General Information

This guide is intended for commercial farmers to provide information on pest management practices for small fruit crops in New England. Both chemical and non-chemical pest control measures are suggested. Whenever possible, the use of integrated pest management (IPM) practices is encouraged. General concepts of IPM are described in the “About Pest Management” section of this guide. Contact your state small fruit or pest management specialists for details regarding specific crops.

All pesticides listed in this publication are registered and cleared for suggested uses according to federal and state regulations in effect on the date of this publication. Pesticide labels are constantly changing, however. It is still required that applicators read the labels carefully before application to be sure of restrictions and rates.

Trade names are used for identification only; no product endorsement is implied, nor is discrimination intended against similar materials.

The user of this information assumes all risks for personal injury or property damage. If the information in this guide does not agree with the current labeling, follow the label instructions. The label is the law.

WARNING! Pesticides are poisonous. Read and follow all direction and safety precautions on labels before using. Handle pesticides carefully and store out of reach of children, pets, and livestock. Dispose of empty containers immediately in a safe manner and place. Contact your state Department of Agriculture for current regulations.

Berry Crops at a Glance

Below are some vital statistics relevant to several small fruit crops. Many factors including site suitability, time commitment and market strategies will have to be thoroughly researched before entering into a small fruit enterprise. Consult with local growers, Extension Specialists, and others to help determine the suitability of a small fruit enterprise. Books and guides can also be very helpful in answering questions about small fruit production. See the resource list at the end of this guide for some useful books and guides.

Soil Fertility Management

Soil and Tissue Testing

Soil tests provide the best way to determine lime and fertilizer requirements for phosphorus and potassium. Leaf tissue or petiole analysis is the best way to determine nutrient status for nitrogen and minor nutrients. With the information from these tests, the grower can make informed decisions about fertilizing and liming small fruit crops. This is important for cost effectiveness and to achieve optimum yield and quality and to safeguard water quality. Following is a list of soil test laboratories in New England. It is best to use local labs because they are calibrated for local soils and recommendations are tailored to New England conditions.

Table 1. General information for some small fruit crops.

	Strawberries	Summer Red Raspberries	Blackberries	Blueberries
Expected yield	10,000-20,000 lb/A	2,000-7,000 lb/A	3,000-7,000 lb/A	6,000-12,000 lb/A
Age to maturity	2 years	3 years	3 years	6-8 years
Life of planting	5 years	6 years or more	6 years or more	More than 50 years
Hardiness	-35½F	-20½F	0½F	-20½F
Optimal pH	5.5-6.5 (6.2)	5.8-7.0 (6.5)	5.5-7.0 (6.5)	4.2-5.2 (4.5)
Spacing	18" x 48"	2' x 8' to 3' x 12'	3' x 10' to 5' x 12'	4' x 10' to 5' x 12'
Plants/Acre	7,260	1,210-2,722	726-1,452	726-1,089

Source: Cornell University

Soil Testing Labs of New England

soil testing (1), leaf tissue analysis (2),
compost testing (3), manure testing (4)

CONNECTICUT
Soil Testing Lab (1)
2019 Hillside Rd.
Storrs, CT 06269
Telephone: 860-486-4274
www.canr.uconn.edu/plsci/stlab.htm

MAINE
The Analytical Laboratory (1,2,3,4)
5722 Deering Hall, Dept. Plant & Soil & Environmental Sciences, Room 407
Orono ME 04460-5722
Telephone: 207-581-2945
Website: http://anlab.umesci.maine.edu

MASSACHUSETTS
Soil & Plant Tissue Testing Laboratory (1,2,3,4)
West Experiment Station
Univ. of Massachusetts
Amherst MA 01003
Telephone: 413-545-2311
www.umass.edu/plsoils/soiltest

NEW HAMPSHIRE
University of NH Analytical Services Lab (1,2,3,4)
Spaulding Hall, Room G-54, 38 College Rd.
Durham NH 03824
Telephone: 603-862-3210
www.ceinfo.unh.edu/agriculture/documents/soiltest.htm

VERMONT
UVM Agricultural & Environmental Testing Laboratory (1,2,3,4)
219 Hills Building, UVM
Burlington VT 05405
Telephone: 802-656-3030, 800-244-6402
Website: http://pss.umv.edu/ag_testing/

PRIVATE
Woods End Research Lab, Inc. (1,3,4)
1850 Old Rome Rd., P.O. Box 297
Mt. Vernon, ME 04352
Telephone: 207-293-2457
Website: http://woodsend.org/

Crop Production Services (1)
25 Elm St.
South Deerfield, MA 01373
Telephone: 413-665-2115
www.cropproductionservices.com/Farmcenter

Taking a Soil Sample

Although soil samples can be taken any time, many prefer to take samples in summer or fall because this allows time to apply any needed lime and to plan a fertility program and order materials well in advance of the growing season. Avoid sampling when the soil is very wet or soon after a lime or fertilizer application. If a field is uniform, a single composite sample is sufficient. A composite sample consists of 10 to 20 sub-samples taken from around the field and mixed together. To obtain sub-samples, use a spade to take thin slices of soil representing the top six to eight inches of soil. (A soil probe is faster and more convenient to use than a spade.) Put the slices into a clean container and thoroughly mix. Take about one cup of the mixture, dry it at room temperature, put it in a sandwich type bag and tightly close it. Label each sample on the outside of the bag. For each sample, indicate the crop to be grown, recent field history and any concerns.

In many cases fields are not uniform. There are many reasons for this including: uneven topography, wet and dry areas, different soil types and areas with varying previous crop and fertilizing practices. In such cases, the field should be subdivided and composite samples tested for each section.

Soil testing laboratories vary somewhat in their services and prices. Soils should be tested for organic matter content every two or three years. Be sure to request this if it is not part of the standard test. For more information, check with your state's laboratory or Extension Specialist.

Cation Exchange Capacity

Cation exchange capacity (CEC) is an important measure of the soil's ability to retain and supply nutrients, specifically the positively charged nutrients called "cations." CEC is reported as milli-equivalents per 100 grams of soil (Meq/100g). Cations are attracted to negatively charged surfaces of small clay and organic matter particles called colloids. CEC can range from below 5 in sandy soils low in organic matter to over 20 in clay soils and those high in organic matter. A low CEC indicates and soil with little ability to store nutrients and one that is susceptible to nutrient loss through leaching.

Base Saturation

The cations calcium (Ca++), magnesium (Mg++), potassium (K+), hydrogen (H+) and aluminum (Al+++) normally account for nearly all cations adsorbed on soil particles. Ca++, Mg++ and K+ are bases which tend to raise soil pH while H+ and Al+++ are acidic and tend to lower the soil pH. If all the cations are basic and none are acidic there would be a 100% base saturation and the soil pH would be about 7 or neutral. In acidic soils there are acidic cations present and the percent base saturation is less than 100. Besides having sufficient quantities of Ca, Mg and K, it is important that they be in balance with each other because an excess of one of these can suppress the uptake of another. As a general rule a Ca:Mg:K ratio of about 20:4:1 is desirable. When expressed as percent base saturation, desired levels are Ca 65-80%; Mg 5-15%; and K 2-5%.

Soil pH and Liming

One of the most important aspects of nutrient management is maintaining proper soil pH. A pH is a measure of soil acidity. A pH above 7.0 indicates alkalinity and a pH below 7.0 indicates acidity. Most of our soils are naturally acid and need to be limed periodically for optimal growth of most small fruit crops with the exception of blueberries which require a pH of between 4.5 and 5.2. (See the table at the beginning of each crop section for the desired pH range for each small fruit crop.) When the soil is acid, the availability of nitrogen (N), phosphorus (P), and potassium (K) is reduced; there are usually low amounts of calcium (Ca) and magnesium (Mg) in the soil; and there may be toxic levels of iron, aluminum and manganese present. Acid soil also reduces the effectiveness of some herbicides.

Besides raising soil pH, lime is the main source of Ca and Mg for crop nutrition. It is important to select liming materials based on Ca and Mg content with the aim of achieving desired base saturation ratios. If the Mg level is low, a lime high in Mg (dolomite) should be used. Lime high in calcium (calcite) is preferable if Mg is high and Ca is low.

The neutralizing power of lime is determined by its calcium carbonate equivalence. Recommendations are based on an assumed calcium carbonate equivalence of 100. If your lime is lower than this, you will need to apply more than the recommended amount, and if it is higher, you will need less. To determine the amount of lime to apply, divide the recommended amount by the calcium carbonate equivalence of your lime and multiply by 100. Your supplier can tell you the calcium carbonate equivalence of the lime you purchase.

The speed with which lime reacts in the soil is dependent on particle size and distribution in the soil. To determine fineness, lime particles are passed through sieves of various mesh sizes. A 10-mesh sieve has 100 openings per square inch while a 100-mesh sieve has 10,000 openings per square inch. Lime particles that pass through a 100-mesh sieve are very fine and will dissolve and react rapidly - within a few weeks. Coarser material in the 20- to 30-mesh range will react over a longer period, such as one to two years or more. Agricultural ground limestone contains both coarse and fine particles. About half of a typical ground limestone consists of particles fine enough to react within a few months, but to be certain you should obtain a physical analysis from your supplier. Super fine or pulverized lime is sometimes used for a “quick fix” because all of the particles are fine enough to react rapidly.

Lime will react most rapidly if it is thoroughly incorporated to achieve close contact with soil particles. This is best accomplished when lime is applied to a fairly dry soil and disced in (preferably twice). When spread on a damp soil, lime tends to cake up and doesn’t mix well. A moldboard plow has little mixing action.

Buffer pH

In addition to soil pH, many soil tests provide a reading called buffer pH (sometimes called lime index). Soil pH is a measure of hydrogen ion (H+) concentration in the soil solution. This is called active acidity. It is an indicator of current soil conditions. When lime is added to a soil, active acidity is neutralized by chemical reactions that remove hydrogen ions from the soil solution. However, there are also hydrogen ions attached to soil particles which can be released into the soil solution to replace those neutralized by the lime. This is called reserve acidity. Soils such as silts, clays or those high in organic matter have a high cation exchange capacity (CEC) and a potential for high reserve acidity. To effectively raise the soil pH, we must neutralize both active and reserve acidity.

Buffer pH is a measure of reserve acidity and is used by the soil testing laboratory to estimate lime requirements. Low buffer pH readings indicate high amounts of reserve acidity, and therefore, high amounts of lime will be recommended. The soil pH should always be lower than the buffer pH except on some alkaline soils. Instead of using buffer pH, some laboratories calculate lime requirement form CEC and base saturation while others make this determination based on aluminum level.

Plant Nutrients—major and minor

Nitrogen

Nitrogen (N) has a pronounced and often dramatic influence on the growth and yield of crops. Management of soil and fertilizer N is difficult because N undergoes numerous transformations and is easily lost from the soil. These losses concern growers for two principal reasons: 1) the losses can and often do adversely affect plant growth and crop yield, and 2) when N is lost in the nitrate form, there is a chance for contamination of groundwater and drinking water supplies.

The Nitrogen Cycle

The N cycle (Fig. 1) illustrates N inputs, losses and transformations. When inputs exceed plant needs, nitrates can accumulate in the soil and pose a threat to groundwater. Conversely, when plant-available forms of N from the soil and any inputs are too low, crop growth suffers. The key to successful management of N is to find the relatively “thin line” region between too much and too little N. It is not an easy task. N transformations and losses are affected by soil conditions and the vagaries of the weather.

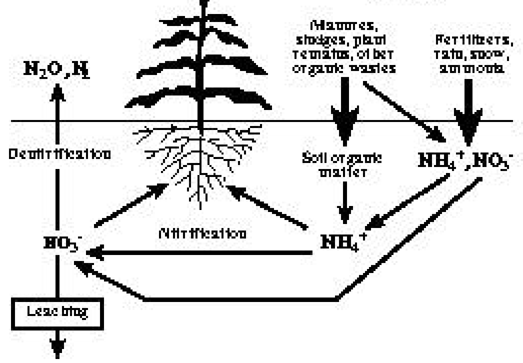

Figure 1. The nitrogen cycle.

Nitrogen Inputs

As can be seen from the N cycle, there are several different sources of the N used by plants:

Soil organic matter: The total amount of N in the plow layer of agricultural soils is surprisingly large. One can estimate the total N in pounds per acre in the six to seven inches of surface soil by multiplying the soil’s organic matter content by 1,000. Thus, a soil with 4% organic matter contains about 4,000 lbs N per acre.

The amount of this total N available to plants in any one year, however, is relatively small. Research has shown that for most soils 1% to 4% of the total N is converted annually to forms plants can use. For soil with a total of 4,000 lbs N per acre, a 1% to 4% conversion would produce 40 to 160 lbs N per acre annually for plant use. If the crop needs 200 lbs N per acre for adequate growth and development, additional N must come from nonsoil sources. Manure and/or commercial fertilizer are the most likely candidates to furnish this supplemental N. On well managed soils used for small fruit production, 20 to 30 lbs of N per acre will result from each percentage of organic matter during the growing season.

Previous cow manure applications: Up to 50% of the total N in cow manure is available to crops in the year of application. Between 5% and 10% of the total applied is released the year after the manure is added. Smaller amounts are furnished in subsequent years. The quantity of N released the year after a single application of 20 tons per acre of cow manure is small (about 15 lbs N per acre). However, in cases where manure has been applied at high rates (30 to 40 tons per acre) for several years, the N furnished from previous manure increases substantially.

The buildup of a soil’s N-supplying capacity resulting from previous applications of cow manure has important consequences for efficient N management, two of which are:

1. The amount of fertilizer N needed for the crop decreases annually;
2. If all the crop’s N needs are being supplied by cow manure, the rate of cow manure needed decreases yearly.

In cage layer poultry manure, a higher percentage of the total N in the manure is converted to plant-available forms in the year of application. Consequently, there is relatively little carry-over of N to crops in succeeding years. This is due to the