FRUITS

TREE FRUIT

There is a need to develop fully-integrated orchard management systems that will promote production and be environmentally sound. Healthy and vigorous orchards produce high-quality fruit at the best possible cost and also, reduce the need for chemical treatments.

Best management practices for orchards include attention to: site preparation, soil management, water management including irrigation and drainage, nutrient management and pest management. Growers can adjust each component to maximize profits while protecting the environment.

ORCHARD SITE PREPARATION

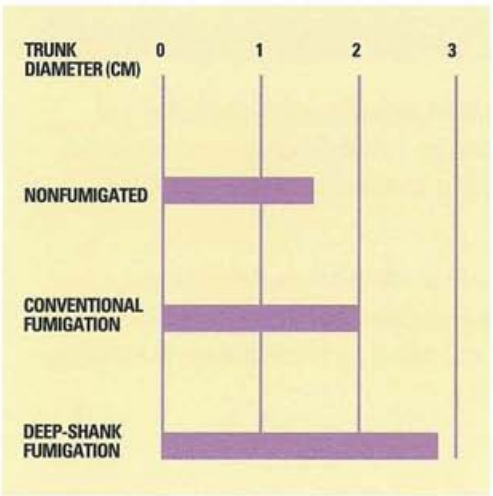
When planning a new orchard, select and prepare an appropriate site at least one to three years in advance. Consider soil testing, past levels of nematodes, organic matter levels, perennial weed control, drainage, soil depth, slope, stoniness and frost pockets.

Soil testing is a must prior to planting. Determine nutrient and pH levels and correct any problems.

Control nematodes, especially Root Lesion nematode. This is crucial to proper establishment of young fruit trees. Nematodes can damage roots and allow fungi to enter roots, disrupting water and nutrient absorption. To determine whether fumigation is necessary, look at the previous crop (corn, for example, increases nematodes), soil type (sandy soils tend to have higher populations than clays), rootstock's tolerance to nematodes and the results of soil samples. If counts are higher than 1,000 nematodes per kilogram of soil, treatment is recommended.

Plan ahead – consider soil test results, past levels of nematodes, weed control, drainage, soil depth, slope, stoniness and frost pockets.

A new fumigation method uses a twin-shank subsoiler to deliver the chemical in a narrow band at three depths.



Comparison of fumigation methods on one-year-old McIntosh apple seedlings (M26 Rootstock). ***(Dr. J.W. Potter, Ag. Canada Vineland)***

Fumigation

Applying fumigants is usually done with a three-point hitch cultivator which places fumigants in a shallow band 1.75 metres wide and 15 centimetres deep. The entire field can be fumigated or just the strips where trees will be planted. Before applying fumigants, prepare a good seedbed. A new method uses a twin-shank subsoiler to deliver fumigant in a narrow band at 15, 30 and 45-centimetre depths. Establishing the sod cover in the summer before fumigation is recommended. Fumigating row strips through the sod allows better weed and erosion control. This may give better nematode control and also subsoils the planting area. The reduced tillage also preserves organic matter and reduces erosion.

Tree Density

Deciding how wide the tree rows should be and how far apart trees should be planted will affect productivity, nutrient management, pest management and water requirements. Before making a decision, consider equipment requirements, availability of skilled labour and availability of irrigation water.

Apples

Tree density has steadily increased over the years as dwarfing rootstocks replace standard rootstocks. The most cost-efficient systems in use are high-density training systems, such as slender spindle (1,750 trees per hectare). The advantages are:

- ►Earlier production with higher yields.
- ►Orchard efficiency is higher (more fruiting wood is produced per hectare).
- ►Production costs per bin decrease.
- ►Potentially higher-quality fruit.
- ►Pesticide use may decline (tree row volume techniques).
- ►Cost recovery time is shorter.

This system requires:

- ►High initial investment.
- ►More professional skills and management are needed.

An example of a highly coloured Empire crop resulting from good sunlight penetration into canopy.

Peaches

The standard for Ontario is 417 trees per hectare. This allows easy movement of standard equipment. The slender spindle system allows densities of 834 trees per hectare. Research completed in 1991 shows yields up by 17% compared to the standard system. Consider the following when making a decision:

- ▸Higher costs to establish orchard.
- ▸Pruning methods will be different.
- ▸Training of trees is critical in the first and second years.
- ▸75% of all work can be done from the ground.

Peach training systems.

SOIL MANAGEMENT

Good soil management in orchards should promote tree growth and good health, productivity and overall fruit quality while preserving soil structure. Issues include ground covers, organic matter and erosion.

Soil management systems include clean cultivation, cultivation plus cover crop, sod plus herbicide strip, sod plus mulch and intercropping between tree rows. In Ontario, growers usually use sod or cultivation plus cover crop. Clean cultivation decreases organic matter, degrades soil structure, increases erosion and increases the potential for winter injury.

Sod with a herbicide strip in these Spartan apples helps to maintain soil structure and prevent soil erosion.

Cultivation/Cover Crops (Peaches)

Soil is worked in April and cultivated regularly until early June. Cultivation reduces competition for moisture between trees, grasses and weeds and increases the air in the soil and soil temperatures (which may help reduce risk of spring frost). In mid June, a cover crop is planted.

When cultivating an orchard, leave some plant material on the soil. The purpose of cultivation is to suppress annual weed growth, not to overwork the soil.

Factors to consider when deciding on the cover crop include:

- Ease of establishment.
- Dry matter produced.
- Effect on nematodes and pests.
- Nutrient interactions.

The cover crop most widely used is annual ryegrass. It establishes quickly and will survive droughts by delaying establishment until conditions improve.

Sod Systems

Producers grow permanent sod between tree rows and mow sod for the life of the orchard. Advantages are:

- Decreased erosion.
- Increased organic matter.
- Water penetrates soil more easily.
- Decreased soil compaction.
- Moderate soil temperatures.
- Decreased mechanical injury of roots.
- Easier orchard operations.

A permanent sod system in peaches.

GRASS VARIETIES FOR ORCHARDS

TYPE	CHARACTERISTICS
CREEPING RED FESCUE	Harder to establish Drought tolerant Fine grass which requires less mowing Persistent Decreases nematode population
PERENNIAL RYEGRASS	Provides good cover, less weed growth Vigorous, fast establishment Suppresses nematode population Dwarfing varieties available
TALL FESCUE	Very vigorous, giving good cover Requires more mowing Shorter types available
ITALIAN (ANNUAL) RYEGRASS	Similar to perennial ryegrass Winterkills Decreases nematode populations Main use in vineyards and peach orchards (non-permanent cover)
MIXES	Includes all the above Preferred practice

Some growers are trying to establish sod the year before planting. In the fall, sod in the tree row is killed with a herbicide. The following spring, trees are planted into the dead grass without cultivation.

A strip of bare ground at the base of the tree helps to reduce competition for moisture from the sod and aids in vole and mice control.

Herbicide Strips

The objective of a herbicide strip is weed suppression during the critical growth stage from early spring to mid summer. A strip of bare ground is left at the base of the trees to reduce competition for moisture between trees and grasses and to aid in the control of voles and mice. The wider the strip, the better tree growth will be. However, a permanently bare strip creates soil problems, increases the possibility of roots being injured over the winter and encourages perennial weeds.

The best solution is to use mulches. Mulches are organic material that are placed within the tree row. Mulches should be applied early to allow decomposition before fall months.

ADVANTAGES ARE	DISADVANTAGES ARE
Moisture is retained/conserved	Mulches may encourage rodents
Soil temperatures are moderated	Material and labour increases costs
Microbial activity is higher	Potential for excessive nitrogen
More extensive rooting is encouraged	Introduction of weed seeds
Soil structure improves	Mechanical harvest of fall apples more difficult
Enhanced nutrient availability	

Possibilities for mulch include: straw, hay (legume hay may contain high levels of nitrogen which may increase late tree growth causing winter damage), wood chips and related products, decomposed organic wastes (e.g. grape pomace — Ministry of Environment permit required) and grass clippings. Apply mulches when soil moisture is high, usually in the spring.

Some growers are modifying their mowers to throw sod clippings into the row area as a mulch.

Compaction

The constant movement of equipment between tree rows may compact soil and result in poor drainage. Subsoiling or mechanical aerators open up soil. However, care must be taken to prevent unwanted root pruning. Techniques should be used when soils are dry as working on wet soil will make problems worse.

WATER MANAGEMENT

Drainage

Surface and soil drainage improve tree growth. If tree roots are in waterlogged soils for extended times, trees become stunted and may die. If drainage does not move water away fast enough, consider:

- ▸French drains, crushed stone over tile drains to the soil surface.
- ▸Planting trees directly over drains (provided that roots won't enter tile lines).
- ▸Building catch basins in the orchard.
- ▸Not planting in that area.

Irrigation

Improves tree growth and health, fruit development and size, and fruit bud initiation. Overhead or trickle irrigation systems are most common. When deciding on a system, consider the following factors:

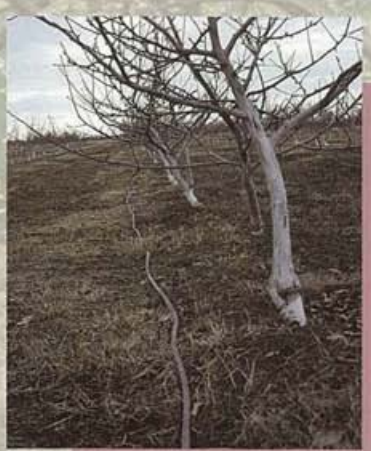
- ▸Water source, quality and supply.
- ▸Water requirements.
- ▸Equipment available.
- ▸Set-up costs.
- ▸Yearly maintenance and operational costs.

Irrigation should begin when 50% of available soil moisture is used and continued until fruit bud initiation is complete. Use a climatic scheduling program or a tensiometer to help in scheduling.

Overhead irrigation may wash pesticides off leaves and fruit. Time applications prior to pesticide use. With trickle irrigation, you may apply fertilizers through the system. Take care that fertilizer does not flow into the water source.

Harrow Research Station Irrigation Study. Peach trees (11-years-old), irrigated when available soil moisture was down to 25%. Cross section in soil at drip line. Note root avoidance of grey sand; this also shows the importance of site and soil selection. *(R. Layne, Ag. Canada, Harrow)*

A tensiometer is a valuable tool for scheduling irrigation. An alternative is to use the climate scheduling program which takes into account the moisture holding capacity of the soil and the evapotranspiration losses of the crop.



Trickle irrigation maximizes effective use of water.

Monitor nutrient uptake with yearly leaf analysis.

NUTRIENT MANAGEMENT

For all tree fruits, nutrients are important. Start by testing soil to determine what nutrients are already available. Do leaf analysis yearly to monitor nutrient uptake. Foliar micronutrients may be used when deficiencies appear. The acceptable range is narrow and over-application may cause damage.

Apply fertilizer when crops need it for growth, depending on the soil management practice used (sod vs. cultivation) and soil type. A healthy sod is one of the best indications of good fertility in the orchard.

PEST MANAGEMENT

Integrated Pest Management (IPM) has been used on tree fruits for more than 20 years. IPM involves monitoring orchards for disease and insects and spraying according to actual findings. Spraying takes place when a pest reaches a determined threshold.

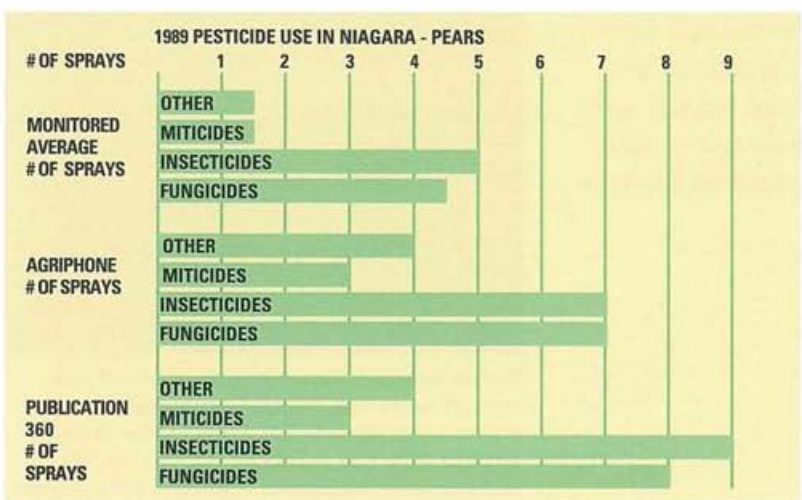
Monitoring

Monitoring equipment includes pheromone traps, physical traps, visually-attractive traps, tapping trays for direct counts and hand lenses. Understand the life cycle of the pest to know the best time and method of controlling the pest. For example, apple scab spores will only grow in specific temperature and moisture conditions. If there is no rain, there is no need to spray.

Monitoring must be done regularly and properly. Orchards should be scouted each week. Some growers hire scouts to handle the responsibility for them. The local OMAF Pest Management Advisor will help interpret monitoring results and make recommendations on applications.

Nitrogen Application

Apply nitrogen in early spring before sod growth. Band nitrogen at the drip line of the tree. If cultivation is used, apply nitrogen after the grass has been worked in. Otherwise, grass will take in nitrogen and trap it for several weeks. Late or excessive applications will stimulate late growth, affect fruit quality and affect winter hardiness.



1989 Pesticide Use in Niagara – Pears.
(G. Walker, OMAF Vineland)

Applications

When using pesticides, growers should be concerned about:

- ▸Safety of the operator and other employees.
- ▸Pesticide costs.
- ▸Application costs.
- ▸Timing of application.
- ▸Biology of the pest.
- ▸Maintenance and calibration of sprayer.
- ▸Impact of spray drift and leaching into groundwater.
- ▸Damage to surrounding crops.
- ▸Weather conditions.
- ▸Coverage and spray penetration.
- ▸Water quality.
- ▸Rate of water used.

To tell if your pest management practices are working, check your crop at harvest. Insect and disease-damaged fruit will be easy to see. If the percentage of culls is too high for your goals, assess practices and adjust. Be sure to set an economic threshold for damaged fruit. After all, input costs will increase, so be sure the investment is worthwhile. Keep good records on applications so that information can be used to spot any trends.

Alternatives to Chemicals

A number of options are being researched and developed including:

Predators/parasites - feed on insects in an orchard. Consider introducing these or selective use of pesticides to encourage natural development.

Pheromones - disrupt mating for Lesser Peach Tree Borer, Codling Moth and Oriental Fruit Moth. (Not currently registered in Ontario.)

Viruses (Granulosis)- are sprayed onto an orchard to attack a certain pest such as the Codling Moth in apples and pears. Work is in preliminary stages.

Ground covers - are adjusted to attract parasites and predators or to lure insects away from trees.

Using resistant varieties - apple cultivars resistant to scab and mildew and Fire blight resistant pears are now available.

Summary

When considering best management practices for tree fruit production, growers must understand the interactions among all components of the management system. When making adjustments or changes to one component, other aspects may be affected.

Seeding a ground cover. Ground covers can be managed to attract parasites and predators or to lure insects away from trees.

The goal in small fruit production is high yield of quality fruit while preserving the environment for future production.

SMALL FRUIT

When growing small fruits, growers must provide an environment that reduces the risk of pests and disease while keeping plants healthy. The result will be a good yield of high-quality fruit. Consumers are increasingly concerned about environmental issues such as pesticide use. Fortunately, by using best management practices, the need for pesticides may be reduced.

SOIL MANAGEMENT

When planting small fruits such as strawberries, raspberries and blueberries, it is important to start planning and making changes at least a year before establishment takes place. Follow these steps:

Soil test - this will provide a reading of soil nutrients, organic levels and pH. Interpret results carefully. Even minor imbalances may cause problems to crops. Adjust soil pH to the following levels: 6.5 for strawberries and raspberries and 4.5 to 5.2 for blueberries.

Prepare site - the year before planting, consider soil fertility, organic matter levels, perennial weeds, drainage, pest levels and soil pH and improve where possible. Examine previous soil test results, earlier crop histories and drainage.

Determine nematode populations - if the site was planted in other small fruits or in orchards, take a soil sample to determine nematode populations. Nematodes damage roots and allow diseases to attack. If counts of root lesion nematodes exceed 500 per kilogram of soil, plants may be stunted and unhealthy. For raspberries, counts of 100 dagger nematodes per kilogram heighten risk of Tomato Mosaic Virus (Crumbly Berry Disease).

Alternatives to chemical fumigation include:

- ▸ Allowing soil to lay fallow for at least one full growing season in a weed-free condition. While this reduces pest risk, it may cause erosion and breakdown of soil structure.
- ▸ Planting cover crops for one year prior to the fruit crop. Use alfalfa, brome hay or another crop that suppresses nematodes.

Organic Matter

Increasing organic matter levels in the soil will improve its ability to hold water and nutrients. If a soil test shows organic matter levels are low, consider using cover crops, or adding manure, straw or hay.

Tillage, including cultivation between rows, breaks down organic matter. To reduce loss, reduce the depth and amount of tillage.

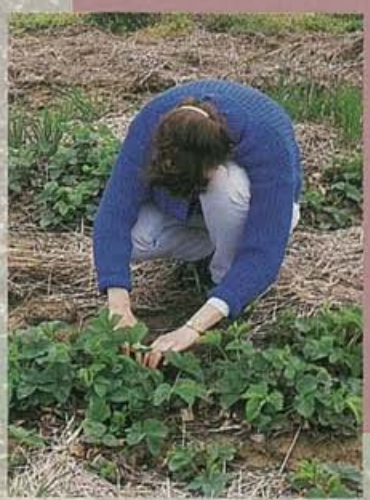
In established raspberry and blueberry fields, permanent sod between rows will reduce soil compaction and erosion, improve soil organic matter levels, make harvesting easier and moderate soil temperatures. The recommended grass for sod cover is Creeping Red Fescue and mixes containing it. This species is relatively resistant to equipment traffic, moderately vigorous and becomes dormant in hot summer months when the crop needs available moisture.

Mulches

The use of wheat straw mulches controls winter injury to **strawberries**. Mulches are also useful during the growing season to control fruit rots, especially Leather Rot. Mulch keeps berries off soil which reduces the spread of fungi to fruit. When the mulch is worked into soil, it adds to the organic matter levels. Timing of mulch application is important. If it is applied too early, plants don't harden; if applied too late, winter injury is possible.

With **blueberries**, a layer of permanent mulch at the base of bushes is essential. Since blueberry roots are shallow, the mulch will preserve soil moisture, decrease soil temperature during the summer, protect roots from winter injury, increase organic matter and provide weed control. Mulches may be sawdust, wood chips, chipped brush or acidic peat moss. If finding mulch is difficult, produce your own by chipping brush and composting it for a year. Some hardwoods, such as walnut, and softwoods, such as cedar, may cause crop growth problems.

Mulching can be used in **raspberry production** to control soil temperature and to conserve moisture.



Straw mulches in strawberries control winter injury, but also keep berries off the soil reducing the spread of fruit rots.

Soil Compaction

Soil compaction is evident in areas that are highly-travelled such as alley ways between strawberry rows and grass strips between raspberries and blueberries. In strawberries, subsoil the alley way when necessary depending on soil type and the amount of traffic. In sod fields, the use of mechanical aerators will have the same effect. Dry soil conditions are necessary for the most effective use of these techniques.

Two Best Management Practices for blueberries include using a combination of a sod ground cover and trickle irrigation.

WATER MANAGEMENT

Drainage is important for productive small fruit crops. Standing water and water-saturated soils increase the development and spread of disease and increases the chance of winter injury damage. Prior to planting, establish tile drainage and good surface drainage.

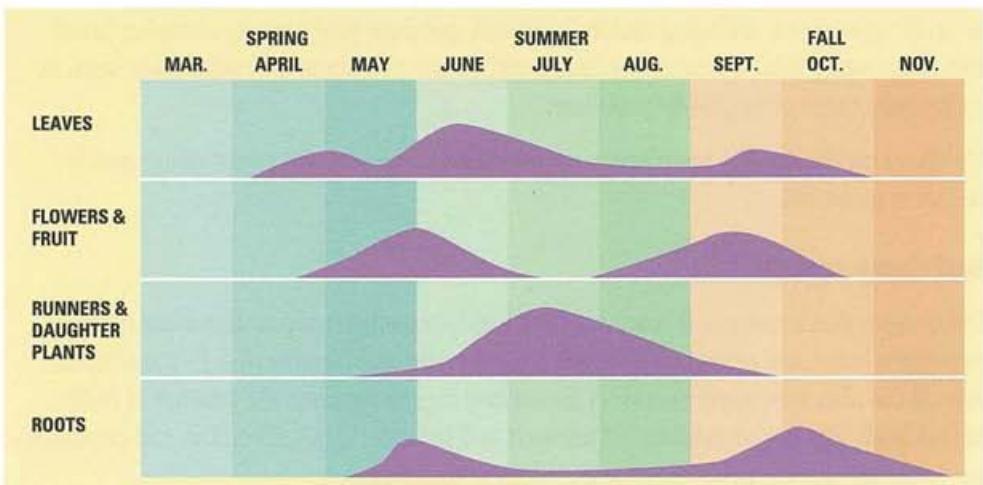
Irrigation of small fruits is important. Small fruits have shallow roots; proper moisture levels must be maintained. Irrigation cools the soil around the roots which encourages root growth. Water is also important when fruit is growing and in the late summer during bud initiation. Trickle irrigation is best suited for raspberries and blueberries. Overhead irrigation does require large volumes of water. However, it can also be used for frost protection in strawberries and low bush blueberries.

Begin irrigation when at least 50% of the moisture in the soil has been used. Trickle irrigation should begin early in the season since small amounts of water are applied at a time. Continue irrigation until after harvest to ensure proper plant growth and bud initiation for the next season.

NUTRIENT MANAGEMENT

Test soils annually to see what nutrients are needed. Also, test leaves to determine nutrient levels. Your fertilizer program can then be fine-tuned for each field. The amount of fertilizer will depend on yield goals, planting density, soil type and the crop. For example, blueberries may need sulphur-based fertilizers to keep soil pH levels low.

Foliar micronutrients are helpful in adjusting nutrient deficiencies. They allow rapid responses. Visual inspection and leaf analysis will indicate need.



A strawberry plant's water requirement through a typical growing season. Peaks on the graph indicate periods when water is particularly important for the plant part listed on the left.

PEST MANAGEMENT

The use of pesticides in small fruit production controls weeds, insects and diseases. Before deciding on control, monitor fields closely to understand pest problems. Keep a record of each field's crop history and previous problems. Any field with a history of Verticillium wilt, Red steele and Black root rot should be avoided. Don't plant into a field that has recently grown tomatoes, peppers, eggplant, melons, raspberries or strawberries. Allow at least two years between small fruit crops. Also, consider herbicide residues or carryover.

An Integrated Pest Management system, including monitoring, timing of sprays and cultural practices, will help to reduce the amount of pesticide used on a crop.

Cultural Control

Crop rotation reduces weed problems and may reduce disease and nematodes.

Select varieties to minimize disease.

Pruning and trellising decreases insect and disease pressure by allowing better movement of air and better penetration of pesticides.

Weed control along the perimeters of the field will eliminate hosts for insects.

Cane density pruning to 10 to 15 canes per metre and maintaining narrow raspberry row width (30 cm) increases light penetration and improves yields.

Monitor small fruits and keep good records to better time sprays and cultural practices.

Pruning and trellising decreases insects and disease pressure by allowing better movement of air and better penetration of pesticides.

Biological Control

►Parasites and predators occur naturally in the environment and feed on insect pests. Avoid pesticides that will harm these.

Chemical Control

►Understand the **pest's life cycle** and apply chemicals at the stage when the pest is most vulnerable. Rainfall and temperature play an important part in pest development. Monitor your fields regularly and carefully. Some growers hire a scout for weekly or bi-weekly monitoring.

►To **control disease,** apply fungicides before damage occurs. In strawberries, for example, apply fungicide during the bloom period to avoid Botrytis grey mold. One or two well-timed sprays are more effective than five sprays between bloom and harvest.

►To **control insects,** monitor fields closely and spray according to action thresholds established for each insect. In strawberries, for example, 2.25 Tarnished Plant Bug nymphs per 15 flowers is an action threshold indicating that it is time to spray.

Alternative Pest Control

Insecticidal soaps - a two per cent solution, that will control 45% of some insects.

Bug vacs - to suck up insects.

Summary

The production of small fruits is intensive and costly. Good management must be practised to ensure profitability. By looking at all growing inputs and realizing how they interact, growers can make best management decisions. The goal is to keep yields high but preserve the environment for future production.

GRAPES

Grape growers need to use integrated vineyard management systems to promote production that is both economically viable and sustainable. It is important to establish and maintain healthy and productive vines through good management practices. This can help reduce the need for treatments that may adversely affect the environment.

To accomplish this, growers should consider:

- ►Site selection and preparation.
- ►Soil and water management.
- ►Pest management.

Integrated vineyard management is needed for economic and sustainable production. Use a combination of cultural management techniques such as hilling in row and alternate alley way cover.

Site Selection

Choose the site for planting vines with attention to:

- ►Air drainage. Good circulation will reduce the potential for disease and lower the risk of frost.
- ►Water drainage.
- ►Wind conditions and climate.

Site Preparation

Thorough land preparation is essential before planting.

- ►Improve the level of organic matter and soil structure. Consider using green manure or cover crops. Install tile and surface drainage as required.
- ►Build the fertility of your soil. Grape vines live and should be reproductive for a long time so make improvements before planting. Also adjust your soil pH to the range of 6.0 to 7.0 before planting.
- ►Control weeds, particularly perennial ones.
- ►Map and mark your fields. Lay out planting to allow air to circulate and to make spraying and harvest easy. Usually, vines are planted north and south to allow the most sun onto vines. If there is a slope, set the rows across the slope to reduce soil erosion, if possible.

A number of soil problems can be present when growing grapes; soil erosion is only one.

SOIL MANAGEMENT

Good soil management will sustain productive grape growing. When growing grapes, a number of soil problems are possible: compaction, erosion, loss of organic matter and poor soil structure.

Management Choices

Many grape growers practice clean cultivation. This may lead to soil erosion and poor soil structure. There are several ways to avoid these problems:

Annual cover crops - seed a cover crop such as Italian ryegrass in August and till it under the following May. Soil is protected during the winter months which reduces erosion.

Semi-permanent cover crops - seed perennial grasses and leave them for two or three seasons before tilling under. Some growers till alternate rows of cover crops each year. This method keeps soil covered for longer periods of time which reduces erosion still further.

Permanent cover crops - seed perennial grasses. This effectively reduces soil erosion but will compete with the grapes. Pay particular attention to nutrients and weed control when using this alternative.

Benefits of soil cover crops in vineyards:

- ►Reduces erosion.
- ►Holds snow to prevent deep freezing.
- ►Maintains soil organic matter.
- ►Can take up extra soil nitrogen in the fall to allow vines to harden off.
- ►Allows cleaner harvesting and other operations in the vineyard.

Some growers compromise, using a sod cover in alternate alley ways and an annual cover crop like oilseed radish in the others.

Soil Structure and Compaction

Grapes, like all crops, need a good root system to be productive. Soil with good structure provides a suitable area for growing roots. Grape roots can penetrate for three to four metres (10 to 12 feet) if soil is in good condition. Soil structure and compaction can be improved by attention to the following practices.

- ►Replace or build the level of organic matter in soil by using cover crops, manure or organic mulches. (Any organic, off-farm waste requires a permit from Ministry of the Environment.)
- ►Reduce the amount of cultivation or use permanent grass cover crops.
- ►Reduce the number of trips over a field. Combine jobs where possible.
- ►Stay off wet soils as much as possible.
- ►Reduce the weight of equipment.
- ►Use deep-rooted cover crops.
- ►Subsoil where necessary at the depth of a compacted layer. Subsoil every two or three years only on dry soils and alternate row middles if possible.

WATER MANAGEMENT

Good water drainage is important for a healthy root system. Poor drainage which allows water to stand on or saturate soil increases frost-heaving damage to grape roots and trellises.

Use irrigation with care, particularly when growing wine grapes, as it will affect the quality of the fruit and delay wood maturity.

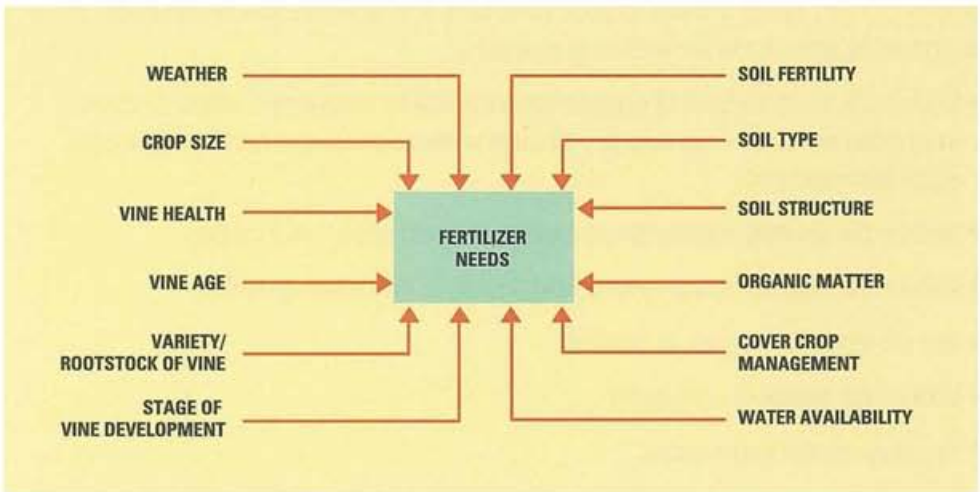
NUTRIENT MANAGEMENT

To manage nutrients effectively, test petiole and soil samples in combination with visual assessment and common sense. Petiole analysis is the most effective practice. Sampling is done in the first two weeks of September.

In established vineyards, usually only nitrogen and potassium additions are needed. Nitrogen can be applied in the form of manure or as inorganic nitrogen. Potassium comes from applications of muriate of potash. For the best results, band fertilizer on grape rows. Do not automatically apply fertilizer every year; petiole analysis will show needs. To prevent leaching and run-off, apply fertilizer in the late spring.

Use petiole analysis to assess nutrient needs.

Keep records of soil and petiole analysis, visual assessment of vine health, yields and weather conditions. These records and your own experience will help interpret problems and results from year to year.



Factors influencing the fertilizer needs of the crop.

PEST MANAGEMENT

Many of the points outlined in this section are preventive. Monitoring pests, using equipment in good repair on healthy vines, on well-maintained trellises and careful spraying will reduce problems.

Chemical pest control may be complemented by appropriate practices and cultural methods.

Cultural Practices

- ▸Select varieties that resist disease where possible.
- ▸Choose a system of training that allows light, air and sprays to penetrate.
- ▸Use good sanitation practices such as: tagging and removing vines with Crown-Gall, Eutypa dieback, or infections; removing **diseased** wood from the vineyard; chopping pruned wood finely and working into soil when vines are healthy; keeping row areas weed-free; and clearing wild grapes from fence rows and surrounding fields.
- ▸Use canopy management, to improve air movement, water evaporation and the penetration of light onto vines.
- ▸Keep trellises in good repair.
- ▸Monitor pest populations in each section of the vineyard. Refer to OMAF Factsheets and code-a-phone information for assistance.

Chemical Control

►Read and follow the label carefully.

►Use sprayers equipped with curtains to reduce drift.

►Calibrate equipment regularly.

►When possible, use directed sprays. For example, while the whole vine must be sprayed for black rot, only fruit needs spray for Botrytis.

►If sampling shows that only outer vines have insects, use a perimeter spray. Pay particular attention to the edges of wooded areas.

►Follow the strategies recommended for each pest. Alternate spray materials to reduce the chance a pest will become resistant.

To control weeds under grapevines, consider:

►A herbicide strip.

►Mulches.

Grape hoe - use the hoe during the early spring to reduce rates of herbicides. Herbicides should be applied after the final hill is in place.

Summary

When growing grapes, it is important to look at the future while working with the "here and now." It is in your best interest to use resources well to ensure both economic and environmental sustainability.