it for me?

Farmers

What are my options for this pest?

How do I set up habitats for beneficial insects that solve my pest problems?

Gardeners

What can I do to control pests in my garden?

How do I control ants around the house and garden?

Livestock yards, stables, chicken houses, compost yards

How do I control flies economically and ecologically?

Educators

Where do I find reference material on biocontrol?

What can I use for resources for class activities?

Institutions

What products can we use in our IPM program?

☞ Call, fax, or e-mail to order (no online ordering) ☞
☞ We look forward to serving you. ☺ Hablamos español ☞



RINCON-VITOVA
INSECTARIES, INC.

PO Box 1555
Ventura, CA 93002-1555

PRESORTED STANDARD
U.S. POSTAGE PAID
VENTURA, CA
PERMIT NO. 837



23-3 ALL FOR ADC 63203

JULI BRUSSELL

RAINY CREEK FARM

572 COUNTY ROAD 2100E

CASEY IL 62420-4224

Use this form to order the complete 3 volume set or individual copies in print or on diskette. **Supplies are limited.**

Please send me (Please indicate number of copies)

____ Volume 1 ____ Volume 2 ____ Volume 3

____ Complete 3 Volume set

Name _____

Address _____

City, State, Zip _____

Mail, email or fax to:

Alternative farming Systems Information Center (AFSIC)
National Agricultural Library
10301 Baltimore Ave., Rm. 304
Beltsville, MD 20705
301-504-6559
301-504-6409 fax
afsic@nal.usda.gov
<http://www.nal.usda.gov/afsic>

Vegetables & Fruits:

A Guide to Heirloom Varieties and
Community-Based Stewardship
3 Volume Set



Compiled by:
Suzanne P. Demuth
Alternative Farming Systems Information Center
National Agricultural Library
10301 Baltimore Avenue
Beltsville, MD 20705-2351



Alternative Farming Systems Information Center

The **Alternative Farming Systems Information Center (AFSIC)** is one of several topic-oriented information centers at the National Agricultural Library (NAL). AFSIC specializes in locating and accessing information related to alternative cropping systems including sustainable, organic, low-input, biodynamic, and regenerative agriculture. AFSIC also focuses on alternative crops, new uses for traditional crops, and crops grown for industrial production.

Vegetables & Fruits: A Guide to Heirloom Varieties and Community-Based Stewardship 3 Volume Set is available in ASCII text through <http://www.nal.usda.gov/afsic> under "Publications". To obtain AFSIC publications on computer diskette, or in hardcopy (limited availability), please make requests by contacting the AFSIC office by phone, mail, e-mail or fax. Please see the order form on the back page.

The 3 volume set consists of:

Volume 1, Annotated Bibliography

Inside you'll find citations and descriptions for books, periodicals, videos, resource guides and internet resources with special emphasis on New World Crops.

Volume 2, Resource Organizations

Find contact information for seed suppliers, seed banks, fruit grower organizations, public gardens and more!

Volume 3, Historical Supplement

Want to find out more about the history of fruit & vegetable crops? Volume 3 describes books, articles and reports including many 1860-1960 publications with emphasis on the historical aspect of heirloom varieties.

Now available on the web! Visit us at:

http://www.nal.usda.gov/afsic/AFSIC_pubs/heirloom/heirloom.htm



The Real Dirt: Farmers Tell about Organic and Low-Input Practices in the Northeast

1994; 2nd printing in 1998 - \$13.95

The *Real Dirt* provides a vivid snapshot of organic and sustainable farming in the Northeast in the 1990s. Based on interviews with more than 60 farmers in eight states, the book summarizes practical methods for ecological soil, pest, disease, crop, greenhouse and livestock management. It offers a farmer's-eye view of how to design rotations, select crops and survive economically in the face of an increasingly chemical dependent and industrialized agricultural system.

Prepared by the Northeast Organic and Sustainable Farmers Network -- a collaborative group of farmers, farm organization representatives, northeastern agricultural educators and university researchers -- The *Real Dirt* responds to increased interest in sustainable and organic farming. Producers and extension educators can turn to The *Real Dirt* for answers to questions about organic and sustainable agriculture.

Its 264 pages of readable, farm-tested experiences are even more accessible thanks to a comprehensive index, bibliography and eight appendices. The glossary, resource directory and lists of organizations and Cooperative Extension contacts for the Northeast region were all updated in 1998 for the second printing.

"What an amazing catalog of ingenious responses to variable conditions faced by farmers. It will encourage the creativity of aspiring and experienced farmers every-where. With its plain, practical advice, the book can be used around the country and the world to help build a sustainable agricultural community."

-- Sam Smith
Caretaker Farms
Williamstown, Mass.

Yes! Send me The Real Dirt for \$13.95. Please add \$3.95 s/h for the first book and \$0.95 s/h for each additional book.

Name: _____

Address: _____

City: _____ State: _____ Zip: _____ Phone: _____

- Make checks payable to: Sustainable Agriculture Publications. Mail to:

Sustainable Agriculture Publications
210 Hills Building
University of Vermont
Burlington, VT 05405-0082

1998 36000

Viticulture



ILLINOIS 1999 SEASON

VINEYARD & WINERY SURVEY

ILLINOIS
GRAPE & WINE
RESOURCES
COUNCIL



Imed Dami, PhD

Assistant Professor, Viticulture Specialist
PSGA, Southern Illinois University

SIU
SOUTHERN ILLINOIS UNIVERSITY
Carbondale

Acknowledgments

The Survey was conducted by Dr. Imed Dami, State Viticulturist, and funded by the Illinois Grape and Wine Resources Council. Thanks are extended to Vineyard and Winery owners who participated in this Survey

published December 2000

1999 VINEYARD AND WINERY SURVEY

Imed Dami, PhD
Assistant Professor, Viticulture Specialist
Plant, Soil, and General Agriculture
Southern Illinois University Carbondale

Grape Producers Survey

Grape production more than doubled

Eighty one percent (81%) of grape producers responded: 73 surveys were sent out and 59 were returned. The results are summarized in the following tables and figures. Two characteristics highlight the 1999-growing season in Illinois: an exceptional vintage year due to favorable weather conditions; and an impressive expansion in acreage and production. Illinois grape producers harvested at least 150 tons of grapes in 1999, up 117% from the 69 tons produced in 1998 (Table 1). Vineyard acreage totaled 200 acres, a 10% increase from last year. Non-bearing acres accounted for more than 60% of the total acreage, due to several newly established vineyards (76 acres were reported being planted in 1999).

I estimate the total vineyard acreage in Illinois to surpass 320 acres, with over 100 acres planted in 1999. These estimates account for acreage of grape growers who have not responded to the survey (19%) (Table 1).

Table 1. Summary of Acreage and Production of Grapes in Illinois: 1998 vs. 1999.

Acreage / Production	1998*	1999**	1999***
Producing Acres	77	77	131
Non-Producing Acres	104	123	195
Total Acres	181	200	326
New Acres	47	76	108
Production (tons)	69	150	150+

*1998 Grower's Survey [IGGVA/IGWRC], **1999 Grower's Survey [81% reporting; Dami]

***1999 Grower's Survey [estimated total; Dami].

Out of the 150 tons produced, about 90 tons are white varieties, and 60 tons are reds (Table 2). Among whites, Vidal blanc leads the way in production (~21 tons), followed closely by Chardonnay and Vignoles (~18 tons each), and Seyval (~16 tons.) Among reds, Chambourcin produced the most with 23 tons, followed by unexpected Concord at 18 tons (Table 2).

Table 2.
Production and Acreage of Winegrape Varieties
Grown in Illinois

Variety	Tons Produced	Producing Acres	Non-Producing Acres		2000 Planned plantings	Total Acres
			< 1999 Acres	1999 Acres		
Whites						
Vidal blanc	20.8	6.3	4.9	3.2	1	15.4
Chardonel	18.5	10.3	5.1	12.1	18.1	45.6
Vignoles	17.8	15.8	7.8	5.7	1	30.3
Seyval	15.5	9.3	2.4	19.1	6.1	36.9
Others	17.1	4.2	3.9	9.8	25.9	43.8
Subtotal	89.7	45.9	24.1	49.9	52.1	172
Reds						
Chambourcin	23.0	13.0	12.0	8.1	11.3	44.4
Concord	18.1	6.6	0.2	0.3	0.6	7.7
Catawba	4.0	2.2	1.1	0.2	0	3.5
Norton	3.8	3.3	9.9	5.2	4.9	23.3
Chancellor	3.6	0.8	0	0.5	2.1	3.4
Others	8.0	5.6	0.3	10.9	4.3	21.1
Subtotal	60.5	31.5	23.5	25.2	23.2	103.4
Total	150.2	77.4	47.6	75.1	75.3	275.4

[Based on 81% response to the growers survey.]

The top 6 varieties planted in Illinois represent more than 75% of the total acreage and include Chambourcin, Seyval, Vignoles, Chardone, Norton, and Vidal blanc (Figure 1). Other varieties with 4+ acres include Traminette, Concord, Foch, Frontenac, and St. Croix.

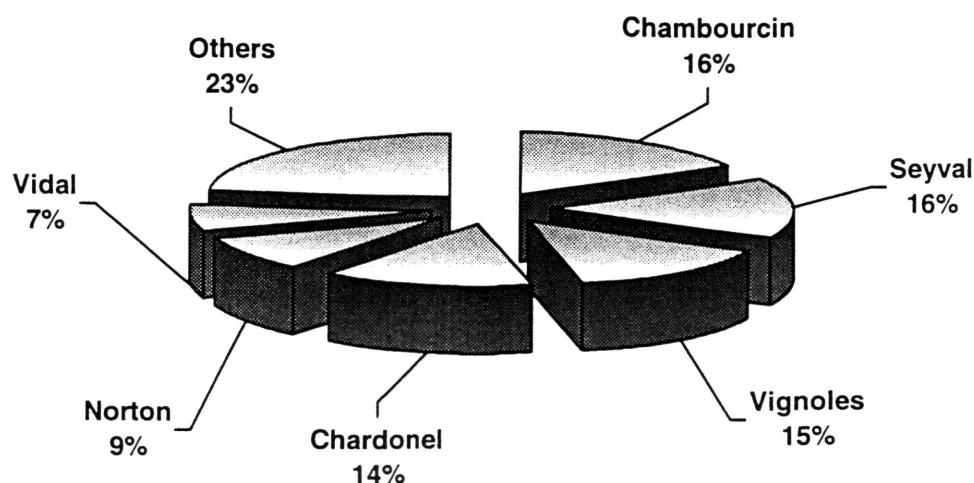


Figure 1. Percentage of Illinois Vineyard Acreage by Variety for 1999

Union County is leading in grape production (62 tons) and acreage (33 acres) in the state, followed by Jackson County (32 tons and 27 acres); Hancock and Jefferson Counties are distant third with production around 19 tons each. Nine (9) other counties produced grapes in 1999 (Figure 2).

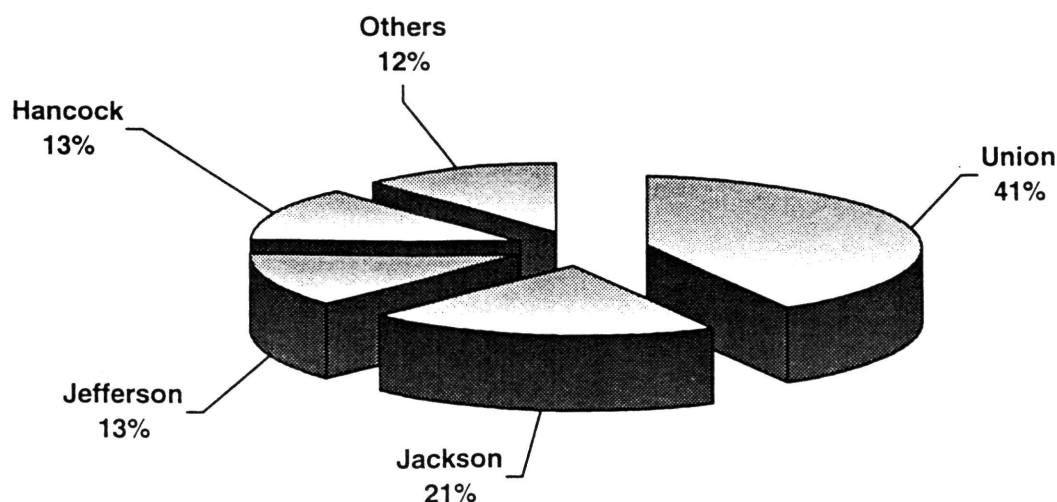


Figure 2. Percentage of Illinois Grape Production by County for 1999

Vineyard & Winery Survey

Future planting is not only expanding in southern Illinois, but also in the west and northwest parts of the state. According to 81 % of survey responses, over 75 acres will be planted; 26 acres in southern Illinois, and 49 acres in west-southwest Illinois (Calhoun, Pike and Macoupin Counties) in year 2000. There is also a steady increase of vineyard establishment in northwest Illinois (10 + acres in Jo Daviess and Whiteside Counties). Predominant varieties of new plantings are Chardonel (18 acres) and Traminette (18 acres) for whites and Chambourcin (11 acres) and Norton (5 acres) for reds.

Harvest was earlier than normal for several varieties due to the hot and dry weather. Different varieties were harvested according to their location and optimum fruit composition. Table 3 summarizes the average and range of harvest date for each variety. This may serve as a guideline for new growers to know approximate ripening dates for Illinois-grown grapes. Prices per ton of grapes sold in the state are also included in Table 3. The data are not presented in attempt to establish a price for grapes; rather they report prices that are being paid. Factual price information is necessary in any business plan. This will also benefit new growers by providing them with the ability to compare winery offers with the industry average. The price range reflects the market value of a given variety, its fruit quality, and mutual agreements between growers and wineries.

Table 3. Harvest Dates and Prices of Illinois-Grown Grapes – 1999.

Variety	Harvest Date		Price (\$) / Ton		Number of Responses
	Average	Range	Average	Range	
Whites					
Chardonel	26 Aug	3 Aug – 5 Sept	1,017	900 - 1,100	9
Niagara	30 Aug	18 Aug – 15 Sept	600	600	5
Seyval	18 Aug	1 Aug – 28 Aug	771	600 - 800	8
Vidal blanc	13 Sept	6 Sept – 27 Sept	730	600 - 800	7
Vignoles	24 Aug	15 Aug – 30 Aug	1,015	900 – 1,300	12
Villard blanc	19 Sept	7 Sept – 1 Oct	600	600	2
Reds					
Chambourcin	17 Sept	6 Sept – 27 Sept	817	750 - 900	11
Chancellor	3 Sept	29 Aug – 7 Sept	600	600	2
Concord	5 Sept	25 Aug – 11 Sept	N/A	N/A	5
Norton	12 Sept	27 Aug – 19 Sept	933	900 – 1,000	6
St. Croix	5 Sept	30 Aug – 10 Sept	N/A	N/A	3

Winery Survey

Inconclusive

Eighteen (18) surveys were sent out and 10 responded or 56%. The objectives of this survey were to determine the current wine production of all Illinois wineries, and to determine the amount of grapes and/or fruits each winery plans to purchase in the near future. The goal was to identify and measure the need for additional Illinois-grown grapes and fruits. This would provide a gauge of supply and demand, and the information would assist prospective growers to determine what to grow and how much. Unfortunately, little over half returned the survey with some incomplete. The low and incomplete responses to this type of survey can lead to misleading conclusions. Therefore, the data should be interpreted very cautiously.

Ten out of 18 wineries reported about 77,000 gallons of wine production in 1999. The **estimate** of current total production of all 18 wineries is about 220,000 gallons. The reporting 10 wineries utilized 135 tons and 15 tons of Illinois-grown grapes and fruits, respectively. Out of 135 tons utilized by wineries, only 47 tons were purchased from commercial growers; the rest were produced in their own vineyards (Table 4). Most vintners who responded to the survey have plans to expand their winery capacity. Thus, they are planning to purchase more fruit in year 2000. According to the survey, the demand for grapes and other fruits will at least triple in year 2000 (Table 4).

Out-of-state purchase will also increase by about 10% this year (Table 5). This is due to several reasons: unavailability of some crops (e.g. *vinifera* grapes and fruits that cannot be grown locally); local supply shortage; and personal choices by vintners due to market and economic considerations. In Table 5, note that over 22,000 gallons of hybrid and American type varieties are purchased from out-of-state. This has the potential to change in the future. It is proven that these varieties can be grown locally. In addition, several vintners have expressed their desire to purchase local grapes as long as the quality is optimum, the price is fair and competitive, and the supply is available.

Table 4.
Illinois-Grown Grapes and Fruits Purchased by
Local Wineries.

Varieties	Tons purchased in 1999	Tons to be purchased in 2000
White Grapes		
Chardonnay	2.0	14.0
Cayuga White	<1.0	4.0
La Crosse	2.5	5.0
Niagara	2.0	2.0
Seyval	8.5	42.5
Traminette	<1.0	5.0
Vidal	4.0	18.3
Vignoles	9.0	12.2
Villard blanc	2.4	5.5
<i>Total</i>	<i>31.0</i>	<i>108.5</i>
Red Grapes		
Catawba	--	5.0
Chambourcin	2.3	21.2
Chancellor	3.5	3.0
Concord	2.0	3.5
De Chaunac	2.5	3.0
Foch	2.2	10.2
Leon Millot	<1.0	7.0
Norton	2.3	9.0
St. Croix	<1.0	2.0
<i>Total</i>	<i>15.6</i>	<i>64.0</i>
Other Fruits		
Apple	13.0	26.0
Blueberry	2.0	1.0
Cranberry	--	15.0
Peach	--	1.0
Raspberry	--	6.0
<i>Total</i>	<i>15.0</i>	<i>49.0</i>

Table 5.
Out-of-State Grapes and Fruits Purchased by
Local Wineries.

Variety	Purchased in 1999			To be purchased in 2000	
	Volume (gal)	Tons	Average price / gal (\$)	Volume (gal)	Tons
Whites					
Niagara	3,744		3.50	4,250	
Seyval	700		4.75	700	
Vidal blanc	5,070		4.50	4,900	
Vignoles	780		5.75	1,250	
<i>Total</i>	<i>10,294</i>			<i>11,100</i>	
Reds					
Catawba	1,960		3.75	2,360	
Chambourcin	360		5.25	360	
Concord	5,084		3.20	7,550	
Foch	2,815		5.53	3,630	
Steuben	2,000		2.90	--	
<i>Total</i>	<i>12,219</i>			<i>13,900</i>	
Vinifera	18,382		--	22,500	
Muscadine	2,500	16.7	--	1,500	10.0
Other Fruits					
Apple	520		1.50	1,000	10.0
Apricot		1.4	9.80	--	--
Blackberry	10		--	--	--
Blueberry		5.8	16.60	--	--
Cherry	1,000		3.00	1,000	10.0
Cranberry	30	15	7.60	1,500	15.0
Raspberry	10	5.5	15.00	600	6.0
<i>Total</i>	<i>4,840</i>	<i>48.4</i>		<i>4,600</i>	<i>46.0</i>

Table 6 shows the numbers on grape juice composition determined by the total soluble solids (°Brix), pH, and titratable acidity (TA). With the exception of few, the numbers are overall optimum and reflect the exceptional 1999-year we had in terms of fruit quality; almost all varieties produced well-balanced fruit compositions. These numbers will also serve as guidelines for new growers to follow and apply during the monitoring of fruit maturation. This will hopefully avoid mistakes on harvest timing; i.e. fruits are not picked too early (under-ripe) or too late (over-ripe).

Table 6.
Juice Composition of Illinois-Grown Grapes.

Varieties	°Brix	pH	TA (%)
Whites			
Chardonel	22.0	3.2	0.79
Cayuga White	18.0	3.2	0.85
G. Muscat	18.0	--	--
La Crosse	19.0	3.12	--
Niagara	14.8	3.3	0.51
Seyval	21.5	3.4	0.87
Traminette	21.0	3.2	0.85
Vidal blanc	22.4	3.32	0.80
Villard blanc	20.9	3.28	0.72
Vignoles	24.2	3.4	0.88
<i>Average</i>	<i>20.3</i>	<i>3.27</i>	<i>0.78</i>
Reds			
Catawba	21.0	--	--
Chambourcin	21.5	3.41	0.75
Chancellor	18.8	3.3	0.74
Concord	18.8	--	--
De Chaunac	16.5	3.0	1.10
Foch	19.3	3.55	1.15
Leon Millot	23.0	3.4	1.03
Norton	22.2	3.5	1.01
St. Croix	20.0	3.3	1.06
Villard noir	21.4	--	--
<i>Average</i>	<i>20.3</i>	<i>3.35</i>	<i>0.98</i>

Survey Sample

Vineyard

[illegible]

Winery

Illinois Wineries Survey 1999

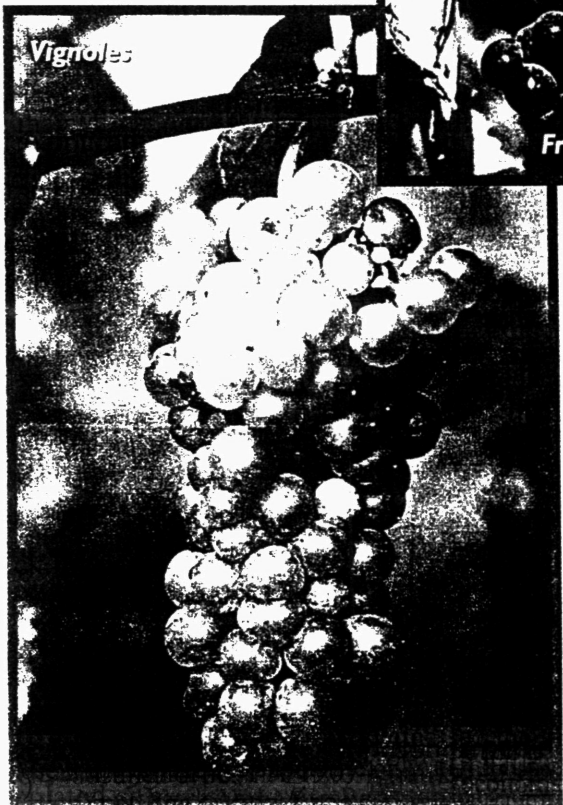
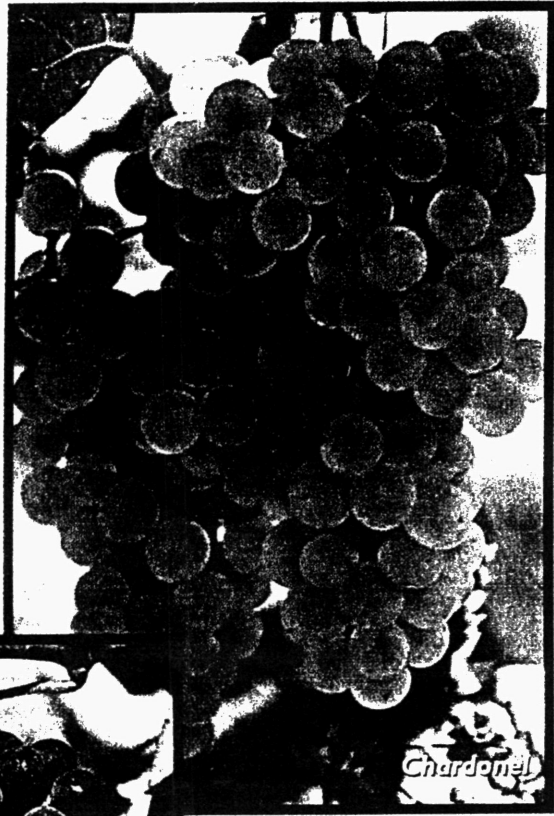
Name Owner/Vintner _____
 Winery Address _____
 Phone Home _____ Business _____
 Fax _____ E-mail _____

Fruits & Juices From Out-of-State

State	Grape varieties	Purchased this year - 1999		Plan to purchase in year 2000		Plan to purchase in year 2005	
		Tons	Gallons Cost/gal or ton	Tons	Gallons	Tons	Gallons
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
	<i>Other Fruits</i>						
1	Apple						
2	Apricot						
3	Blackberry						
4	Blueberry						
5	Cranberry						
6	Peach						
7	Raspberry						
8	Strawberry						
9							
	Total Winery Capacity Gallons	<u>1999</u>		<u>2000</u>		<u>2005</u>	

(Continued)

	Purchased this Year - 1999				Plan to purchase in year 2000		Plan to purchase in year 2005	
	Tons	Boxes	pH	T.A. (%)	Tons	Expected last price / ton	Tons	Expected last price / ton
White Varieties:								
Chardonnay								
Cayuga White								
LaCrosse								
Muscat								
Seyval								
Trametes								
Vidal Blanc								
Villard Blanc								
Vignoles								
Red Varieties:								
Cabernet								
Chambourcin								
Chancellor								
Concord								
DeCadeaux								
Frank								
Frontenac								
Lake Meade								
Marion Cynthiana								
St. Croix								
Fruit:								
Apple								
Apricot								
Blackberry								
Blueberry								
Cranberry								
Goose								
Raspberry								
Strawberry								



Illinois

Grape

and Wine

Industry

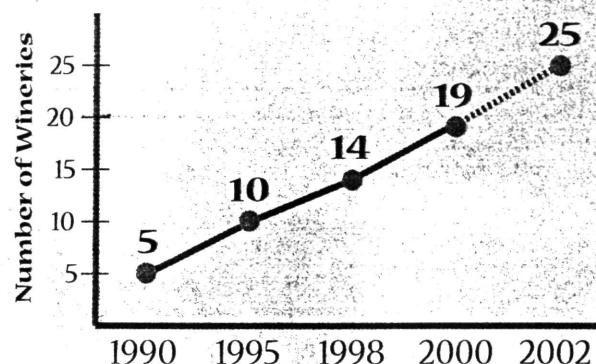
Fact Sheet

Before prohibition, Illinois was the fourth largest producer of grapes and supplied almost 25% of the wine consumed in the United States. In the last 50 years, Illinois dropped into the lowest 10% of the grape and wine producing states. The Illinois Grape and Wine Resources Council has undertaken numerous initiatives to address the needs of this productive and profitable industry.

The mission of the Illinois Grape and Wine Resources Council is to provide support and growth services to the grape and wine industry in Illinois including:

- advocacy, liaison, and promotion of grape growing and winemaking;
- training, information, and consultation to grape growers and winemakers;
- research support pertinent to the Illinois grape and wine industry; and
- marketing policy and strategy development to promote Illinois wines in the marketplace.

Illinois Winery Growth



Illinois Grape Production

ACREAGE/PRODUCTION	1998*	1999**	1999***
Producing Acres	77	77	131
Non-Producing Acres	104	123	195
Total Acres	181	200	326
New Acres	47	76	108
Production (tons)	69	150	150+

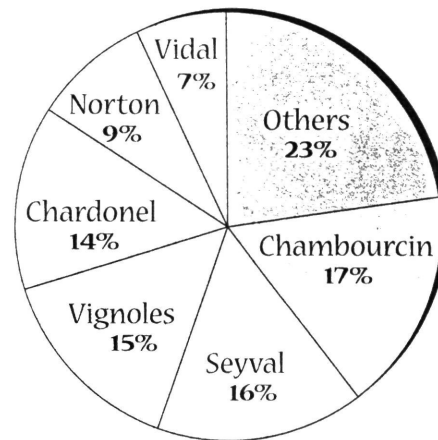
* 1998 Grower Survey [IGGVA/IGWRC]

** 1999 Grower Survey [81% reporting, Dami]

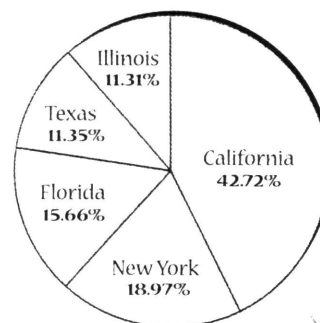
*** 1999 Grower Survey [estimated total, Dami]

Illinois Grape Varieties

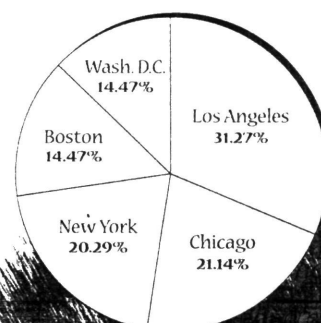
- The top six varieties represent over 75% of the state's total acreage.
- Currently, Union County leads production (62 tons) and acreage (33).
- Jackson County ranks second with 32 tons and 27 acres. (1999)



Illinois Wine Consumption



Top 5 States
1997



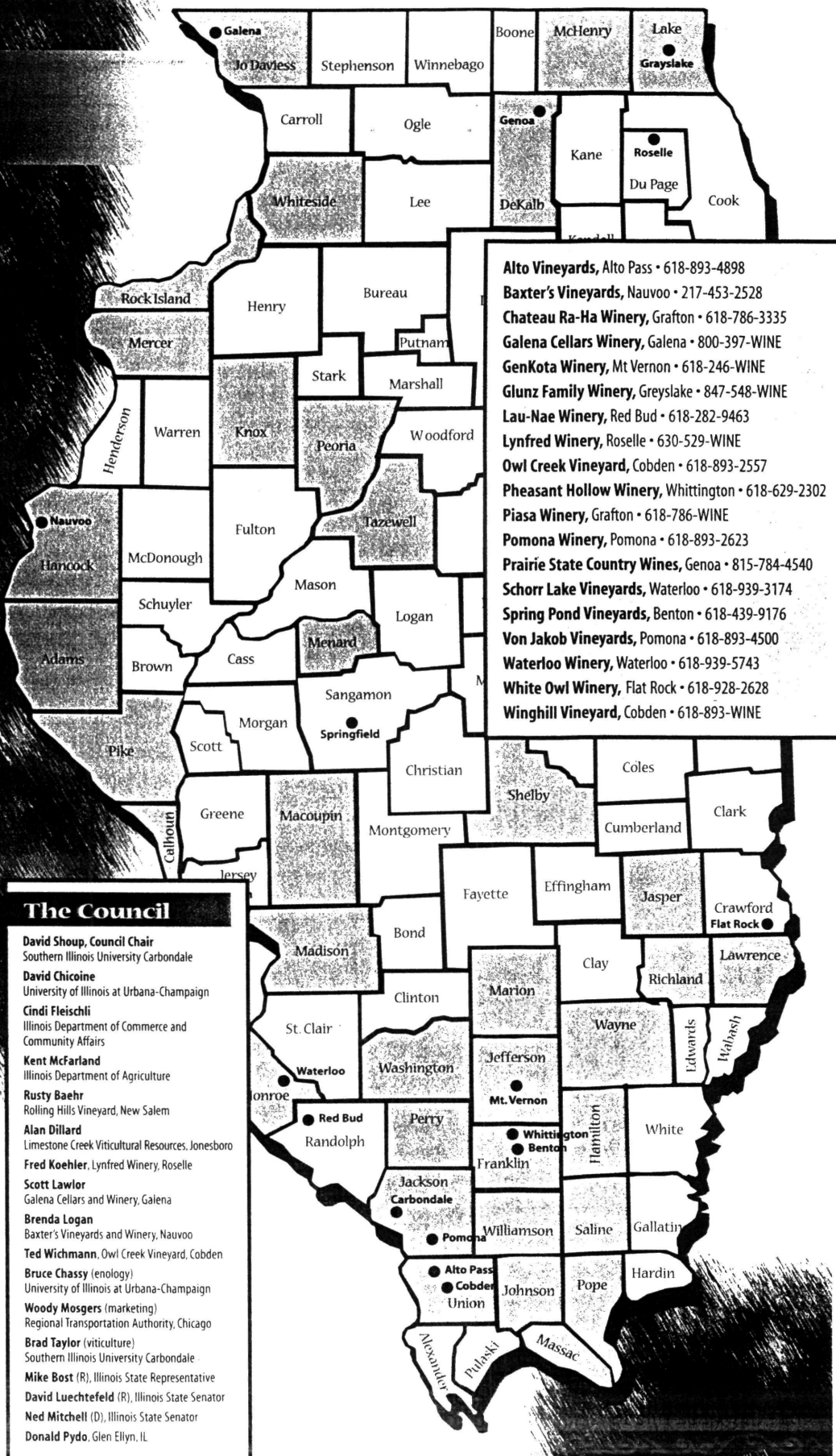
Top 5 Metro Markets

Illinois Wineries

Grape Growers by County

Adams	1
Calhoun	2
DeKalb	1
Franklin	4
Hamilton	1
Hancock	4
Jackson	16
Jasper	3
Jefferson	4
Jo Davies	7
Johnson	1
Knox	1
Lake	1
Lawrence	2
Macoupin	1
Madison	1
Marion	1
Massac	1
McHenry	1
Menard	1
Mercer	1
Monroe	2
Peoria	1
Perry	1
Pike	4
Pope	1
Richland	1
Rock Island	1
Saline	2
Shelby	3
Tazewell	1
Union	12
Washington	1
Wayne	1
Whiteside	1
Williamson	4
TOTAL	91

(November 1999)



The Council

David Shoup, Council Chair
Southern Illinois University Carbondale

David Chicoine
University of Illinois at Urbana-Champaign

Cindi Fleischli
Illinois Department of Commerce and Community Affairs

Kent McFarland
Illinois Department of Agriculture

Rusty Baehr
Rolling Hills Vineyard, New Salem

Alan Dillard
Limestone Creek Viticultural Resources, Jonesboro

Fred Koehler, Lynfred Winery, Roselle

Scott Lawlor
Galena Cellars and Winery, Galena

Brenda Logan
Baxter's Vineyards and Winery, Nauvoo

Ted Wichmann, Owl Creek Vineyard, Cobden

Bruce Chassy (enology)
University of Illinois at Urbana-Champaign

Woody Mosgers (marketing)
Regional Transportation Authority, Chicago

Brad Taylor (viticulture)
Southern Illinois University Carbondale

Mike Bost (R), Illinois State Representative

David Luechtefeld (R), Illinois State Senator

Ned Mitchell (D), Illinois State Senator

Donald Pydo, Glen Ellyn, IL

IGWRC Staff

VITICULTURE SPECIALIST

Imed Dami
Plant and Soil Science Department
College of Agriculture MC 4415
Southern Illinois University Carbondale
Carbondale, IL 62901
618-453-1782 (phone)
618-453-7457 (fax)
imeddami@siu.edu

ENOLOGY SPECIALIST

Stephen Menke
Food Science and Human Nutrition
University of Illinois
at Urbana-Champaign
1304 W. Pennsylvania Avenue
Urbana, IL 61801
217-244-9222 (office phone)
217-898-9624 (cell phone)
217-333-9329 (fax)
menke@uiuc.edu

INTERIM EXECUTIVE DIRECTOR

Patty Williams
College of Agriculture MC 4416
Southern Illinois University Carbondale
Carbondale, IL 62901
618-453-4041 (phone)
618-453-8428 (fax)
pattyw@siu.edu


Commercial Grape Production in Illinois



Opportunities
&
Challenges




Imed Dami
Southern Illinois University at Carbondale





Illinois Grape & Wine Industry Growth

Year	Acres	Vineyards	Wineries
1996	82	41	10
1998	180	82	14
1999	326	90	17
2000	400+	100+	20




Illinois Grape & Wine Industry 2000

- Vineyards = 100+
- Vineyard acreage = 400+ A
- New Plantings acreage = 100+
- Grape production = <500 tons
- Wineries = 20
- Total wine production = 250,000 gal

Market Considerations


1. Sale to winery:
 - Grower/vintner contracts
 - Consider grape varieties in demand by wineries
2. Use of grapes in own winery
3. Sale to home winemakers



Site Selection Considerations


Excellent site is a cornerstone for successful grape production

1. Climate: extreme minimum & fluctuating temperatures
2. Soils: physical & chemical characteristics
3. Proximity to crop hazards: 2,4-D drift, wild life.



Climate Considerations

- 1) Minimum winter temperature and frequency
- 2) Frequency of spring frost
- 3) Site topography
- 4) Length of growing season (frost-free-days)
- 5) Growing degree days (heat units)
- 6) Rain fall near harvest



Site Topography

Elevation: highest relative to surrounding area

- Good cold air drainage
- Good air circulation / Drying summer breezes

Slope: land inclination

- slight to moderate (3 - 15%)

Aspect: direction of slope (N, E, S, W)

Soil Considerations

Information from Soil Survey Maps (USDA-NRCS)

Most important:

- Soil depth: minimum 30-40" permeable soil
- Drainage: moderate to well-drained; no "wet feet"
- Soil chemistry: optimum pH = 5.5 – 6.5

Least important:

- Fertility: moderate

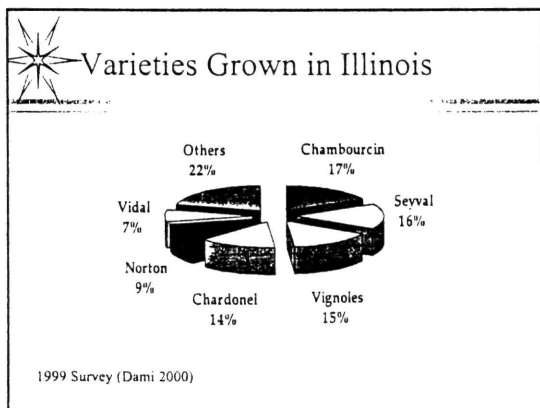
Types of Grapevines

Grape Species	Examples of Varieties
European (<i>V. vinifera</i>)	Chardonnay, Merlot, Cabernet
American (<i>V. labrusca</i>) (<i>V. aestivalis</i>)	Concord, Catawba, Niagara Norton
French Hybrids	Vidal, Seyval, Vignoles, Foch
French-American Hybrids	Chardonel, Traminette, Frontenac


Winter Hardiness of Grapevines

Rank	Hardiness	Bud Injury LT50	Examples of Varieties
1-4	Tender	+5F to -5F	Merlot, Chardonnay, Pinots, Cabernet franc
5-7	Moderate	-5F to -15F	Vidal blanc, Chardonel, Traminette, Chambourcin
8-9	Hardy	-15F to -20F	Seyval, Vignoles, Catawba, Niagara, Norton
10	Very Hardy	-20F to -35F	Concord, Foch, Frontenac, St. Croix, Leon Millot

- ## Variety Selection Criteria
- Fruit and wine quality
 - Market demand
 - Winter hardiness
 - Disease susceptibility (bunch rot)
 - Ripening season (early-, mid-, late-season)
 - Others (yield potential, growth habit, cultural requirements).




- ## Site Preparation
- One or two seasons before planting:*
- Weed control
 - Soil testing: 0-8" and 8-16" for pH and nutrients
 - Nutrient/pH adjustment
 - Tree/brush/rock removal
 - Cultivation: sub-soiling, plowing, disking
 - Cover crop establishment




Soil Chemistry – Desirable Ranges

pH	5.5 – 6.5
Organic matter	2 – 3 %
Phosphorus	40 – 50 lbs/acre
Potassium	250 – 300 lbs/acre
Magnesium	200 – 250 lbs/acre
Zinc	8 – 10 lbs/acre
Boron	1.5 – 2.0 lbs/acre




Vineyard Design

- Row orientation: across slope; parallel to prevailing summer wind; or north-south
- Row spacing: width of tractor and implements 9-12'
- Vine Spacing: variety- & site-dependent, 6-8'
- Row Length: site-dependent, common 300'
- Headlands & drive alleys: turning equipment 30-40'




Planting Considerations

- Order from reputable grapevine nurseries
- No. vines / acre = 43,560 ft² / row' x vine' spacing
- Add 2-3% extra to allow for losses
- Order early fall for planting following spring
- Plant in spring: soil temperature above 50F
- Keep roots moist all time before planting
- Minimize root pruning
- Water immediately after planting




Trellis Construction

- Vine staking: train straight trunk (e.g. bamboo)
- Trellis wire: 12.5 gauge wire HT galvanized III
- End posts: minimum 5" x 9'; CCA pressure-treated
- Line posts: minimum 3" x 8'; CCA pressure-treated
- Cross arms: wooden or metal for GDC system
- End structures: external vs. internal assemblies



Vineyard Establishment Check List -I-

- Determine market outlook and winery demand
- Select appropriate varieties
- Determine suitability of site – climate and soil
- Order vines from nursery
- Test soil for possible amendments
- Control perennial weeds
- Clear site, level land, correct drainage if needed
- Adjust pH (lime) and fertility (P, K, Mg)



Vineyard Establishment Check List -II-

- Rip soil when dry, disc, plow, and level (late summer)
- Establish permanent grass cover crop (early fall)
- Install fencing (deer) if necessary
- Lay out vineyard (spring)
- Kill 24"-36" grass strip in the row with Glyphosate
- Plant vines (spring)
- Set posts, construct trellises, and train vines (summer)

Commercial Vineyard Establishment Costs
Single High Wire Trellis System

8X10 Spacing, 12 rows of 45 vines each

Year 1

Operation Cost/Acre	Estimated Total	Units	Unit Cost	Units/Acre
Site Preparation				
Subsoiling		Acre	\$60.00	1
\$60.00				60.00
Plowing/Rotovating		"	60.00	1
60.00				60.00
Pre-plant Weed Control		"		
Roundup spray	4 ft wide row		\$14.00	2
\$28.00				28.00
Labor		hour	7.00	5
35.00				35.00
TOTAL \$183.00				
Vineyard Layout				
16 Ga. Wire, marked at 10'		Roll	\$26.00	1
\$26.00				26.00
Stakes/flags		each	0.30	24
7.20				7.20
Labor		hour	7.00	6
42.00				42.00
TOTAL \$75.20				
Planting				
Vines		each	\$1.75	600
\$1,050.00				1,050.00
Vine shelters		each	0.75	600
450.00				450.00
Bamboo, 7ft.		bundle	70.00	3
210.00				210.00
Labor		hour	7.00	30
210.00				210.00
TOTAL \$1920.00				

Post Planting Care

Weed Control	spot spray	\$14.00	3	42.00
\$ 42.00				
Fertilization (N)	pounds	0.85	30	25.50
Disease/Insect Control	acre	220.00	1	220.00
220.00				
Canopy Management Labor	hour	7.00	40	280.00
280.00				
Other Labor (mowing, etc)	hour	7.00	40	280.00
280.00				

TOTAL \$847.50**Trellis Construction, "H" Brace**

End Posts	each	\$ 8.00	48	384.00
\$384.00				
Line Posts	each	4.00	192	768.00
768.00				
Hi-tensile 12.5 Ga. Wire	roll	60.00	2	120.00
120.00				
Staples	box	5.00	3	15.00
15.00				
Gripper and Gripples	set	150.00	1	150.00
150.00				
Labor	hour	7.00	60	420.00
420.00				

TOTAL \$1857.00**OR Tie Back Trellis with Anchors**

End Posts	each	\$8.00	24	192.00
\$192.00				
Line Posts	each	4.00	168	672.00
672.00				
Anchors	each	5.00	24	120.00
120.00				
Wire, staples Gripper, etc. same as above				705.00
705.00				

TOTAL \$1689.00**Total costs, year one, using "H" Brace system: \$4,882.70****Total costs, year one, using anchors: \$4,714.70**

Commercial Vineyard Establishment Costs
Single High Wire Trellis System
Year 2

Operation Estimated Total	Unit	Unit Cost	Units/Acre	Cost/Acre
Planting, Vine Replacement				
Vines (est. 2%) \$ 17.50	each	\$ 1.75	10	17.50
Labor 7.50	hour	7.00	1	7.50
				TOTAL
\$ 25.00				
Vineyard Maintenance				
Weed Control \$ 110.00	acre	\$110.00	1	110.00
Fertilization 42.50	pounds	0.85	50	42.50
Disease/Insect Control 410.00	acre	410.00	1	410.00
Canopy Management Labor 560.00	hour	7.00	80	560.00
Other Labor (mowing,etc) 280.00	hour	7.00	40	280.00
			TOTAL	\$1402.50

Total costs, year 2: \$1427.50

Commercial Vineyard Establishment Costs
Single High Wire Trellis System
Year 3

Operation	Unit	Unit Cost	Units/Acre	Cost/Acre
Estimated Total				
<hr/>				
Vineyard Maintenance	acre	-----		\$ 1402.50
Harvest Lugs	each	\$ 10.00	10	100.00
100.00				
Harvest Bins	each	225.00	4	900.00
900.00				
Harvest Labor	hour	7.00	10	70.00
70.00				
				TOTAL
\$ 2472.50				

Commercial Vineyard Establishment Costs
Single High Wire Trellis System
Year 4

Operation	Unit	Unit Cost	Units/Acre	Cost/Acre
Estimated Total				
<hr/>				
Vineyard Maintenance	acre	-----		\$1402.50
Harvest Labor	acre	\$ 7.00	30	210.00
210.00				
				TOTAL \$1612.50

Returns at Various Prices per Ton

Assuming yields at four (4) tons per acre in year 4 and beyond:

Year	\$500/T.	\$600/T.	\$700/T.	\$800/T.	\$900/T.	\$1000/T.
One	0	0	0	0	0	0
Two	0	0	0	0	0	0
Three (50%)	1000	1200	1400	1600	1800	2000
Four	2000	2400	2800	3200	3600	4000

Total of Costs, Years one through three: \$8569.70, thus **First Net Income Year** would be:

Year	\$500/T.	\$600/T.	\$700/T.	\$800/T.	\$900/T.	\$1000/T.
3	1000	1200	1400	1600	1800	2000
4 and beyond:	2000	2400	2800	3200	3600	4000
5	-----					
6	-----					
7	-----					
8	-----					
9	-----					
10	-----					
11	-----					
12	-----					
13	-----					
14	-----					
15	-----					
16	-----					
17	-----					
18	-----					
19	-----					
20	-----					
21	-----					
22	-----					
23	-----					

Net Year

Net Year

Net Year

Net Year

Net Year

Almost There!

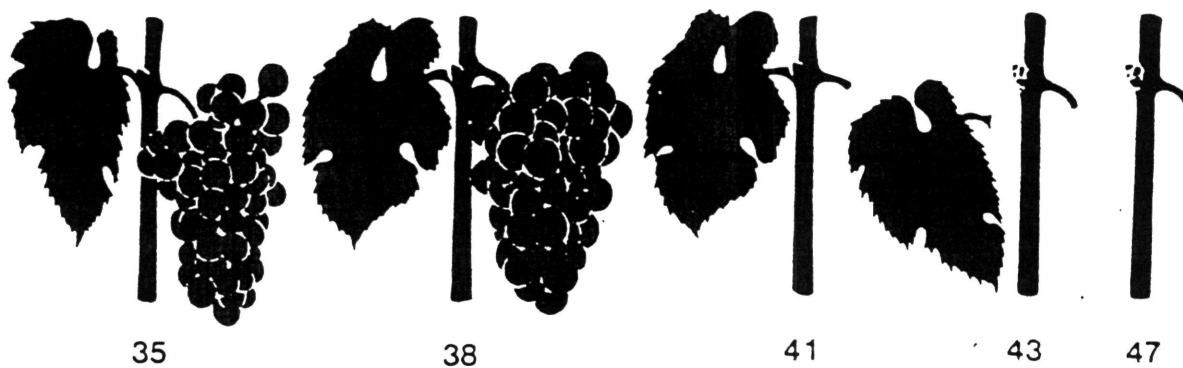
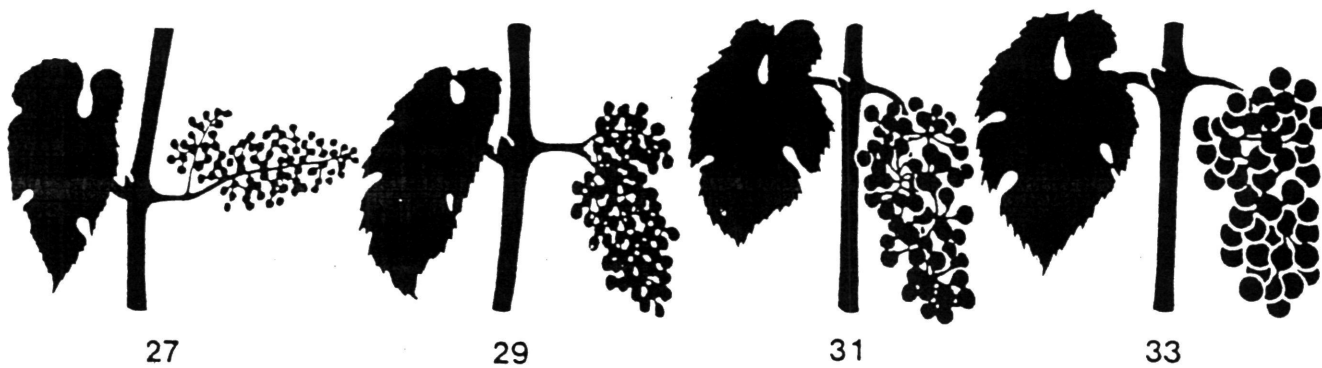
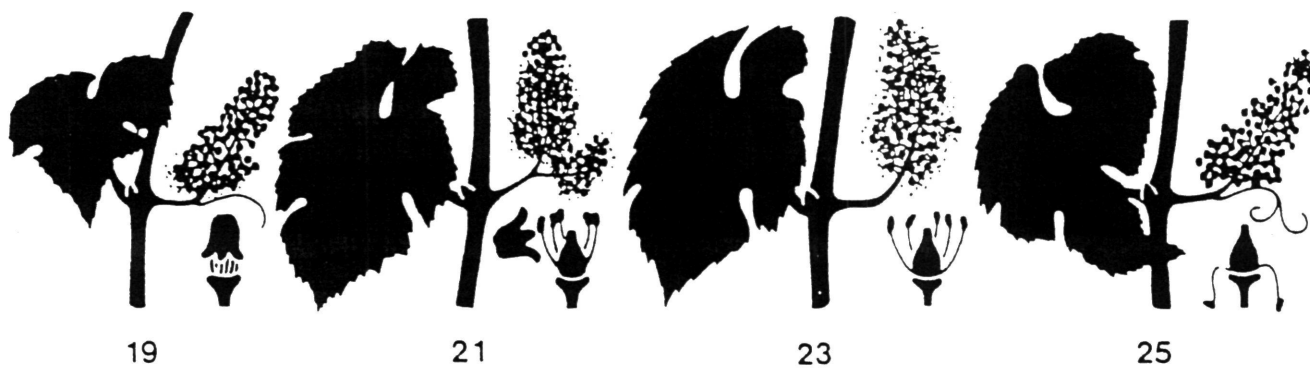
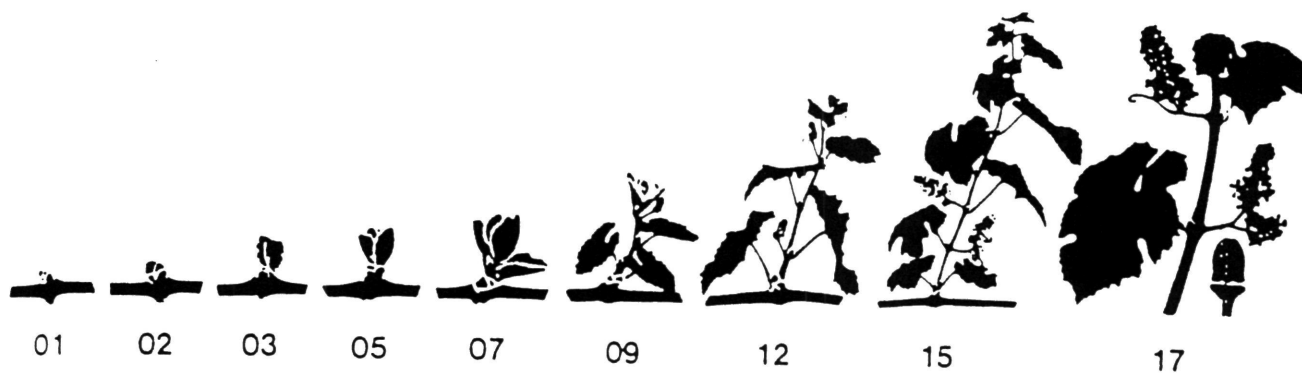
Net Year

TABLE 1. Stages in Shoot Development in the Grapevine^a

Eichhorn-Lorenz Stages^b	Baggiolini Stages^c
01 Winter dormancy: winter bud scales more or less closed	A Winter bud: bud nearly completely covered by two brownish scales
02 Bud swelling: buds expand inside the bud scales	
03 Wool (doeskin stage): brownish wool clearly visible	B Bud swell
05 Bud burst: green shoot first clearly visible	C Green shoot
07 First leaf unfolded and spread away from shoot	D Leaf emergence: tips of leaves visible, bases still protected by wool
09 Two to three leaves unfolded	E Leaves unfolded; first leaves spread away from shoot; internodes visible
12 Five to six leaves unfolded; inflorescences clearly visible	F Four to six leaves unfolded; all inflorescences visible
15 Inflorescence elongating; flowers closely pressed together	G Inflorescences separated and spaced along shoot
17 Inflorescence fully developed; flowers separating	H Flowers separated
19 Beginning of flowering; first caps falling	
21 Early flowering: 25% of caps fallen	
23 Full flowering: 50% of caps fallen	I Flowering
25 Late flowering: 80% of caps fallen	
27 Fruit set: young fruits beginning to swell, remains of flowers lost	J Fruit set
29 Berries small; bunches begin to hang	
31 Berries pea-sized; bunches hang	
33 Beginning of berry touch	
35 Beginning of berry ripening; beginning of loss of green color (<i>véraison</i>)	
38 Berries ripe for harvest	
41 After harvest, end of wood maturation	
43 Beginning of leaf fall	
47 End of leaf fall	

^aAdapted from OEPP/EPPO (1984); used by permission.

^bData from Eichhorn and Lorenz (1977). See also Fig. 3.



3. Stages in grapevine shoot development from dormant bud to leaf fall. See also Table 1. (Reprinted, by permission, from L. Lorenz, 1977)

Sources of Viticultural Information (Apr 2000)

Dr. Imed Dami, Viticulturist
Southern Illinois University at Carbondale / University of Illinois at Urbana Champaign

Viticulture (Grape Growing)

Most of these books are available from Practical Winery and Vineyard magazine (call 415/479-5819) for current prices). Another source of grape and wine text is Kellgren's Wine Book Catalog. The address is: Specialty Books Company, PO Box 616, Croton-on-Hudson, NY 10520-0616; Phone: 1-800-274-4816, Fax: 914/271-5125, E-mail: Kellgren@aol.com.

- Grapes: Production, Management and Marketing. 1991. Cahoon G., M. Ellis, R. Williams and L. Lockshin. Bulletin 815. Ohio Cooperative Extension Service- The Ohio State University. (614-292-1607). *Excellent for viticulture in the Mid-West, including Illinois.*
- General Viticulture. 1974. Winkler, A.J., J.A. Cook, W.M. Kliewer, and L.A. Lider. University of California Press, Berkely, CA. 710 pp. *The "standard" technical reference.* This text is available through Kellgren's Wine Book Catalog (see first paragraph, this page).
- Viticulture: Vol. 2 Practices. 1992. Coombe, B.G. and P.R. Dry. Winetitles, Adelaide, Australia. 376 pp. *A very practical and comprehensive text on viticultural practices.*
- Sunlight into Wine: A handbook for winegrape canopy management. 1991. Smart, R. and M. Robinson. Winetitles, Adelaide, Australia. 88 pp. *A must for serious grapegrowers.*
- Biology of the Grapevine. 1992. Mullins, M.G., A. Bouquet and L. Williams. Cambridge University Press, New York, NY. 239 pp. *A contemporary text for the serious viticulture student.*
- Oregon Winegrape Grower's Guide. 1992. 4th edition. 30 chapters, 264 pp., about \$30.00. Available from Practical Winery and Vineyard magazine (call 415/479-5819). *Useful for Illinois growers as well.*
- The Mid-Atlantic Winegrape Grower's Guide. 1995. Wolf, T.K. and B. Poling. *This 132-page guide provides a comprehensive guide for the establishment and operation of commercial vineyards in middle-Atlantic and surrounding states.* The cost is \$20.00 (payable to NC State Univ.). Mail to Dept. Agricultural Communications, Box 7603, North Carolina State University, Raleigh, NC 27695-7603.
- Guide to Winegrape Growing. McGrew, J.R. 1991. 22 pp. Available from American Wine Society, Rochester, NY (call 716/225-7613). *Geared toward hobbyists.*
- A Practical Ampelography Identification. 1979 Galet, P. Cornell University Press, Ithaca, NY. 248 pp. *A systematic key to variety identification.*

Pest Management

- Illinois Commercial Small Fruit and Grape Spray Guide. Cooperative Extension Service, University of Illinois at Urbana-Champaign. 42 p. *A must for all commercial grape growers*. It is updated every year. To order this guide (item number ICSG-1 cost \$6.00), call Information Technology and Communication Services (UIUC) at 1-800-345-6087.
- Midwest Small Fruit Pest Management Handbook. 1997. Bulletin 861. To order this guide (item number FPM cost \$8.50), call Information Technology and Communication Services (UIUC) at 1-800-345-6087. 173 p. *Excellent reference for Illinois grape and small fruit pest management. Another must for all grape growers*.
- Compendium of Grape Diseases. Pearson, R.C. and A.C. Goheen. 1988. APS Press, Am. Phytopath. Society, 3340 Pilot Knob Road, St. Paul, Minnesota, 55121. 93 pp. (1-800-328-7560). *Another excellent grape guide of grape diseases; provides biology of pathogens and colored pictures of symptoms*.

Professional Societies

There are several professional societies that serve the grape and wine industry. Each has a regular journal or newsletter. The American Society for Viticulture and Enology (ASEV) is the premier technical society in the U.S. The ASEV publishes a quarterly journal of research and sponsors annual meetings and trade shows. Persons interested in ASEV membership can contact the ASEV at: PO Box 1855, Davis, CA 95617-1855, or call (916/753-3142).

The Eastern Section of the ASEV is active in the eastern U.S. Like the parent society, the ASEV Eastern Section sponsors an annual meeting as well as technical symposia of benefit to grape and wine producers. The ASEV/Eastern Section address is: ASEV/ES, Department of Food Science and Technology, NYSAES/Cornell University, Geneva, NY 14456-0462 (315/787-2277).

Trade journals

- Vineyard and Winery Management
Box 231, Watkins Glen, NY 14891 (607/535-7133)
(Practical viticulture and enology information with predominantly eastern perspective).
- Practical Winery and Vineyard
15 Grande Paseo, San Rafael, CA 94903 (415/479-5819)
(Roughly equal amounts of viticulture and enology).
- Wine East
620 North Pine Street, Lancaster, PA 17603 (717/393-0943)
(eastern viticulture and enology with some technical information).
- American Vineyard
PO Box 626, Clovis, CA 93613-0626 (559/298-6675)
(News on viticulture and enology in the US plus technical information).
- Desktop Products Guide - Vineyard and Winery Management
103 3rd Street, PO Box 231, Watkins Glen, NY 14891 (607/535-7133)
(A catalog of viticulture and enology products suppliers, processors, trade associations, maps, and educational centers.)

Viticulture Website References

University of Illinois	<u>http://w3.aces.uiuc.edu/NRES/faculty/Skirvin/cfar/</u>
Cornell University	<u>http://www.nysaes.cornell.edu/hort/faculty/pool/GrapePagesIndex.html</u>
Cornell University	<u>http://www.nysaes.cornell.edu/fst/faculty/henick/asev/</u>
Purdue University	<u>http://www.hort.purdue.edu/hort/ext.html</u>
University of California-Davis	<u>http://wineserver.ucdavis.edu/</u>
American Society for Enology & Viticulture	<u>http://www.ajev.com/asev.html</u>
Virginia Tech & State University	<u>http://www.vaes.vt.edu/winchester/faculty/wolf/wolf.html</u>
Ohio State University	<u>http://www2.oardc.ohio-state.edu/grape</u>

Commercial Wine Grape Varieties for Illinois

Dr. Imed Dami, Viticulturist

Southern Illinois University Carbondale / University of Illinois at Urbana Champaign

Due to the lack of field data and experience on performance of several wine grapes in Illinois, the prospective grower should approach planting new varieties with caution. Before establishing a vineyard, you should consider the viticultural characteristics (contact me for this information) and market demand of the variety(s) to be planted (contact local wineries for grapes they wish to purchase and how much). The major challenge in growing grapes is winter injury, which is likely to occur during the grapevine life. The frequency of occurrence of subfreezing temperatures depends on the site; best sites have less frequent (e.g. once in 8 or 10 years) winter damage than poor sites (every 2 to 3 years). For these reasons, more winter hardy varieties are planted in central and north of the state and less hardy varieties are planted in the southern part of the state. In general, it is expected to observe winter injuries in dormant buds at about -10F in moderately hardy varieties; -15F in hardy varieties and -20F or below in very hardy varieties. *Note that the nature and extent of winter injury are not entirely predictable due to the complex interaction between the variety, the site and the weather.* Other considerations for variety selection include disease susceptibility (especially bunch rot), ripening season (early, mid or late season), yield potential, growth habit, and cultural requirements.

Regions	Cold Hardiness Zone	Average Annual Minimum Temperature	Varieties grown in each region
North: upper third of the state	5a	-20F to -15F	<i>Whites:</i> LaCrosse <i>Reds:</i> St. Croix, Frontenac, Leon Millot, Marechal Foch
Central: middle third of the state	5b	-15F to -10F	<i>Whites:</i> Seyval, Vignoles, LaCrosse, Niagara <i>Reds:</i> St. Croix, Leon Millot, Marechal Foch, Frontenac, Concord, Catawba, Norton*
South: lower third of the state	6a & 6b	-10F to 0F	<i>Whites:</i> Seyval, Vignoles, Niagara, Chardone, Traminette, Cayuga white, Vidal blanc, Villard blanc <i>Reds:</i> Norton, Concord, Catawba, Chambourcin

* Norton is a very cold hardy variety but requires long-growing season (at least 180 days) to ripen its fruit.

Commercial Wine Grape Varieties for Illinois

Variety	Strengths	Weaknesses
<i>Whites</i>		
<i>Cayuga White</i>	Cold hardy, disease-resistant, high yields, good wine quality, promising future in Illinois	Overripe fruit produces wine with strong labrusca character, should be picked before full maturity, excessive vigor in fertile sites
<i>Chardonel</i>	High demand by wineries, high quality fruit and wine, high yields, less susceptible to bunch rot than parents Chardonnay & Seyval, very promising future	Less hardy than Seyval, susceptible to crown gall in wet sites, susceptible to Phylloxera (in Virginia) and thus should be grafted
<i>LaCrosse</i>	Fruity and similar to Seyval but more cold hardy, has performed well in Central Indiana	Susceptible to bunch rot, lack of experience in Illinois, uncertain demand
<i>Seyval</i>	Cold hardy, good quality wine, high yields	High maintenance-not easy to grow- grape, propensity to overcrop thus requires cluster thinning, very susceptible to bunch rot complex
<i>Traminette</i>	High demand, high yields, excellent fruit and wine quality, good disease resistance	Susceptible to trunk winter injury on heavy soils, lack of experience in Illinois
<i>Vidal</i>	High yields, high quality wine, easy to grow, good resistance to bunch rot complex, late bud break (minimum spring frost injury)	Like Seyval may need some cluster thinning, susceptible to viruses (tomato and tobacco ring spot) and thus should be grafted
<i>Vignoles</i>	Very cold hardy, high quality wines, especially dessert wines, late bud break	Moderate vigor and low yields, very susceptible to bunch rot complex due to tight clusters
<i>Villard Blanc</i>	Very productive, good for blending	Uncertain future demand
<i>Reds</i>		
<i>Chambourcin</i>	High demand by wineries, perhaps the highest quality among red hybrids, productive, good resistance to bunch rots	Propensity to overcrop thus requires cluster thinning, not as cold hardy as the other hybrids
<i>Frontenac</i>	Very winter hardy, productive, unique flavor attributes, blending potential	Acidity is a potential winemaking problem, but wine has not been made in Illinois yet
<i>Leon Millot</i>	Similar to Foch, but more vigorous and productive, good wine quality, has performed better than Foch according to local growers	As with any variety, make sure a market exists before planting
<i>Marechal Foch</i>	Very winter hardy, early-ripening, adapts to short growing season in the north	Medium vigor should be grafted to ensure adequate vigor, very susceptible to bird damage, uncertain demand
<i>Norton</i>	High demand, excellent cold hardiness, high fruit and wine quality, good disease resistance	Low yields, should be trained on Geneva Double Curtain in fertile soils, high acid and pH of fruit, susceptible to bird damage, sensitive to 2,4-D
<i>Saint Croix</i>	Very winter hardy, early ripening, adapts to short growing season in the north, American variety without the Labrusca flavor	Propensity to overcrop, thus requires cluster thinning

Winter hardiness, disease susceptibility and sensitivity to copper and sulfur of grape varieties.

Varieties	WH	BR ²	DM	PM	BOT	PH	EU	Anth	CG	ALS	C	S
Catawba	5	+++	+++	++	+	+++	+	+	+	+	++	No
Cayuga White	4	+	++	+	+	+	+	+++	?	++	+	No
Chambourcin	3	+++	++	+	++	?	?	+	++	?	?	Yes
Chancellor	4	+	+++	+++	+	+++	+	++	++	+++	+++	Yes
Chardonnay	4	?	++	+++	++	?	?	+	++	++	?	No
Concord	5	+++	+	++	+	+++	+++	+	+	++	+	Yes
De Chaunac	4	+	++	+++	+	++	+++	++	++	+++	+	Yes
Delaware	5	++	+++ ³	++	++	+++	+	++	+	+	+	No
Elvira	6	+	++	++	+++	+	+	?	++	++	++	No
Esprit	5	?	++	+++	++	?	?	?	?	?	?	?
Fredonia	5	+	+++	++	+	?	?	?	+	+	?	No
Horizon	5	?	+	+++	++	?	?	?	+	+++	?	No
LaCrosse	5	?	+	++	+++	?	?	?	?	?	?	?
Léon Millot	5	?	+	++	+++	?	?	+	+	?	?	?
Maréchal Foch	5	++	+	++	+	?	+++	++	?	+	?	Yes
Melody	4	+++	++	+	+	?	?	?	?	++	?	No
Niagara	4	+++	+++	++	+	+++	+	?	++	+	+	No
Norton		+	++	+	+	?	?	+	?	?	?	Yes
Rougeon	4	++	+++	+++	++	+++	+	?	?	+++	+++	Yes
Saint Croix	6	?	++	++	++	?	?	?	?	?	?	?
Saint Pepin	5	?	+	+++	++	?	?	?	?	?	?	?
Seyval	4	+++	++	+++	+++	+	+	+	+++	++	+	No
Ventura	6	++	++	+++	+	?	?	?	+	+++	?	No
Vignoles	4	+	++	+++	+++	++	++	+++ ⁴	+++	++	?	No
Villard blanc	3	?	++	+++	+	?	?	+++	?	?	?	?
Vincent	4	?	+	++	+	?	?	?	?	?	?	?
Vivant	4	++	++	++	++	?	?	?	?	+++	?	?

WH = Winter hardiness, 1 = very tender, 2 = tender, 3 = slightly hardy, 4 = moderately hardy, 5 = hardy, and 6 = very hardy.
 BR = Black rot; DM = Downy mildew; PM = Powdery mildew; BOT = Botrytis; PH = Phomopsis; EU = Eutypa; Anth = Anthracnose; CG = Crown gall; ALS = Angular leaf scorch; C = sensitivity to copper spray injury; S = sensitivity to sulfur spray injury.

¹ Portions of this table were excerpted from the *Wine and Juice Grape Varieties for Cool Climates*, a Cornell Cooperative Extension Publication, *Illinois Commercial Small Fruit and Grape Spray Guide* and personal experience.

² Disease categories are rated as follows: + = slightly susceptible or sensitive; ++ = moderately susceptible or sensitive; +++ = highly susceptible or sensitive; ? = relative susceptibility or sensitivity not established.

³ Berries not susceptible.

⁴ Fruit of Vignoles is highly susceptible to anthracnose while foliage and shoots are only slightly susceptible.

Note: Norton, Chambourcin, Concord, Baco noir, and Chancellor are sensitive to Endosulfan (e.g. "Thiodan 50WP"), an insecticide for foliar phylloxera.

Vineyard Site Selection

Imed Dami, PhD
Assistant Professor and Viticulture Specialist
Department of Plant, Soil and General Agriculture
Southern Illinois University at Carbondale

Successful grape production begins with selecting an excellent vineyard site. Therefore, site selection is the most important decision a prospective grower makes when considering growing grapes on a commercial scale. This decision would affect yields and profitability for the rest of the vineyard life (20 to 30 years). When selecting a vineyard site three aspects should be considered: climate, soil, and proximity to potential hazards.

1) Climate

Climate is the prevailing weather of a geographic region. Climate is divided into three categories: macroclimate, mesoclimate, and microclimate. *Macroclimate* is the climate of a large region. For example, the Midwest region is characterized by a continental macroclimate where daily temperatures can fluctuate drastically. On the other hand, regions in proximity to large bodies of water (e.g. Great Lakes) have a macroclimate characterized by moderate daily temperatures. Midwinter fluctuating temperatures are usually more harmful to vines than steady cool temperatures. *Mesoclimate* is the climate of a vineyard site affected by its local topography and described by its relative elevation, slope and aspect. *Microclimate* is the environment within and around the canopy of the grapevine, which describes sunlight exposure, air temperature, wind speed, and wetness of leaves and clusters.

Winter minimum temperatures

Vine injury due to low temperatures is one of the major limiting factors of commercial grape production in the Midwest. The severity of winter injury depends on the cold event conditions (minimum temperature, duration, conditions preceding a cold event, time of the season), variety, vine part, and cultural practices. Injury may take place in buds, canes, trunks, or all combined. Bud injury usually causes partial crop loss, whereas trunk injury may cause vine loss which would require retraining the following season.

In cold climate regions, the selection of varieties is primarily determined by the minimum temperature they can withstand and the frequency of its occurrence. Critical minimum temperatures, which cause injury, vary with the inherent cold hardiness of the grape variety and usually range between 0F and -20F or lower (Table 1). Frequency of minimum temperature occurrence is another important consideration. For example, a grape variety that sustains winter injury at -10F is unsuitable for an area that experiences -10F every year. However, the same variety can be successfully grown in another site where -10F occurs only once in every 10 years. The challenge is to match a given variety with the appropriate site that provides a successful and sustainable production during the life of the vineyard.

Table 1. Example of grape cultivars with various cold hardiness levels and corresponding critical minimum temperatures at which injury begins (Based on Zabadal and Andresen 1997).

Hardiness category	Grape cultivars	Temperature at which tissue injury begins (F)
Very cold tender	Cabernet Sauvignon, Merlot	≥ 0
Cold tender	Chardonnay, Riesling, Vidal	-5
Moderately hardy	Cayuga, Seyval	-10
Hardy	Chancellor, Niagara, Vignoles	-15
Very hardy	Concord, Foch, Frontenac	≤ -20

Spring frost

Once vines resume growth in spring, new shoots are sensitive to spring frost and are injured at temperatures of 30F or below. Spring frosts do not generally kill vines but may cause yield reduction. Early budding varieties are more susceptible to spring frost. Some hybrids (Seyval, Chancellor) have fruitful secondary buds and may produce a full crop when primary shoots are injured. Vineyard sites located on sloping land are least prone to spring frost injury while flat sites are most frost-prone and requires extra frost protection measures. Frost injury can also occur in the fall and can be a problem for late-ripening varieties in regions with a short growing season.

Topography

The best vineyard sites are characterized by a good elevation relative to the surrounding area with a gentle slope (5-10%), which promotes cold air drainage and freedom from frost. Like a fluid, cold air flows downhill and accumulates in low spots or valley floors called frost pockets. For this reason, vineyards should be established only at higher elevations and frost pockets should be avoided. During the growing season, air circulation is also enhanced in hilly sites. Summer breezes allow faster drying of leaves and clusters following rain thus minimize the risk of fungal infections.

Length of the growing season

The length of the growing season is another consideration in site selection. It is measured as the number of days (called frost-free-days, FFD) between the last spring frost and the first fall frost. Grape varieties have different requirements of growing season length to ripen their fruit and harden-off. Generally, grapevines require between 150 FFD (for early varieties) and 190 or more FFD (for late varieties).

Heat accumulation

To measure the warmth of a grape-growing region, the standard method for grapes is to cumulate daily growing degree-days (GDD), or heat units, from April 1 to October 31 using a base temperature of 50F. Based on this concept, Winkler et al. (1974) developed 5 regions with I being the coolest (1,700 GDD to 2,500 GDD) and V the warmest (4,000 GDD to 6,000 GDD) region. In most regions in the Midwest, GDD is not a limiting factor for grape growing; however, as vineyard expansion is pushed further north, GDD can be detrimental. It is recommended to grow grapes only in regions with at least 2,000 GDD (Zabadal and Andresen 1997).

2) Soil Requirements

Grapevines can grow in a wide range of soil types. However, they thrive in deep and well-drained soils. These soils promote a healthy and well-developed root system. On the other hand, soils which restrict root development and aeration produce low yields, low vigor, and may shorten the life span of the vineyard. Soils with poor internal water drainage, shallow hardpans, high water tables should be avoided. Potential vineyard sites should have a minimum of 30 to 40 inches of permeable soil.

Soil fertility is not as critical as its physical properties. Ideal vineyard soils have moderate fertility. Very fertile soils should be avoided because they promote excessive vine vigor which leads to reduced yield, low fruit quality, and costly vineyard management. Soil pH, however, is an important aspect of soil chemistry and should be adjusted if not within the optimum range (5.5-6.5) for grape growing.

Soil information can be obtained from soil surveys published for each county. These publications describe soil types, internal water drainage, fertility and other information about the local climate. In addition, on site evaluation of the soils is recommended in order to check the information from the survey and identify variations.

3) Proximity to Crop Hazards

Other elements outside climate and soil requirements should be considered during the site selection process. This includes wildlife and herbicide drift. Deer depredation affects young (foliage) and mature (fruit) vines, but it is most devastating in newly established vineyards. Sites close to woodlands are most prone to deer depredation. The extent and cost of protection methods will depend on the severity of depredation. Temporary management measures include the use of repellents, soaps, scare devices and regulated shooting. Long-term protection involves the construction of a permanent deer exclusion fencing which will last for 20 years or more.

Birds can also cause serious crop loss by consuming grape berries. Proximity of vineyards to wooded areas worsens the problem. Methods of protection include the use of distress call emitters, propane cannons, Mylar ribbons, bird eye scare balloons and netting with the latter being the most effective and expensive.

In Illinois, growth regulator-type herbicides (e.g. 2,4-D) are frequently used in row crops, right-of-ways, railroads, and golf courses. Grapevines are very sensitive to these herbicides and serious injury may occur from drift onto grape leaves. Thus, during site selection, these high-risk areas should be avoided.

In summary, excellent vineyard site is a keystone for economic success in grape production. Knowing that no site is perfect, in selecting a vineyard site more emphasis should be placed on above ground features of a site than on soil characteristics. An ideal vineyard site is located highest in the surrounding area with a gentle sloping terrain where critical low temperatures occur once or twice in 10 years and spring and fall frosts are minimum. Soils are deep and well-drained, and fertility is moderate. The vineyard site is not surrounded by woods and far from drift of injurious herbicides.

References

Winkler, AJ, JA Cook, WM Kliewer and LA Lider. 1974. General Viticulture. Berkeley, California: University of California Press.

Zabadal, TJ and JA Andresen. 1997. Vineyard Establishment I: Preplant Decisions. Bulletin E-2644. East Lansing, Michigan: Michigan State University.

Soil Considerations for Vineyards

Imed Dami, PhD. Viticulture Specialist
Southern Illinois Universtiy

Physical Properties

- ❖ Depth: minimum depth is 30 inches of rooting zone.
- ❖ Internal water drainage: best soils are moderate to well-drained. No “wet feet”.
- ❖ Information on physical properties is available in soil surveys. Each county in the state has a soil survey, which is obtained through your local county/Extension office or the USDA-Natural Resources Conservation Service. Your potential site is in the survey with more information on soil properties and weather information.

Chemical Properties

- ❖ Fertility: moderate fertility is best (2-3% organic matter is normal). Grapes do not like very fertile soils.
- ❖ pH: very important to have optimum pH between 5.5 and 6.5. Southern Illinois soils are usually acid and thus require liming.
- ❖ Information on chemical properties is obtained through soil analysis. Soil samples need to be collected first as follows:
 - Use a soil probe, spade, or shovel and a clean plastic bucket.
 - Take samples from the field in a Z or X shape pattern to assure representative sampling. Take 10 to 20 sub-samples. Mix thoroughly and retain about 1 pound of the mixed soil for testing.
 - Sample at least at two different depths: first at 0-8” then 8-16”.
 - Send the two samples from the two depths to one of the soil laboratories (list enclosed).
 - Send me a copy of the soil test results for recommendations on pH and nutrient adjustment.
 - Request testing on soil pH, macro- and micronutrients, and Cation Exchange Capacity (CEC).

ILLINOIS SOIL TESTING LABORATORIES (October 1999)

Alvey Laboratory
1511 East Main Street
PO Box 175
Belleville, IL 62222
Phone: (618) 233-0445
Fax: (618) 233-7292
E-mail: alveylab@aol.com

Universal Analytical Lab., Inc.
15006 State Route 127 North
Carlyle, IL 62231
Phone: (618) 594-2627
Fax: (618) 594-2637
Website: www.ualab.com

Blacklog Ag Services
RR1 Box 23
Lakewood, IL 62438
Phone: (217) 774-4838
Fax: (217) 774-4913

Mowers Soil Testing Plus, Inc.
117 East Main
PO Box 518
Toulon, IL 61483
Phone: (309) 286-2761
Fax: (309) 286-6251

GMS Laboratory
23877 East 00 North Road
PO Box 61
Cropsey, IL 61731
Phone: (309) 377-2851
Fax: (309) 377-2017
E-mail: gmslab@gmslab.com

Southern Illinois Soil Lab
375 North Old US Rt 66
PO Box 448
Hamel, IL 62046-448
Phone: (618) 633-1811
Fax: (618) 633-1810

Key Agricultural Services, Inc.
114 Shady Lane
Macomb, IL 61455
Phone: (309) 833-1313
Fax: (309) 833-3993
E-mail: keyag@macomb.com

Sparks Soil Testing Service
Box 841
Lincoln, IL 62656
Phone: (217) 735-4233
Fax: (217) 732-4626
E-mail: sstinfo@aol.com

The listing of soil testing laboratories does not imply endorsement of their services, nor does the failure to list other laboratories imply inferiority of their services.

COMMERCIAL NURSERY LIST (July 1999)

American Nursery (H, V)
Rt 1, Box 87 B1
Madison, VA 22727
(540) 948-5064
Fax: (540) 948-5150

Blossomberry Nursery
(Concord, Muscadines, T)
Rt 1, Box 158-A
Clarksville, AR 72830
(501) 754-6489

Chaumette Vineyard (Chardonal, Norton)
1838 Kenneth Place
St. Louis, MO 63104
(314) 444-1927
Fax: (314) 444-1775 or (573) 756-6522
E-mail: Johnsonh@daniel-henry.com

Double A Vineyards
(A, Frontenac, H, N, T, V)
10275 Christy Road
Fredonia, NY 14063
(716) 672-8493
Fax: (716) 679-3442
E-mail: vine@rakgrape.com
Website: www.rakgrape.com

Evergreen Vineyard & Nursery, Inc.
(A, Custom propagation, H, N, V)
17 Southwinds Circle, Suite 7
Washington, MO 63090
(314) 390-2301
Fax: (314) 390-2332
E-mail: vineyard@usmo.com

Grafted Grapevine Nursery (H, N, V)
2399 Wheat Road
Clifton Springs, NY 14432
(315) 462-3288
Fax: (315) 462-5234

Mori-Vines, Inc. (H, R, V)
RR#2, Niagara-on-the-Lake
Ontario L0S 1J0, Canada
(905) 468-0822
Fax: (905) 468-0344

Pilot Rock View Grapevine Nursery
(H, Norton, T)
8380 Ebenezer-Ovil Road
Hopkinsville, KY 42240
(502) 269-2411

Post Familie Vineyards
(Muscadines, Norton, Vignoles)
Rt 1, Box 1
Altus, AR 72821
(800) 275-8423 or (501) 468-2741
Fax: (501) 468-2740

Ripley County Farms
(H, Norton)
PO Box 614
Doniphan, MO 63935
(573) 996-3449
E-mail: rcf@semo.net

Stark Bro's Wholesale and Co.
(Custom propagation)
PO Box 398
Louisiana, MO 63353
(800) 435-8733
Fax: (324) 754-5290
E-mail: starkwholesale@starkbros.com

The listing of grapevine suppliers does not imply endorsement of their products, nor does the failure to list other suppliers imply inferiority of their products. (A = Native American varieties; H = Hybrid varieties; R = Rootstocks; N = New York bred cultivars; T = Seedless table varieties; V = Vinifera varieties).

GRAPEVINES NEEDED PER ACRE

Row Spacing (Feet)	Vine Spacing (Feet)	Number Plants Needed / Acre
8	8	681
8	7	778
8	6	908
9	8	605
9	7	691
9	6	807
10	8	545
10	7	622
10	6	726
11	8	495
11	7	566
11	6	660
12	8	454
12	7	519
12	6	605

VINEYARD SUPPLIES

The following provides a brief listing of supplies that are needed in vineyard operations. An extensive listing of additional industry supplies associated with grapes is available in the "Directory & Products Guide" published by Vineyard & Winery Management magazine. This catalog is the yellow pages to North American Wine and Vineyard Suppliers [Address: 103 Third Street, PO Box 231, Watkins Glen, NY 14891. Tel: 607/535-7133]. Other listings are available in your local yellow pages.

Company	Address	Phone	Supplies
Buchheit	1817 N. Market Sparta, IL 62286	618/443-2455	Trellising supplies, deer fencing, sprayers, implements
Innovative Fence Systems	640 E. Main St. Palmyra, NY 14522	315/597-1111	Trellising supplies, wooden and metal posts
Jim's Supply Company	3530 Buck Owens Blvd. PO Box 668 Bakersfield, CA 93302	800/423-8016 661/324-6514	Trellising and training supplies, metal cross arms and posts, pruners, bird nets,
JDL Sales & Service	RR 2 Box 214 Pittsfield, IL 62363	217/285-2347	High tensile wire, Deer fencing, trellis supplies, posts
La Barge Equipment CO.	PO Box 8125 Holland, MI 49422	800/511-2022 616/399-7544	Galvanized metal cross arms
Orchard Valley Supply	734 Main Street Fawn Grove, PA 17321	717/382-4612	Trellising supplies, harvesting, safety and wine making equipment; training and bird control supplies; sprayers, chemicals
MDT and Associates	3527 Morgan Ave. N. Minneapolis, MN 55412	612/529-4355	Pruners, trellising supplies, grow tubes, training supplies, bird and deer control, grape & wine books
Midwest Vineyard Supply	PO Box 428 Mulkeytown, IL 62865	618/724-9074	Grow tubes, gripples, wire vise, anchors, pruners, harvesting supplies, and vineyard posts.
SPEC Trellising Division	39 Indian Drive Ivyland, PA 18974	800/2374594 215/322-5588	Trellising supplies
The Grower's Supply Center	2415 Harford Road Fallston, MD 21047	410/931-3111	Pruning and harvesting equipment, training supplies.

The listing of vineyard suppliers does not imply endorsement of their products, nor does the failure to list other suppliers imply inferiority of their products.

ignoble Illinois

The subscription fee is \$10.00 per year (January 2001 – December 2001) for 6 newsletters issued bi-monthly. To receive future issues of “Vignoble Illinois” newsletter please complete this form and include your check for \$10.00 payable to SOUTHERN ILLINOIS UNIVERSITY - CARBONDALE.

Please print or type:

Last Name: _____ First Name: _____

Vineyard / Winery Name: _____

Address: _____

Address: _____

City: _____ State: _____ Zip Code: _____

Telephone: _____ E-mail: _____

Mail this form and a check for \$10.00 (payable to SIUC) to:

Imed Dami
Department of Plant, Soil and General Agriculture
Mailcode 4415
Southern Illinois University
Carbondale, IL 62901-4415

IGGVA

Are you a new or renewing Member? New _____ Renewing _____

Type of Membership:

Full (Grower or Vintner) Voting –

0.10 of 1% of annual gross sales: _____

Associate – Non-Voting (\$ 25.00): _____

Full voting membership is open to any legal entity (i.e. sole proprietorship, partnership or corporation) located in Illinois which engages in the bottling, blending and/or production of wine (vintner) and/or the growing of grapes or fruit from which wine is made (grower).

Name(s): _____

Address: _____

City:	State	Zip code
--------------	--------------	-----------------

Phone:	Fax	E-mail
---------------	------------	---------------

Do you grow grapes or other fruit for wine production: Yes_____No_____

Number of plants per acre

What is your wine making status? Bonded_____Amateur_____

Are you involved in the wine or grape industry in any other way? If so, how?

If none of the above applies to you, what is your interest in becoming a Member?

PLEASE SEND THIS APPLICATION WITH DUES TO:

IGGVA

Brenda Logan, Secretary-Treasurer

Baxter's Vineyards

2010 East Parley Street

P. O. Box 342

Nauvoo, IL 62354

IGGVA CONFERENCE 2000

PROCEEDINGS ORDER FORM

If you would like to receive a copy of the Conference Proceedings (60+ pages), please complete and forward this form to the address below. The proceedings include topics on diseases and control, weed control, new fungicides, young vineyard spray program and survey on acreage, production, and prices of varieties grown in Illinois. It is well worth it!

	Price	Quantity	Total
IGGVA Member	\$ 10.00		
IGGVA Non-member *	\$ 15.00		
Shipping and Handling (Prepaid)			\$ 0.00
Total			\$

* If you wish to become an IGGVA member please complete the attached application.

Last Name: _____ First Name: _____

Vineyard / Business: _____

Address: _____

City: _____ State _____ Zip Code _____

Phone: _____

Please remit order form and check or money order to:

IGGVA
Brenda Logan, Secretary-Treasurer
Baxter's Vineyards; 2010 East Parley Street
P. O. Box 342; Nauvoo, IL 62354

Spring Pond Vineyards & Winery

Terry Milligan

13772 Spring Pond Road
Benton, IL 62812
618-439-9176 (phone)
618-435-5071 (fax)

Spring Pond Vineyards is located 1 1/2 miles southeast of Benton in the Rend Lake Recreation area in southern Illinois. The vineyard was planted in 1987 and the winery was built in 1997. This is a family owned operation with four generations working the vineyard and winery. All wines are estate grown and bottled. Tours available. Tasting room and retail sales hours: January-March, Friday and Saturday, 12-6 PM, Sunday, 1-6 PM. April-December, Wednesday-Saturday, 12-6 PM, Sunday 1-6 PM.

Von Jakob Vineyard, Ltd.

Dr. Paul & Rhoda Jacobs

1309 Sadler Road
Pomona, IL 62975
618-893-4500 (phone, fax)
idr@midwest.net
www.VonJakobVineyard.com

Welcome to Von Jakob Vineyard, "Little Germany" on a Shawnee Forest hill in the Illinois Ozarks. Taste the award winning wines. Over 25 medals in international competitions in the first two years of operation. Wines for all meals and occasions. Dry to sweet, red to white. Unique to Von Jakob is our Honey Blush wine. We also produced the first White Port in the state, a multiple medal winner, even in California competitions. Enjoy our 2000 square foot deck, one-half of which is covered for weather. Our inside facilities include a 900 s.f. tasting room and gift shop and 1200 s.f. atrium with fireplace. This seats 100 people for all-weather weddings, parties, or any occasion. Bring a picnic lunch or let us provide one. Sit on our deck, take a walk through the vineyard or to our pond, and enjoy God's countryside. We know you will find our vineyard a great place to have a glass of wine and a plate of cheese or maybe just a great place to relax and get away from it all. Hours: Thursday, Friday, Saturday, Monday 10 AM-5 PM, Sunday 12-5 PM. Open all year.

Waterloo Winery

Mark L. & Susan Hendershot

725 N. Market Street
Waterloo, IL 62298
618-939-5743 or 618-939-8339 (phone)
618-939-4882 (fax)
www.waterloowinery.com

Waterloo Winery, located on scenic Highway 3 in historical Waterloo, is 25 minutes from downtown St. Louis, MO. The 1818 mansion and winery operation offers a unique blend of viticulture and history. The farming complex has experimented with up to 40 different grape varieties. The winery is open year around. Open for tasting 12-5 PM, Wednesday-Sunday. Enjoy the wine gardens with picnic and barbecue facilities, gift shop and cellar tours. Specializing in custom labels, etched bottles, unique glassware, and baskets for all occasions.

White Owl Winery

Ken, Pat, Brian, & Joy Neighbors

White Owl Winery
RR 1, 122A Birds Road
Flat Rock, IL 62427
618-928-2628

Specializing in a variety of fruit wines, White Owl Winery will be opening in the fall of 2000. Call for information and updates.

Winghill Vineyard & Winery

Judith & Richard Parks

5100 Wing Hill Road
Cobden, IL 62920
618-893-WINE (9463)
whfarm@midwest.com

Come experience the newest winery on the Shawnee Hills Wine Trail. Free wine tasting, gift shop, and featuring an art gallery for local artisans to show and sell their work. Located in the red barn 3.5 miles east of New Highway 51 on Wing Hill Road or 5.2 miles west of Interstate 57. At Exit 36, go west on Lick Creek Road 0.6 miles, turn right at Hall Church Road, go 1.8 miles. Hall Church Road becomes Wing Hill Road. Go 2.8 miles to 5100 Wing Hill Road. Watch for yellow "Peacock Crossing" signs. Open year around. Tasting room/gallery hours from 12-5 PM Friday through Sunday or by appointment.

The Illinois Grape Growers & Vintners Association

Alto Vineyards

Paul Renzaglia

P.O. Box 51, Highway 127 South
Alto Pass, IL 62905
618-893-4898 (phone)
618-893-4935 (fax)

Alto Vineyards, located in the heart of the scenic Shawnee National Forest in southern Illinois, was established on its family owned vineyard in 1988. Our estate produced wines have already been recognized with numerous awards in competitions across the United States and Canada. Tasting room and retail shop open Sunday-Friday, 1-5 PM, Saturday, 10 AM-5 PM year around. Closed Easter, Thanksgiving, Christmas, New Years Day.

Baxter's Vineyards & Winery

Brenda & Kelly Logan

2010 E. Parley Street
Nauvoo, IL 62354
217-453-2528 (phone)
217-453-6600 (fax)
baxters@nauvoo.net

Located in Historic Nauvoo. Open daily except for major holidays. Complimentary wine tasting, tours, handcrafted gifts made by area craftsmen, and specialty foods including Carol's homemade pies and sweet breads. Family owned and operated, Baxter's Vineyards is the oldest winery in Illinois. Hours are 9 AM-5 PM Monday-Saturday, 10 AM-5 PM Sunday. Baxter's Village, also located at the winery, is a group of unique shops featuring a craft shop, gift shop, glass blower, and bed & breakfast.

Chateau Ra-Ha Winery

Harry & Rita Hussmann

230 E. Main Street
Grafton, IL 62037
618-786-3335 (phone)
chateauraha@gtec.com

Located in Grafton, Illinois, Chateau Ra-Ha Winery was completely flooded in 1993. Open again at a new location in Grafton, the new winery is built partially into a hillside. Open year around. Hours are Monday-Saturday, 11 AM-7 PM, Sunday, 12 noon-7 PM. Call for information.

Galena Cellars Winery

Scott Lawlor & Christine Lawlor White

515 S. Main Street, P.O. Box 207
Galena, IL 61036
815-777-3330 (phone)
800-397-WINE
815-777-3335 (fax)
www.galenacellar.com

Located in the historic lead mining town of Galena, Illinois. Open daily at 9 AM except major holidays. Family blends, ferments, and ages 24 award winning table and fruit wines. Winery offers tasting, tours, and a wide array of wine accessories. Visit Grants Place Restaurant on second floor featuring our Galena Wines. Now Open - The Vineyard Tasting Room. Open Friday, Saturday, Sunday, June-October. Relax on the deck and enjoy a glass of wine and our spectacular panoramic country views.

GenKota Winery, Ltd.

Dr. Bradley & Tamara L. Drake

301 N. 44th Street
Mt. Vernon, IL 62864
618-246-WINE (9463) (phone)
618-246-9465 (fax)
genkota@mvn.net
www.genkota.com

GenKota Winery is located at Mt. Vernon (I-57/64, exit 95) on the frontage road behind Denny's and Steak & Shake. GenKota's selection of award winning wines includes dry, semi-dry, semi-sweet, and sweet covering the spectrum of reds, blushes, and whites including an international award winning Port. GenKota's large gift shop/tasting room offers gifts, gift baskets, and personalized labels in addition to tasting and tours. Hours: April-December, Monday-Saturday, 10 AM-7 PM, Sunday, 12-6 PM. January-March, Monday-Saturday, 11 AM-6 PM, Sunday, 12-4 PM. Weather permitting open on Friday and Saturday until 8 PM to enjoy wine on the deck. Closed on major holidays.

Glunz Family Winery & Cellars

Joseph B. Glunz, Jr.

888 E. Belvidere Road, Suite 109 & 211
Grayslake, IL 60030
847-548-9463 (phone)
847-548-8038 (fax)
www.gfwc.com

Opened in 1993, Glunz Family Winery & Cellars is located in Chicago's northern suburb of Grayslake, five minutes west of Great America and Gurnee Mills Outlet. Four generations of the Glunz family have been in the Illinois wine business since 1888 specializing in fortified wines. Hours: Wednesday-Saturday, 10 AM-6 PM, Sunday 12-5 PM. Closed Monday and Tuesday.

Lau-Nae Winery

Mike, Donna & Matt Mollet

1522 State Route 3
Red Bud, IL 62278
618-282-9463 (phone, fax)
www.Lau-Naewinery.com

Lau-Nae Winery is located 1/2 mile west of Red Bud on Route 3 in historic Randolph County, the site of the first capital of Illinois (Kaskaskia). In addition to the family vineyard, the winery includes a fruit orchard, blackberries, elderberries, and a nut grove of southern Illinois pecans and walnuts. Tasting room is open Wednesday-Saturday, 10 AM-5 PM, Sunday 12-5 PM. Closed Monday, Tuesday and major holidays. Our winery offers locally made items such as home-made quilts, crafts, candles, jellies, and candies. We also offer etched wine bottles for all occasions and hand painted wine glasses and ostrich eggs by local artists. Relax on the wide front porch or by the cozy fireplace while enjoying a glass of our fine wine.

Lynfred Winery

Fred E. Koehler

15 S. Roselle Road
Roselle, IL 60172
630-529-WINE (phone)
630-529-4971 (fax)
www.lynfredwinery.com

Situated in Roselle, a suburb of Chicago, in a grand old Victorian house is the Lynfred Winery. Fred Koehler, a self-taught winemaker, earned national recognition in 1985 when his wines bested 303 others including top California bottlings in a Reno, Nevada judging. Of the new 24,000 square feet addition, our new tasting room is now open and four bed & breakfast suits will be open soon. Open for tasting daily from 10 AM-7 PM. Tours on Saturday and Sunday, 2 and 4 PM.

Monte Alegre Vineyard

David & Beth Ponce

473 Ponce Trail
Carbondale, IL 62901
618-549-3952 (phone)
618-549-6152 (fax)
montealeg@aol.com

Monte Alegre Vineyard is located on the east edge of Carbondale in the heart of the Greater Shawnee grape growing region of Illinois. Monte Alegre is a family run vineyard and wholesale winery with a variety of white and red wines including our unique blend, Monte Alegre Sangria. Monte Alegre winery prides itself on being a supplier of quality estate wines to restaurants and wineries. Please call for tour and sales information.

Owl Creek Vineyard

Ted Wichmann

2655 Water Valley Road
Cobden, IL 62920
618-893-2557

Owl Creek Vineyard on the Shawnee Hills Wine Trail is located in beautiful southern Illinois, 4 1/2 miles south of Giant City State Park near Carbondale. The Makanda Boardwalk craft shops, regional antique stores, bed and breakfasts, fantastic hiking trails, and scenic countryside surround the winery. Hours: May-December, Wednesday-Sunday, 12-5 PM, January-April, Saturday and Sunday, 12-5 PM.

Pheasant Hollow Winery

Bill Needham, Bruce Morganstern, & Jack Griggs

14931 State Highway 37
Whittington, IL 62897
618-629-2302 (phone)
618-985-3689 (fax)

Nestled on the eastern shore of Rend Lake in southern Illinois, Pheasant Hollow Winery is in the heart of a recreation destination that includes a marina, boatel, artisans center, golf course, and many restaurants. Just east of Interstate 57 at Exit 77, Pheasant Hollow Winery is located on over five acres of scenic woodlands. Sit on our deck, enjoy the wildlife, and sip one of our finely crafted award winning fruit or table wines. Tour our wine cellar anytime. Tasting room and gift shop hours: May 1-September 30, 10 AM-8 PM, Monday-Saturday, Noon-8 PM Sunday. October 1-April 30, 10 AM-6 PM, Monday-Saturday, Noon-6 PM Sunday. Closed on major holidays.

Piasa Winery

211 W. Main, Box 327
Grafton, IL 62037
618-786-WINE (9463) (phone)
www.PiasaWinery.com

Piasa Winery is located in Grafton, IL, specializing in the finest wines of our region, offering wine from ten Illinois wineries and six Missouri wineries. The first bottling of our own wine will be in the fall of 2000. In addition to the 225 styles of wine in stock, our gift shop offers beer, gift baskets, gourmet cheese and sausage. Complimentary wine tasting. Open Wednesday-Sunday, 11 AM-??

Pomona Winery

George Majka & Jane Payne

2865 Hickory Ridge Road
Pomona, IL 62975
618-893-2623 (phone, fax)

Located in the Shawnee Hills of southern Illinois and surrounded by some of Illinois' most scenic areas, the Pomona Winery has specialized in award winning fruit wines made from local apples, peaches, blueberries, and strawberries. The tasting room, decks, picnic areas and garden, nestled in a beautiful sylvan setting, provide the perfect surroundings for experiencing and enjoying these special wines. Winery and grounds are open daily April through December: Monday-Saturday, 10 AM-5 PM, Sunday 12-5 PM. Weekends only in March. Closed January and February.

Prairie State Mercantile/ Prairie State Country Wines

Rick & Maria Mamoser

217 W. Main Street
Genoa, IL 60135
815-784-4540 (phone)

In the heart of Genoa's Main Street Shopping District, Prairie State Mercantile is home to Prairie State Country Wines. Located east of Interstate 39 on State Route 72, we are proud to offer our hand-crafted wines. Illinois produce is the main ingredient in these old-fashioned country wines with varieties such as Apple, Elderberry, Niagara grape, and Strawberry. Look for seasonal favorites such as Dandelion. In addition to our wines, our Mercantile offers the widest selection of Illinois wines and finer goods in northern Illinois. Visit us Monday through Saturday from 10 AM-5 PM, Sundays soon. Tasting daily. We look forward to your visit.

Schorr Lake Vineyards

Paul & JoAnn Nobbe

1032 S. Library Street
Waterloo, IL 62298
618-939-3174 (phone)

The winery and vineyard are located just outside Waterloo on the edge of peaceful, picturesque Schorr Lake. A quiet wooded area where one can relax on the deck overlooking the six acre vineyard or enjoy the beauty of the sunset over the lake. The winery features estate grown and produced table and fruit wines. Tasting room and gift shop open April-December, Friday, Saturday, and Sunday, 12-6 PM or by appointment.

ignoble Illinois

Volume 2 - Issue 03

May-June 2001

Summer Workshops

Highlights

Summer Workshops

Viticulture Summer Meeting 2001

New Executive Director for IGWRC

Disease Control Reminders

Insect Control Reminders

Expanding Research Test Plots in Northern & Western Illinois

Control of Johnsongrass

Canopy Management

Upcoming Events

Join us at one of three statewide vineyard canopy management workshops. Demonstrations will illustrate the current practices of canopy management including shoot thinning, shoot positioning, leaf pulling, and cluster thinning. Training young vines will also be discussed. Please note that the first workshop will be held at the Horticulture Research Center in Carbondale on June 16 from 9am until 12pm. See the Upcoming events section for additional workshop information. Brochures with directions were sent out. If you have not received one please let me know.

Viticulture Summer Meeting 2001

Also, I encourage you to attend our Annual Summer Meeting which has been very successful. The first meeting was held in Carbondale in 1999; then in Godfrey in 2000. This year the meeting will be held in northern Illinois in Galena on 28 July. Peter Hemstad is the feature speaker and he is one of the leaders in breeding hardy varieties at the University of Minnesota. He is very familiar with Frontenac and other promising varieties with great potential in Illinois. State Specialists will also participate including Dr. Babadoost, Plant Pathologist, who will answer all questions on grape diseases; Dr. Weinzierl, Entomologist, has extensive knowledge of insects and will describe those relevant to grapes. Dr. Menke will demonstrate how to sample grapes and analyze the juice. I will discuss canopy management practices. We look forward to your attendance!

New Executive Director for IGWRC

Bonnie Cissell has recently joined the IGWRC staff and will be the council's first permanent, full time executive director since its creation in 1997. In this capacity, Cissell will work closely with Imed

Dami, Stephen Menke, and other council members in working to promote the grape and wine industry in Illinois. Her primary responsibilities will focus on marketing, public relations and strategic planning.

"One of our main concerns at this time of year," Cissell stated, "is working on making the State Fair a really positive experience for our Winery owners and for the public as well. In addition to that, our annual Wine Judging Competition is coming up, and we're considering some changes that will enhance this experience for the participants and lead to improved public relations opportunities."

Bonnie Cissell may be reached at 618-536-4972 or IGWRC@siu.edu.

Disease Control Reminders

- ❖ Remember that disease control is not only about fungicide spray application so many times a year. It also involves cultural practices such as canopy management (see section below), which benefit the taste of the fruit and its cleanliness from fungal diseases. Make sure you implement canopy management practices (shoot positioning, leaf pulling) in your vineyard in order to increase air circulation, speed leaf drying, and improve spray penetration around clusters. All these practices are helpful in controlling the major fungal diseases in Illinois.
- ❖ Fertilization is another cultural practice that should be carefully managed to control diseases. Avoid excessive fertilizer application of nitrogen because it leads to excess vigor, which in turn leads to a high disease pressure (especially botrytis bunch rot). Cane pruning weight, taken during the dormant season, is a good indicator of vine size. Optimum weight

is 2.5 to 3 lbs per vine on a high cordon system with 8 foot vine spacing. Beyond 3 lbs/vine indicates excess vigor. During the growing season, indicators of excessive vigor include presence of several long lateral shoots, unusually large and dark green leaves, and the presence of shaded yellow leaves.

- ❖ Do not make the decision of controlling diseases in your vineyard based solely on the cost of fungicides. You are taking a huge and unwise risk. The cheapest fungicides are not necessarily the most effective; “one fungicide for all diseases” does not work either; and “Silver Bullet Fungicide” does not exist (even though Abound came pretty close!)
- ❖ FYI - University of Illinois Plant Clinic: This clinic is located in Urbana, Illinois and functions as a clearinghouse for plant problems. Services include plant and insect identification, diagnosis of disease, insect, and weed problems, nematode assays and help with nutrient related problems, as well as recommendations involving these diagnoses. The clinic is in operation 1 May – 15 Sept. For more information contact: <http://w3.aces.uiuc.edu/CropSci/Research/clinic/clinic.html> or call 217-333-0519.
- ❖ Here are a few tips on controlling the major grape diseases:

Black rot

Fungicide spray before bloom and the next two following bloom are the most important to control black rot. Use the most effective fungicides and highest recommended rates for black rot, especially if you experienced infection during the previous year. I have seen black rot infections in almost all premium varieties grown in Illinois, including Chardonel, Chambourcin, Seyval, and even the newly released Frontenac (for more information on variety susceptibility, see the Illinois Commercial Small Fruit and Grape Spray Guide 2001). Nova and Elite are the best rated for black rot control. Both are sterol inhibitors, and are systemic, which means they provide preventative (before infection) and eradicant (kick-back or after infection) protection. Both are better choices in rainy conditions before, during and after bloom. Abound is next on the “top-guns” list and is an excellent protectant but has little postinfection activity. Finally, Mancozeb (e.g.

Manzate, Dithane, and Penncozeb), Ferbam, and Ziram are good protectants but have no postinfection activity.

Downy mildew

Infection period is almost similar to black rot; thus the best way to control downy mildew is to use the most effective fungicides in the spray before (pre-bloom) and the spray after bloom (post-bloom). Varieties that are susceptible to downy mildew include Chancellor, Catawba, Niagara, Reliance, and Einset Seedless (for more information on variety susceptibility, see the Illinois Commercial Small Fruit and Grape Spray Guide 2001). The best fungicides for downy mildew are Abound and Ridomil. Abound is primarily a protectant with limited postinfection activity and provides excellent control of downy mildew in addition to black rot and powdery mildew. Ridomil is also an excellent systemic fungicide for downy mildew. However, unlike Abound it is only effective against downy mildew and nothing else. Coupled with its high cost has made Ridomil an unattractive option for many growers. Also, Ridomil and Abound are more prone to disease resistance; hence they should not be overused. Other good protectants include Mancozeb and Captan. Due to the pre-harvest interval restriction (PHI = 66 days; same for Ridomil MZ since it contains some Mancozeb), Mancozeb is applied early in the season then switched to Captan (PHI = 4 days) in late summer. Actually, Captan can provide protection from bitter rot when applied 4 to 6 weeks before harvest.

Botrytis bunch rot

This disease is especially severe on varieties with tight clusters and thin skins. In our region, the most susceptible and important varieties are Vignoles and Seyval. Other susceptible varieties planted in small acreage include Baco noir, Aurore, Chelois, La Crosse, and Elvira. Therefore, fungicide spray should be considered only with susceptible varieties. Botrytis fungicides are relatively expensive and should not be used in non-susceptible varieties. There are three major products: Rovral, Elevate, and Vanguard. According to the grape spray guide the timing of application is similar for all 3 and up to 4 sprays are recommended: 1) early to mid bloom; 2) prior to bunch closing (berry touch); 3) veraison (beginning of fruit ripening); and 4) prior to harvest if needed.

While you can spray up to 4 sprays, the spray guide highly recommends not exceeding 3 applications per season due to the risk of resistance. So what is the best timing to spray against Botrytis? Believe it or not, this question is still being debated and there is extensive research being conducted in New York and elsewhere trying to answer this question. The latest development states that control of botrytis at veraison is the most crucial since the fruit is most susceptible at that stage. The best products, Vanguard and Elevate, should be used. However, bloom time spray may add more protection especially under wet conditions (which is usually the case in our environment). A “proposed” botrytis control program may start with Vanguard during bloom; followed by post bloom with a “strobie” (e.g. Abound, which will also control black rot, powdery mildew and downy mildew); then Elevate at veraison. Grape berry moth (GBM) damage to clusters increases Botrytis infection, thus measures to control GBM should be considered. Botrytis control is also accomplished through cultural practices by providing good air circulation via cultural practices (shoot positioning, and leaf pulling in the fruiting zone).

Insect Control Reminders

Aerial Phylloxera (leaf form)

Leaf galls are usually observed on native (Norton) and French-hybrid varieties (Seyval, Chambourcin). Varieties with *Vitis riparia* ancestor are the most susceptible (Frontenac is one of them). Although they are not deadly, leaf galls can impair vine growth. Examine foliage on a weekly basis before and after bloom. Apply spray when first galls are detected. Spray again 10-12 days later if new growth becomes infested. Mid- to late-season sprays for phylloxera are usually ineffective and thus wasteful. Endosulfan (Thiodan 50 WP) is registered for foliar phylloxera. According to New York and Missouri Spray guides, only wettable powder formulations should be used. Also BE AWARE that Endosulfan causes injury to and should not be used on Chambourcin, Norton, Chancellor, Baco noir, Concord, Colobel and Cascade cultivars. Carbaryl (Sevin) should be used instead. A new insecticide, Danitol, is listed in the spray guide to be effective against foliar Phylloxera if applied during bloom.

Grape Berry Moth (GBM)

GBM is the most serious grape insect that may cause economic losses to our grapes. The damage is prima-

rily to the berries and is caused by larvae feeding. There are several generations (3 or more) per season. We are currently monitoring GBM activity by using pheromone traps in our test vineyard in Carbondale and three other commercial vineyards. The first sight of GBM was in one of the commercial vineyards in Union county on 14 May through 18 May. This indicates the first flight of GBM adults. The first week of June, I observed a typical sign of GBM infestation with the presence of webbing in the cluster, which indicates that first-generation larvae are feeding on small berries (Chardonnay is the victim in this case). This corresponds to about two weeks after first trapping GBM. Timing of insecticide spray two to three weeks after first flight should control early generation of GBM. This is not the most damaging phase. Actually, many growers do not even notice it. Second and subsequent generations feed inside berries producing red spots at the point of entry (small hole). The last generation is usually the most damaging. After veraison, damaged berries are susceptible to Botrytis and other pathogens that can lead to bunch rot. Vineyards with the highest risk are those that suffered heavy infestations in previous years; and ones that border wooded areas. The economic threshold is 2% cluster damage (2 out of 100) and insecticide application becomes necessary. Danitol is an insecticide newly registered for grapes and labeled for use against grape berry moth, Japanese beetle, and leafhoppers. It is rated highly effective against grape berry moth. Danitol has a 21-day PHI and 24 hrs REI. I strongly recommend growers to use pheromone traps to assess the risk of GBM infestation in their vineyards. You can order a GBM kit by contacting Great Lakes IPM (800-235-0285).

Expanding Research Test Plots In Illinois

Planting Workshop in Northern Illinois

On 12 May, our northern grape growers joined me and volunteered their time and effort to plant additional varieties in the existing vineyard test plot. This test plot was established last year and new cultivars and selections from Minnesota, Wisconsin, and New York were added this spring. The goal of this test plot is to evaluate these cultivars and new selections under northern Illinois climate and soils and find out the best performers based on cold hardiness, fruit and wine quality. This information will be invaluable for prospective and existing growers in northern Illinois. At this time, there is no experience or records of performances of these varieties in this region.



Our northern grape growers hard at work digging holes, planting vines, and placing grow tubes and stakes.

I would like to extend sincere appreciation to the Lawlor family of Galena Cellars for their ever-generous hospitality. A huge thanks to all the volunteers and for the assistance of the state Enologist, Steve Menke, who helped with the trellising. Finally, the Illinois Grape and Wine Resources Council are greatly appreciated for funding this important and beneficial research project.

...More Planting in Western Illinois

Two days earlier, I visited Bellevue Hollow Vineyard in Calhoun County to plant two grape varieties. Dr. Jim Nickell, owner of one of the largest vineyards in Illinois offered the space in a site with a spectacular view. Jim offered to use his tree planter and needless to say, 30 vines were planted in record time... According to Jim, the tree planter and his crew planted 600 to 800 vines per hour, which corresponds to about 1 to 1.5 acre planted per hour...very impressive!! If you are interested in future planting of a large vineyard (5+ acres), you may consider using a tree planter. Jim rents his tree planter at \$25 an acre.



Planting team in action: Jim Nickell and I planting vines under the supervision of Shawn Norton who tamps the soil, straightens the vine, and gives us the signal to plant the next vine. George's task is to enjoy the view while driving the tractor.

Can You Control Johnsongrass in Your Vineyard?

Dr. John Masiunas, Weed Scientist – UIUC
(217) 244-4469 masiunas@uiuc.edu

Johnsongrass (*Sorghum halepense*) is a particularly troublesome perennial grass weed that commonly occurs in southern Illinois. *Sorghum album* a related weed can occur as far north in Illinois as Kane County. Johnsongrass reproduces both by seed and by rhizomes. The rhizomes can be particularly difficult to eliminate. The sorghums, including Johnsongrass, are warm season grasses, not starting growth until late May or early June. Johnsongrass can reach heights of 10 feet easily overtopping trellis systems in vineyards and shading out grape plants.

Control of Johnsongrass requires an integrated approach. The first component is preventing Johnsongrass from establishing in your vineyard. Make sure that any grass seed you use in your vineyard is free from weed seed. Regularly scout your vineyards and rogue out any Johnsongrass plants. Dense stands of cool season grasses such as perennial ryegrass, tall fescue, creeping fescue, or orchardgrass between rows of grapes can prevent seedlings of Johnsongrass from establishing in late spring and early summer. These cool season grasses go dormant during the heat of the summer. Thus, they are not effective in competing against established Johnsongrass or seedlings emerging later in the summer. Warm season grasses such as Bermudagrass can be more effective competitors against Johnsongrass but they can cause serious problems in vineyards. Studies in peach orchards found that Bermudagrass produced allelochemicals inhibiting tree growth. Similar inhibition could occur in vineyards.

The third component in Johnsongrass control is tillage. Tillage is a double edge sword when trying to control perennial weeds, especially in fruit plantings. Tillage can injure the grapes and can spread the rhizomes. But when tillage is done well, the rhizome fragments will produce plants more easily controlled by postemergent herbicides and it will bring rhizomes to the soil surface where they are more easily killed by desiccation and freezing and thawing. Multiple tillages are necessary, especially if you are trying to

deplete food reserves in the rhizomes by preventing newly emerging shoots from supplying the rhizomes with sugars.

Several postemergence herbicides are registered for grapes, but do not rely solely on herbicides for Johnsongrass control. Roundup (glyphosate) and Touchdown (sulfosate) are nonselective herbicides which can be applied as directed applications to actively growing Johnsongrass. If either herbicide contacts the green tissues of grapes severe damage will occur. Roundup and Touchdown should be applied to small Johnsongrass seedlings before they become established. With larger, perennial plants thorough coverage of the leaves is necessary to ensure that an adequate amount of the herbicides are absorbed to kill the shoot meristem along with the rhizome system. Multiple applications as the Johnsongrass regrows from unaffected rhizome sections are necessary to completely control the Johnsongrass.

Three selective, postemergence grass-active herbicides are registered for use on grapes. Poast (sethoxydim) can be used in bearing grapes but is not particularly effective against Johnsongrass. Multiple applications, up to a total of 5 pints per acre per season will be required to provide acceptable Johnsongrass control. The pre-harvest interval for grapes is 50 days making it impossible to apply Poast in August. Fusilade (fluazifop) and Prism (clethodim) can be used on nonbearing grapes, a year or more before harvest. Both Fusilade and Prism are more effective against Johnsongrass than Poast, still multiple applications are necessary to control dense well-established stands. With all postemergence grass-active herbicides a crop oil concentrate should be used and the Johnsongrass has to be actively growing.

Canopy Management: The Solution to Premium Grapes and Wines

Successful wine industries such as California have reached worldwide recognition as a result of step-by-step improvements. According to Dr. James Wolpert, Chair of the Department of Viticulture and Enology at UC Davis, improvement of California wine in recent years has come as a result of closer relationships and better communication between growers and wineries. I have witnessed the same phe-

nomenon from my experience in the east (Virginia) and my visits to wine regions in the northwest including Washington and Oregon. It seems that we cannot over emphasize enough the importance of this message to our young and blooming industry. Our growers should realize that they are the real winemakers.

With the tremendous planting, which has occurred the last 3 years, production is estimated to double each year. Wineries would have more grapes to choose from and become "picky" about what to purchase. Winemakers unanimously agree that quality grape is the number one criteria in deciding what and where to buy, and for how much. The best way to ensure quality grapes, growers should embrace canopy management (CM) practices. These practices are usually conducted in fine wine regions to produce premium fruit and wine. However, they are becoming a routine practice for vineyards seeking maximum wine quality. If our wine industry becomes and continues to be successful, it is critical we produce the finest grapes possible in all of our vineyards. The following describes one of the ways to achieve that goal:

What is CM?

According to Dr. Richard Smart, author of 'Sunlight into Wine': "Canopy management is the practice which results in the modification of position or amount of leaves, shoot and fruit in space to achieve a desired arrangement."

Vine canopy is the shoot system, which includes the stem, the leaves, and fruit clusters. In the viticulture world, canopy is described by its length, height, width, leaf area, and shoot density. Shoot density refers to the number of shoots per foot of row or foot of cordon.

Why CM and what are the benefits?

Canopy management has several viticulture advantages such as maximizing sunlight interception, which means minimizing shading, and very importantly maintaining a balance between shoot growth and fruit production.

Benefits? YES!! The extra work undertaken by growers has a significant pay off both for their pockets and the grapevines:

- ❖ Increased air movement, which leads to faster drying time from rain and dew; thus, less disease pressure.

- ❖ Better spray penetration and disease control.
- ❖ Improved fruit composition and varietal character.
- ❖ Increased bud fruitfulness.
- ❖ Improved winter hardiness.

Steps of CM

There are 5 major steps or practices that growers should follow and apply to their vineyards. There are grape varieties that require all 5 steps, some require less, and others require repeat of some of the 5 steps. The growing season also has a major impact on CM. Dry summer (like in 1999) required less CM steps than a wet summer in 2000. Growers have to follow the basics and fine-tune the steps according to variety, site, season, and own experience.

Here are the 5 steps of CM listed in order of vine development throughout the growing season:

Step 1 – Shoot Thinning (Suckering)

Suckering trunks and cordons: This consists of removal of suckers (unwanted shoots which grow on the trunk or cordon). One or two suckers are left at the base of the trunk only if a new trunk needs to be trained in second and third year vines; or if trunk replacement is deemed necessary due to injury (cold, disease, or mechanical). On the cordons, unfruitful shoots are removed first unless they are needed for spur renewal. Once all shoot thinning is done, shoots should be spaced evenly along the cordon length and have a density of 4 to 6 shoots per foot of cordon or canopy. With 8-foot vine spacing, this corresponds to 32-48 shoots per vine on a single curtain/high cordon system, and 64-96 shoots per vine on a Geneva Double Curtain (GDC) training system. Remember that with a divided canopy (e.g. GDC, and Scott Henry), there are two feet of canopy for each foot of row.

When: This is best done early in the season when shoots are about 1-3" (trunk suckering) to 8-12" (cordon suckering) long. At this stage, shoots are easily rubbed off; fruit clusters are visible to distinguish between fruitful and unfruitful shoots; and less labor is involved. Suckering may require more than one pass. Some of the vineyards in southern Illinois were severely hit with frost injury in mid-April. Therefore, growers with frost-prone vineyard sites should plan to shoot thin after the spring frost threat has passed.

Step 2 – Shoot Positioning

The best scenario is when shoots grow vertically