The New York Berry News

CORNELL UNIVERSITY

Volume 01, Number 1 March 18, 2002

What's Inside

Welcome! This is the premier edition of the 'New York Berry News' online newsletter: A newsletter that aspires to provide a statewide perspective on the production of berry crops in New York. To begin with, this newsletter will be published once a month, every month of the year. However, as this newsletter develops/matures, this may increase. The New York Berry News is not necessarily intended to provide detailed, step-by-step information on the management of small fruit crops in New York, particularly in the form of pesticide recommendations and fertilization rates. This information is available through Cornell Cooperative Extensions "Pest Management Guidelines for Small Fruit Crops" and other CCE publications. We will, however, attempt to provide pertinent or new information, as developed from Cornell's researchers and extension personnel, on a timely basis. We will also scour regional sources for a articles that we think will be of interest to New York growers.

Again, this is the first edition. This means that much could change about the format and content of this newsletter as we experience "growing pains". In fact we hope that this newsletter DOES change over time. We certainly welcome all comments, suggestions, and criticisms about this newsletter that will improve the content for New York growers. The last page of the newsletter has the contact information for the newsletter. Thank you - *Bill Turechek, Editor.*

Currant Events: Check out the new NYSAES Tree Fruit and Berry Pathology web site at:

www.nysaes.cornell.edu/pp/extension/tfabp/

Pesticide News: ***Quadris fungicide*** (manufactured by Syngenta Inc.) has recently received an EPA federal registration on strawberries. The registration was sought, in particular, for its activity against anthracnose. The fungicide is expected to gain approval by the DEC this season for use in New York.

Switch fungicide (manufactured by Syngenta Inc.) is unlikely to receive a label this season. Switch, a combination of fludioxinil and cyprodinil, will be labeled against gray mold on strawberry.

A few news items concerning changes in chemical controls for insects should be hit upon. A miticide (hexthiazox, common name of ***Savey***) sold by Gowan has received New York DEC registration for control of two-spotted spider mites on strawberries and raspberries. Savey kills eggs and immature mites and is generally considered soft on predatory mites. The label limits use to one time per season. Savey joins several other miticides registered for use on strawberries (e.g. Kelthane, Agri-mek, Vendex) but is the only miticide registered for raspberries. In other news, some changes are pending that will affect insecticide options for control of cranberry fruitworm in blueberries. Dow Corporation is expecting New York registration of an insect growth regulator (tebufenozide, common name is ***Confirm***) sometime this season. Whether it will be available by bloom (when it is needed) is another question. We will keep you posted on that. Also, azinphos-methyl (Guthion, Bayer Corporation) continues to go through EPA review as part of the Food Quality Protection Act. The latest information I have is that it will continue to be available, for the time being, on blueberries, for control of cranberry fruitworm, although the re-entry interval has been increased to 4 days.

Fast Facts: **A look at what you should be looking for in your plantings** - Bill Turechek and Greg English-Loeb, Cornell University, Geneva, NY.

— Strawberry —

It's about time to think about removing your mulch. For the most part, we have had a fairly mild winter so snow cover should not prevent this, but if you have to wait, try to have your mulch removed by mid-April at the latest. Irrigation should also be ready to go for frost protection.

Red stele is a particularly destructive disease. The best solution to avoiding this disease is to plant resistant varieties. In the northeast Allstar, Annapolis, Cavendish, Delmarvel, Earliglow, Guardian, Idea, Lateglow, Midway, Mohawk, Northeastern, Primetime, Redchief, Scott, Sunrise, Tribute, Tristar, and Winona are resistant. However, if a susceptible variety is planted (such as Jewel and Honeoye) and the disease is a problem, a spring application of Ridomil Gold can be applied in a banded application after the ground thaws but before bloom. However, this treatment will only prove to be effective if the berries are not planted in a particularly wet site.

Leaf blight, leaf scorch, and leaf spot are the three foliar diseases that growers in U-pick or PYO operations should keep in mind. Although these diseases have the potential to reduce yield, the greatest threat lies in their ability to dissuade customers from picking, returning to and recommending your farm to new customers. See article below on these important diseases and how to manage them.

There are no major arthropod pests that require action prior to significant vegetative growth. Between mulch removal and the prebloom period, however, there are several potential pests to be aware of. These will be covered in the next edition.

— Raspberry —

Most of your dormant pruning should have begun by now. For summer bearing varieties, all of last year's floricanes (the ones that fruited last year), diseased canes, and winter-damaged canes should be removed. Primocanes (this years fruiting wood) should be thinned to 3-4 canes per squar foot. For fall bearing varieties, mow the canes down using a bush hog or sickle bar mower. Leave several inches of cane to avoid crown injury and enable bud shoot. Unlike summer bearers, you want the maximum number of canes per square foot on your fall bearing varieties.

Anthracnose, spur blight, and cane blight are three diseases where early season management is critical to their control. All three diseases cause lesions on the cane. Anthracnose appears as small purple spots scattered on young canes and tends to be much worse on black and purple raspberries than reds. Spur blight is centered around individual buds and appears as purple to brown blotches in mid-summer. Even though symptoms are not evident until later in the season, infection occurs early and infected buds fail to grow. Cane blight is much more of a problem on red raspberries. Cane blight can be confused with spur blight. However, cane blight is much more likely to involve the entire cane (not just the buds) and infection sites are typically associated with pruning wounds or other injuries.

Managing these disease begins with pruning or removing the diseased canes before new canes emerge in the spring. A dormant application of lime sulfur or copper is also critical where any of the se diseases are problematic. Thorough coverage of the canes is critical to achieving control so be sure that this application is done on a calm day. A note of caution: This spray may be phytotoxic if applied after ½ inch green, particularly on a warm day. A dormant lime spray is not needed on fall bearing raspberries because the previous year's canes should be mowed down and removed.

Phytophthora root rot is one of the most serious diseases of raspberry, especially on susceptible varieties such as Titan, Taylor and Reveille and on raspberries planted on wet sites. Infected plants produce a few, weak and stunted canes. Leaves on on these canes are typically small, turn yellow, or show signs of scorching along the edges and between the veins. Infected plants typically wilt and collapse just before harvest, when the demand on the plant is at its highest. The crown tissue on infected plants may appear discolored. However, if the plants are dug up, many the roots and crown tissue appear dead.

If Phytophthora has been a problem in the past, applications of Ridomil Gold as a soil drench in early spring when the ground is cool and wet or Aliette as a foliar application when 3 inches of new growth appear in the spring are the recommendations. Ridomil is probably the better of the two treatments.

There really are no major arthropod pests of

raspberries that require control between bud swell and the prebloom period. During the dormant period, however, you should be on the look out for signs of cane borer larvae. Infested canes and roots should be removed prior to the spring growth.

— Blueberry —

If you haven't started, now is the time to prune your blueberries. There are number of excellent articles that have come out recently that deal with pruning blueberries and I have attempted to summarize the key points here. On older bushes, prune out all winter-injured, broken, or insect-damaged canes. Prune out canes older than 8 years old or greater than 1 inch in diameter, any cane that is rubbing against another, or those that will not receive much sunlight. Younger canes produce more fruit than older canes, rubbing injury can lead to the development of fungal canker, and blueberry leaves need 30% full sunlight to maximize production. The canes should be pruned as close to the ground as possible. Leaving stubs will promote the development of disease. You should prune bushes to an upright growth habit with the goal of having 10-20 canes varying in age from 1 to 8 years old. On the remaining canes, detailed branch pruning should be done to remove diseased or injured wood. On young bushes, little pruning is required. Remove the flower buds for the first 1 to 2 years by rubbing off the fruit buds or pruning back the shoot tips.

The only potentially significant arthropod pests of blueberries that may require control prior to bloom are scale insects. Several species of scale feed on stems, leaves, and fruit, causing reduced plant vigor and producing honeydew that promotes sooty mold. Proper pruning (removing old canes) will help reduce problems with some species of scale. A delayed dormant oil spray, applied after bud scales start to expand but before the first leaf stands out, will help reduce overwintering populations. Make sure to use sufficient water (250 gallons per acre) to ensure good coverage.

Fusicoccum and Phomopsis cankers are the biggest problems this time of the year. In plantings with light infection, pruning out diseased canes and burning them is key to maintaining low levels of disease. A delayed dormant (i.e., as leaf buds begin to break) spray of lime sulfur will reduce disease in problematic plantings.

— Currant and Gooseberry —

If you have a problem with scale insects on currants or gooseberries, a dormant oil spray can be applied before bud swell and burst in the spring, to control the overwintering adults. One other potentially important arthropod pest of currants is the currant aphid. The aphids become active around budbreak, causing distorted leaf growth. Timing for control of currant aphids is at budbreak or shortly there after.

No major disease needs attention prior to budbreak. However, as the foliage begins to appear, begin to scout for powdery mildew. Applications of Nova 40W or JMS stylet oil should be applied. Care should be taken with oil applications because multiple or excessive applications may delay ripening or reduce the sugars in mature berries. Sulfur is also labeled but care should be exercised here as well as some some varieties of gooseberry are sulfur shy and applcations made to close to an oil application or during warm weather may prove phytotoxic.

Strawberry Fields Forever!

By Cathy Heidenreich and Bill Turechek, Cornell University, Geneva, NY.

So what's the big deal about a few leaf spots here and there, anyway?! Why do we need to be concerned about controlling the fungi that cause them? Let's think a moment about the whole purpose of leaves. What's their function other than providing us shade for a picnic or helping to keep our houses cool in the summer? Leaves are the energy powerhouses for the plant, producing the food needed to keep them strong and healthy, and fruiting prolifically. They also build the stored reserves needed in perennial plants to sustain them through our northern winters. Any reduction in their power producing capabilities then, potentially results in reduced fruit load or winter hardiness. Foliar infections, which build up over time in our perennial strawberry plantings, may contribute significantly to the productivity and longevity of the planting. Scouting and preventative maintenance in terms of strawberry foliar diseases could be a wise bet in protecting your investment.

Leaf spot, caused by the fungus *Mycosphaerella fragariae*, is one of the most common and widespread diseases of strawberry. It is also the cause of black seed; a disease of the fruit that can occur when warm and wet conditions exist during bloom. Prior to the development of resistant cultivars this disease was the most economically important strawberry disease in the Northeast. However, many commercially grown cultivars are not resistant to leaf spot so this disease can still be of great importance where susceptible

cultivars, such as Honeoye, Raritan, and Kent are grown.

Leaf Scorch, caused by *Diplocarpon earlianum*, is a problem on numerous cultivars in North America and can markedly reduce vegetative growth and fruit yield. It is a common disease of strawberry in Ontario, Canada, where epidemics occur normally from August to October. Losses range from negligible to severe, depending on numerous factors, including cultivar susceptibility, type of cropping system, and weather conditions. Scorch can severely weaken plants, resulting in sharp growth declines for shoots and roots, and reduced numbers and vigor of crowns. Severely infected plants may die from environmental stresses, such as heat, cold or drought.

Leaf Blight is caused by the fungus *Phomopsis obscurans*. The major damage caused by this fungus in perennial planting systems is destruction of older foliage in late summer resulting in reduced plant vigor and yield in the following season. (It also can cause severe defoliation in nursery production areas in the southeastern US.) Leaf blight is particularly destructive to slow-growing or weak plants. It seldom damages young, runner plants, and rarely attacks the fruit in the Northeast. The spread of leaf infecting fungi such as *P. obscurans* is favored by frequent rains, overhead irrigation, and heavy dews. Little spread occurs during hot, dry weather in the summer, although symptoms may continue to develop during this period.

A rapid build up of all three leaf diseases occurs in late summer and autumn during rainy periods or when overhead irrigation is used frequently after renovation. The buildup of these diseases can seriously weaken plants and provide large amounts of inoculum for heavy infections the following spring.

Control measures for strawberry foliar pathogens: Growers should plant in light, well-drained soil with good air circulation and exposure. Purchase disease free plants from a reputable nursery and choose leaf spot/leaf scorch resistant cultivars suitable for your location. When filling in rows, carefully space runner plants in matted-row culture and control weeds in all plantings to improve air circulation and reduce drying time for leaves. Older or infected leaves should be removed before setting runners in new plantings. Removing and burning all debris at renovation (after harvest) helps to reduce overwintering inoculum of leaf pathogens.

If leaf diseases have been a problem in the planting the previous year, or conditions are favorable for disease development, consider an early spring application of Captan 50WP (3-6 lb/A) for control of leaf diseases. Nova 40W is labeled for use in New York for control of leaf spot and leaf blight. Applications should begin when disease appears and continue on a 14 to 21 day schedule or when conditions favor disease development. Applications may be applied up to the day of harvest at 2.5-5.0 oz/A. If repeated applications are necessary, it may be wise to alternate Nova 40W with a tank mix of Benlate and Captan for resistance management. Thoroughly cover all above ground plant parts with spray, especially undersides of leaves. Always follow pesticide label directions and restrictions for use.

Discouraging Birds and Geese in Berry Fields.

By Sandra Jones, On-Farm Food Safety Program Lead, OMAFRA, Guelph (Taken from *The All Ontatio Berry Grower*)

Birds can be a serious problem for many growers. Unchecked, birds can completely destroy a crop. Birds are also potential carriers of pathogens such as Salmonella. Many on-farm food safety guidelines recommend controlling movement of animals and birds in and around fields. Sounds like good advice, but how do you go about removing birds from a field?

There are several bird control options available for growers. These include acoustical repellents, visual repellents and physical exclusion. Acoustical repellents rely on sound to scare the birds away. Examples of such repellents would be propane-fired cannons (bird bangers) and electronic sound devices (eg. AV alarm®). The down side to using this option is the noise generated to scare off the birds may also irritate the neighbours. Another option is visual repellents. Birds generally have good eyesight and react to both movement and things that resemble their enemies. Examples include streamers, flashtape, mirrors and hawk/owl silhouettes. Unfortunately, these tend to be effective for short period of time only and rarely provide sufficient protection by themselves. Netting physically keeps the birds away from the crop; however, it is usually the most expensive option if there is a large area to cover.

In Canada, geese are managed under the Migratory Birds Convention Act. As such, producers are advised to contact the Federal Government (Canadian Wildlife Services) in order to determine what steps can be taken to control problem geese. In New York, geese, woodpeckers, and other migratory birds are managed under the Federal Migratory Bird Treaty Act

administered by the US Fish and Wildlife Services. Other birds, particularly crows and blackbirds, are not.

You do not have to contact the Canadian Wildlife Service (CWS) or the US Fish and Wildlife Service to apply a technique that does not injure the birds. Examples would include bird-bangers, horns, firecrackers, netting (if limited area), and dogs. Take action early in spring to stop the birds from getting a foothold on the farm. A dog that loves chasing birds may prove useful, but be sure it doesn't also foul in the field and cancel the efforts of controlling animals in the field. A dog can also do damage to the crop - crushing produce to get to the birds. With a permit, a shot gun (to kill or shoot in the air) or a scare pistol can be used. Only one supplier in Canada will sell the pistol and a permit is required to purchase. Canadian Wildlife Services have the permit applications and can readily fax one off.

To prevent birds from nesting around irrigation ponds, you may have to make a change in design or management of the site. Again, be vigilant right from the start - as soon as the birds start showing interest. Allowing vegetation to grow up along the shoreline will often discourage nesting birds, as predators will use margins and corridors to search for nests. Birds (including geese) prefer areas with high visibility. Other options include use of fencing around the pond (even temporary snow fencing will work) and flash tape. Use a dog or person to roust the birds on a regular basis (don't let them get too comfortable). If that fails, you can apply for a permit that will allow you to destroy the eggs by adding mineral oil to the eggs, shaking the eggs or burying the eggs.

References:

1. Canadian Wildlife Services: 1 (905) 336-4464
2. Resident Canada Geese in Agricultural Southern Ontario. CWS, Agri-Food Canada and OMAFRA, March 1997.
3. Bird control on grape and tender fruit farms. OMAFRA factsheet. Order No. 98-035

Water Requirements and Water Stress in Strawberry.

By A.H. El-Farhan and Marvin. Pritts, Dept. of Horticulture, Cornell University, Ithaca, NY 14853

Water is usually a relatively inexpensive input in fruit production, and many producers have the luxury of supplying more water than is really necessary to obtain a full crop. This is particularly true in the Northeast where ample water is usually available, especially in spring. However, excessive irrigation (or overhead frost protection) can contribute to nutrient leaching and disease development. For example, researchers in Norway examined four levels of supplemental irrigation and a control over two years. In one year, there were no differences in yield among treatments, and in another year, the lowest yields were in the two treatments receiving the most supplemental irrigation, corresponding to low N levels in leaves. Clearly, water supplied in excess can be as detrimental as insufficient water.

In 2001 and again in 2002, the Northeast is experiencing a severe drought. It is possible that there will not be adequate water for some growers to irrigate adequately this coming spring. But even under "normal" conditions, irrigation is necessary for strawberries because they have shallow root systems and exhibit sensitivity to water stress. Only 5 days after a soaking rain, it is possible that strawberries will require irrigation. Strawberry yields with supplemental irrigation are often 40 to 60% greater than when no additional irrigation is provided.

How much water does a strawberry plant need? In strawberries, a critical stage of growth is the establishment period of the transplants. For about two weeks, newly set transplants are susceptible to even mild water stress. This vulnerability is mainly because plants have not developed a good fibrous root system with fine root hairs for water absorption. In the fruiting year, yield reductions of 33% and size reductions of 17% have been documented under only moderately dry conditions without irrigation.
Strawberries grown on plastic beds in warm climates require about 18 in. of water over a 200 day growing season - after they have become established. This is the equivalent of about 22 gal per plant per season. (Actual water use by the strawberry plant is about 55% of this amount because more water is applied than what the plants actually use because of losses due to leaching, evaporation, inefficient application and an inadequate ability to assess water requirements on a daily basis.) Matted row growers often ensure that a minimum of 1 in. is applied as irrigation or rainfall during the growing season, mainly to replace soil moisture lost to evapotranspiration. However, this is only a "ballpark" figure and requirements can be greater under extended warm, dry conditions.

How do water deficits affect growth? Water stress can interfere with photosynthetic activity and reduce the potential growth of the plant. Photosynthetic rates of non-stressed strawberry plants can be as high as 35 mg of CO2/dm2/h, but under droughty conditions, can drop to 16 mg of

$CO_2/dm^2/h$.
Several experiments have been conducted to measure the responses of specific vegetative plant parts to water deficit stresses. Root systems of strawberry are affected by water shortages, with the root/shoot ratio increasing in response to water stress. Reductions in the number of leaves, runners, and crowns also have been observed when long and frequent droughts are experienced.

The rate of leaf expansion is greatest during a 5 hour period beginning one hour before sunset. Water stressed plants have a reduced rate of leaf expansion during this period, and these differences can accumulate over the season until well-watered plants have twice the leaf area as non-irrigated plants.

With only moderate water stress (75% of required water), leaf area can be less than half that of the well-watered plants after a four month period. A portion of the difference in leaf area can be attributed to leaf death under droughty conditions, especially of older leaves. The older the leaf, the more prone it is to senescence should stress conditions occur. Furthermore, under moderate water stress, younger leaves are able to maintain a higher relative water content than older leaves.

How do water deficits affect fruiting? Water deficit has been shown to cause fruit yield reductions by decreasing flower numbers, fruit set, numbers of fruit per plant and fruit size. Differences in yield and fruit quality between well-watered and stressed plants have been demonstrated by many studies on various cultivars and in various production systems.

Numbers of fruit per plant can be decreased by more than 30%, and total fruit production can decline by about 80% when plants are severely stressed from the beginning of the growing season. Accelerated ripening and smaller fruit size occur in water-stressed strawberries.

'Surecrop' has a larger root system and is more tolerant to drought than 'Raritan' with a much smaller root system. However, when water is not limiting, 'Raritan' has higher yields, suggesting that there is a physiological cost associated with maintaining a large root system.

How to determine if irrigation is required? The measurement of a crop's water needs in the field usually is estimated with tensiometers, electrical conductance tools, weather data or pan evaporation. Usually, these tools are used to trigger supplemental irrigation when soil moisture falls below a predetermined level.

Researchers achieved the maximum yield response when soil moisture was kept above 65% of field capacity in the top 60 cm of the soil. However, obtaining maximum yields may not be equivalent to achieving economically optimal yields, especially in areas where irrigation costs are high. Tensiometers can be used to assess field capacity of the soil, and take the guess-work out of estimating irrigation needs based on rainfall or how wet the soil feels. A rule of thumb is to not let the soil moisture fall below 50% field capacity. Charts are available showing tensiometer readings at field capacity for a given soil type.

By setting a bucket over a strawberry plant in the evening and examining the plant the next morning, one can estimate the need for irrigation by seeing if beads of water have formed on the edges of younger leaves during the night. "Guttation" is a phenomenon by which xylem sap is exuded through the pores of the hydathodes in the leaves as the result of root pressure. Guttation usually takes place at night when transpiration is low, and humidity and soil moisture are high. Research suggests that guttation only occurs in well-watered plants. (Only young leaves exhibit guttation; older leaves have more resistance to water flow.)

How to apply water? Researchers have found that drip irrigation is much more efficient (requiring about 50% less water) than overhead for meeting the water requirements of the strawberry. However, studies suggest that the use of water in many strawberry fields is not optimized. Evidence of this inefficiency was found in a comprehensive survey of strawberry growers in the Huelva region of Spain. Although soil type, cultivar and climate were the same for these growers, and 78% of the growers considered their water use sufficient, the variation in water use/area was as much as 96% for some irrigation systems. These researchers calculated an index of uniformity, with 100% indicating that each emitter in the field is providing the same amount of water per unit time. Within fields, the irrigation uniformity index averaged 49%, despite the fact that the majority of systems were only between 3 and 5 years old. These data suggest that growers are not optimizing their use of irrigation water, partially because of uneven distribution of water within a field.

In a nutshell, if the dry conditions of 2002 continue, you will need to ensure that the irrigation system is up and running at planting, since young plants are most susceptible to drought stress. Develop a method of assessing plant water needs, whether it be using

tensiometers, looking for guttation, or using electrical conductivity meters. Finally, determine if your irrigation system is applying water uniformly. If not, make necessary adjustments. Drip irrigation systems tend to be more uniform and efficient than overhead systems.

Information for this article was extracted from:
El-Farhan,A.H. and M.P. Pritts. 1997. Water requirements and water stress in strawberry. Adv. in Strawberry Research 16:5-12.

Nitrogen Management. By Caleb Torrice, Extension Educator

I have had a lot of questions about fertilizers on small fruits. I wish this were a topic where there was one correct simple answer. Unfortunately, the way I think of fertilizer management is the old barrel analogy. There are many boards making up a barrel, but the barrel can only hold as much water as the shortest board. Nitrogen is one of the very important nutrients that all of our small fruit crops need in order to flourish. I found an article that summarized nitrogen management very well and maybe it can help with your nitrogen management.

Nitrogen is one of the most important nutrients involved in crop production for several reasons: 1) nitrogen is the soil nutrient required in the greatest amount by the plant, 2) plant response to nitrogen levels is dramatic, 3) this nutrient controls many aspects of plant growth and development and 4) the public is greatly concerned about nitrogen in ground water.

Too little nitrogen will result in reduced plant vigor; poor fruit set, and reduced yield. Indirect effects could include an increase in disease and/or insect susceptibility. On the other hand, excessive nitrogen will result in susceptibility to cold injury and mites, an imbalance between vegetative and reproductive growth and soft fruit of poor quality, and perhaps environmental contamination. It is important that the correct amount of nitrogen be applied at the correct times.

Nitrogen exists in several forms in the soil. One form is organic matter. Nitrogen in this form is unavailable to the plant, but eventually microorganisms will decompose this organic matter into a useable form. One useable form is nitrate nitrogen. Most plants, including strawberries, brambles, currants, and gooseberries, take up this form through their roots and convert it into amino acids, proteins, and enzymes. Unfortunately, this form is very water-soluble and can leach into the groundwater.

A third form is ammonium nitrogen. Blueberries and cranberries are the only two commercial fruit crops that preferentially take up the ammonium form of nitrogen. The fertilizer of choice for these crops is ammonium sulfate when the soil pH is greater than 4.5, and urea when the soil pH is less. The ammonium form is more available than the nitrate form in cool, damp, acidic soils. The preference of blueberries and cranberries for ammonium nitrogen makes sense when one considers that they evolved in cool, damp, acid soils where much of the nitrogen would exist in the ammonium form.

Ammonium nitrogen is readily bound by soil colloids and not as easily leached as nitrate nitrogen. In warm, dry, neutral soils, ammonium nitrogen is converted by microorganisms into nitrate nitrogen. This is why ammonium fertilizers such as urea are acceptable for small fruits, which require nitrate nitrogen. The ammonium ions are slowly released from the soil colloids and converted into nitrate nitrogen, acting as "slow-release" fertilizers for these crops. Ammonium fertilizers are also less expensive than nitrate forms. The disadvantage of using ammonium fertilizers for crops other than blueberries is that under the cool, moist conditions of early spring, microorganisms are not active and the nitrogen stays in an unavailable state. Also, if ammonium fertilizers are used under warm, moist conditions, the ammonia can volatilize and kill the lower leaves of the plants. For young plants, this can result in severe stunting. Ammonium toxicity can also occur if fertilizers are used immediately following soil fumigation since microorganism are killed in that process. Finally, use of ammonium nitrogen lowers the soil pH and can change the availability of other nutrients.

What, then, is the best choice of fertilizer? For blueberries, ammonium sulfate is best for most circumstances. For other crops, ammonium nitrate is recommended since it provides a "fast-acting" form for cool soils, and a "slow-release" form for when the soil warms. Some growers choose to apply calcium nitrate early in the spring, and ammonium nitrate later. Calcium nitrate is relatively more expensive, but provides a readily available supply of nitrogen so the plant can get off to a good start. The use of balanced fertilizers (10-10-10 or 15-15-15) is not generally recommended unless plants require additional potassium and phosphorus. Most of the nitrogen in these fertilizers is in the ammonium form, and the potash is generally potassium chloride. Raspberries, currants and gooseberries are sensitive to high rates of

chlorides. Furthermore, high phosphorus levels can inhibit the uptake of other vital nutrients such as calcium, iron and zinc. It does not make ecological or economical sense to apply nutrients that are not needed.

When should nitrogen be applied? For blueberries, ammonium fertilizers should be applied in early spring. Nitrogen is more efficiently used if applied in two portions; therefore, some growers elect to apply one half in late March and the other half in late April or early May. This practice is encouraged on lighter soils, and is acceptable on heavier soils as long as plants sufficiently harden in fall. A leaf analysis in early August will give some indication of the nitrogen status of the plants. Values between 1.7 and 2.1% indicate that nitrogen is adequate. Be careful when applying ammonium sulfate or urea later in the season. These fertilizers can volatilize under warm, moist conditions and injure the plant after application.

For summer bearing raspberries, currants and gooseberries, apply ammonium nitrate in early spring - usually late March or early April in New York. Later applications may soften fruit and increase susceptibility to winter injury. A leaf nitrogen level of approximately 2.5% the first of August indicates that plants are in good shape.

For fall bearing types, winter injury is of no concern since canes are mowed each year. Nitrogen is usually applied in 2 or 3 split applications at monthly intervals beginning in April. Nitrogen is positively related to cane height, cane diameter and productivity, but negatively related to earliness of harvest. `Heritage' plants with leaf nutrient levels near 3.3% are often loaded with fruit, but may fail to ripen these fruits before the first frost. Excessive nitrogen will also soften fruit and make it more susceptible to gray mold which thrives under the cool, moist conditions of autumn. A leaf nutrient value of 3.0% or less is satisfactory.

Junebearing strawberries have traditionally been fertilized once during the renovation process after harvest. This "feast or famine" situation is probably not ideal for good growth. A better strategy is to apply a majority of the nitrogen at renovation, and the remainder in September. Since the strawberry fruits so early in spring, early applications are usually not prudent since fruit will soften and become very susceptible to rot. If plants are growing in very sandy soils, or are deficient in nitrogen, then a light spring application will be beneficial. In the vast majority of cases, however, spring nitrogen applications will only hurt fruit quality. An exception would be a slow release fertilizer. These can be applied in spring and are slowly released during the season as temperature increases. The danger of applying too much nitrogen at renovation is that meristems will tend to form runners rather than flowers, and mite populations may increase.

The question of how much nitrogen to apply has been avoided to this point. It is difficult to give exact amounts since this depends on soil type, amount of rainfall or irrigation, age of planting, mulching system, and inherent plant vigor. Plants on sandy soils require more nitrogen that those on heavy soils. Irrigated plantings will also require more nitrogen. Younger plants require relatively more nitrogen than older plants, but because older plants are larger, the absolute amounts will be less. Plantings that have been mulched require additional nitrogen to help microorganisms decompose the organic matter, but this nitrogen will be released at a later time and then nitrogen requirements will be less. Finally, vigorous cultivars of cold tender varieties generally require less nitrogen. The approximate nitrogen needs of small fruit crops for each of these situations are given in the Cornell Recommendations for Small Fruit Production. Leaf analysis should be used to fine-tune your nitrogen program.

Questions or Comments about the New York Berry News?

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