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FFF01-03
April 11, 2001

Crop Conditions: The season had been running bout 10 days to 2 weeks behind last year, but about normal overall. Warm weather over the past week has accelerated development considerably. At this time in the southern part of the state brambles have 1 inch shoots, early grape varieties (Foch) are at bud break, peaches and apples are at full bloom. In the northern part of the state apples are at half inch green, peaches are past swollen bud, and early grapes are at full swell. If the unseasonable warm weather continues, fruit crops will be well ahead of normal before the end of the week.

Apple Scab: The most important time of year for scab control is from green tip to petal fall. If you don't control scab during this period it's an uphill struggle the remainder of the season. Be sure sprayers are properly calibrated; thoroughly read the label of all pesticides you will be applying; use sufficient water to provide good coverage; choose calm, good drying conditions for spraying (Good luck on this suggestion); prune trees so they have an open canopy allowing for good spray penetration; and maintain a tight schedule if wet weather persists during the primary scab period. *(Pecknold)*

Brown Rot Of Stone Fruits: Management of brown rot began last year after harvest...with the removal of all fruit, mummies and blighted twigs. It continues this year at pink with early season fungicide sprays. We fortunately have an abundance of fungicides for use in control of brown rot. See ID-168, "2001 Indiana Commercial Tree Fruit Spray Guide", for a complete listing of suggested fungicides. *(Pecknold)*

Getting the Most Out of Glyphosate and Other Sprays: Fruit growers often apply a post-emergent herbicide beneath the tree or vine row in spring to control winter annuals and other weeds. Often a pre-emergent herbicide is included in this application. Glyphosate (Roundup) is a post emergent systemic herbicide that is widely used for this first weed spray. In order for glyphosate to be effective, it needs to be absorbed into the plant. In soft water glyphosate has no problems in being absorbed. However in hard water glyphosate will be 'tied up' and not absorbed as readily. Hard water, common in many parts of Indiana, contains high concentrations of soluble salts, calcium and magnesium. When these cations are present they react with the negatively charged glyphosate to form compounds that are not readily absorbed by plants. This results in poor uptake and poor weed control.

The solution to the hard water problem is to add ammonium sulfate to the spray water before mixing with glyphosate. Ammonium sulfate ions tie up the calcium and magnesium ions forming conjugate salts. Additionally, some of the glyphosate reacts with ammonium to form a compound that some weeds preferentially absorb. Follow the Roundup label recommendations on the amount of ammonium sulfate to add.

Another problem associated with spray water quality is that many fungicides and insecticides break down quickly in high pH water. Captan, Cygon, Imidan, Kelthane, malathion, and Omite are examples of compounds that are especially vulnerable to alkaline hydrolysis. Both the Commercial Tree Fruit and Small Fruit and Grape Spray Guides have a discussion of spray tank pH. Briefly, addition of about 2 ounces of

food grade citric acid per 100 gallons of water will lower the pH from about 8.0 to about 5.5. *(Bordelon)*

Select 2EC Herbicide Supplemental Label for Strawberry: Source: Richard C. Funt, Extension Small Fruit Specialist, Ohio State University, Columbus. Previously, Prism, which is a post-emergence, selective herbicide for non-bearing strawberry production, was to be applied no later than one year before harvest. Now Select 2EC herbicide (same product as Prism) has been labeled for bearing strawberries and can be applied within 4 days of harvest. At the rate of 6 to 8 ounces per acre, Select 2EC plus a non-ionic spreader can control such grasses as quackgrass, crabgrass, foxtail, and barnyard grass. Generally, grasses need to be 4 to 6 inches or taller for maximum absorption. Grasses should be actively growing, which indicates good soil moisture and temperatures above 55 F. Repeat applications may be necessary. Select can be effective if applied one hour before rainfall. The supplemental label indicates that the use of crop oil with a 17% emulsifier is to be added to the tank mix. Crop oil can cause some injury to strawberry plants at certain temperatures (below 45 F or above 80 F). Ohio State specialists generally recommend a non-ionic spreader rather than crop oil. A non-ionic spreader can be just as effective as crop oil, with less risk of leaf damage; however, Valent Corporation indicates that crop oil can be more effective on weed control and will not accept responsibility for the use of a non-ionic spreader, if control is unsatisfactory to the grower.

Efficient Use of Nitrogen Fertilizer in Fruit Production: This is adapted from an excellent article by Eric Hanson, Michigan State University Horticulture; and Jim Nugent, MSUE District Horticulturist, that appeared in Fruit CAT Alert Vol. 16, No. 1 and The Fruit Growers News April, 2001 issue.

Most fruit plantings require annual applications of nitrogen (N) fertilizer for optimum production. Using appropriate rates and application methods is important from an environmental and economic standpoint. Excessive N rates may reduce fruit quality or yields, and pollute surface water or groundwater resources. Recent natural gas price increases are expected to substantially increase nitrogen fertilizer costs, providing added incentive for farmers to use fertilizers in an efficient and effective manner.

Knowing the symptoms of inadequate and excessive N is important. Deficient plants produce short terminal shoots. Deficient apple, peach, and cherry leaves are pale green to yellow, and pear leaves may exhibit a bronze tint. Color develops uniformly on the leaf with no patterning or mottling and leaf size is small. Nitrogen is mobile in trees. Deficiency symptoms first appear on older leaves because N moves out of older tissue into actively growing younger leaves. Leaves tend to drop early in the fall. Twig growth is thin. Fruit set may be light, with a heavy June drop. Fruits will be smaller and often color and mature somewhat earlier than usual. Deficiency may also result in the production of weak flower buds, which are more likely to be damaged by cold temperatures during winter and spring. Low N trees are more likely to be damaged by cold winter temperatures than trees with adequate N. Excess nitrogen can severely reduce fruit quality and tree hardiness. Large, dark green leaves that remain on the plant late into the fall are indicative of too much N. Apples color poorly and lose firmness more readily in storage. Soluble solids are lower in grapes. Growth continues late into summer and fall, and plants are more susceptible to winter injury.

Monitor the N status of the plants. Tissue analysis provides a means of assessing whether current N rates are appropriate, as well as identifying other nutritional problems. Sample mature orchards, vineyards, and blueberry plantings every two to four years and younger plantings more frequently.

The pH status of the soil may affect the availability of N in the soil. Sample soils every two to four years to aid in the maintenance of desired pH. There are three important considerations for liming when orchards and vineyards are maintained with permanent sod between rows and weed-sprayed strips under plants:

1. Take soil samples from the weed sprayed strip area.
2. With this notill system, lime should be applied at relatively light rates, but with greater frequency than in tillage systems.
3. If N is band applied, then lime also should generally be band applied.

Adjust N rates to the soil type. Highest rates are generally needed on sandy soils low in organic matter because these soils supply less native N and are most prone to leaching. Lowest rates are generally needed on heavier soils where N is naturally more available. Some fruit plantings on very fertile clay or organic soils may not need annual N applications. Keep these factors in mind and adjust N rates accordingly for different areas of a planting.

Place fertilizer where it is accessible to the plant, but distribute it so the roots are not burned. Most commercial fertilizers are salts; if concentrated, they can injure plant roots. On young trees and vines, spread fertilizer in a circle 3 to 4 feet in diameter around each plant, keeping fertilizer 8 to 10 inches away from the trunk. Fertilize newly planted vines and trees after enough rain has fallen to settle the soil. If possible, apply fertilizer to mature orchards in a broad band about as wide as the tree canopy. On mature vineyards spread fertilizer in the row in a band 5 to 6 feet wide. Applying N in bands instead of broadcasting will allow the rate per acre of orchard to be reduced without a significant impact on the crop.

Nitrogen use efficiency in orchards can often be increased by injecting N through trickle irrigation systems (fertigation). MSU research in tart cherries found N rates could be reduced by 50 percent without affecting yield or growth if N is applied via trickle irrigation. Successful fertigation requires an irrigation system with relatively uniform application per emitter, a method of injecting the N into the system, and good backflow prevention to assure no N reaches the water source. Nitrogen is applied in four or more equal applications during the early to mid growing season. This spoonfeeding approach appears to increase N use by the trees and helps minimize the potential of nitrate leaching. To determine the N rate per application, begin by calculating about 50 percent of the normal rate, and then divide that amount by the number of anticipated applications.

Avoid volatilization losses of urea. Be aware that substantial amounts of N in urea can be lost to the atmosphere as ammonia gas if urea remains on the surface of the soil for extended periods during hot weather. This loss can be avoided by applying urea during cool weather or just before predicted rains, or irrigating just after applications, since volatilization does not occur once urea is moved into the soil. Some volatilization losses can also occur from ammonium nitrate or ammonium sulfate, but at much lower rates than urea.

Orchards Rates of N

Although optimum N rates vary considerably from site to site, use rates in accompanying Table 1 for orchard crops as an initial guide. Be conservative with N rates until you are familiar with the planting. It is much easier to apply additional N than to manage excessive vigor caused by rates that are too high. Excessive vigor is particularly damaging in new, high density apple plantings.

Specific orchards may require more or less N than indicated in Table 1. Adjust these rates according to your conditions on the basis of leaf N concentrations and orchard vigor, fruit quality, and productivity. Three factors that have a great effect on N requirements are soil type, orchard floor management and pruning. Orchards on fertile loam soils may require N at only half the recommended rates, whereas those on very sandy soils may require 50 percent more N. Heavily sodded orchards may require 20 percent more N than clean, cultivated plantings. Similarly, orchards heavily infested with weeds may require higher rates. Incorporation of a legume in the sod should reduce the need for N, but research is unclear to what extent. Heavy pruning stimulates vegetative growth and can reduce or replace N requirements. Heavily pruned trees should be fertilized lightly if at all.

Under Midwest conditions, spring and fall applications have been equally effective. Spring applications are advised on sandy soils because fall applications may result in leaching losses during spring snow melt. Many growers split their N applications, applying half to two thirds in April and the remainder in early June after fruit set is known. The second application can be reduced or skipped if a light crop is set to avoid excessive vigor that year. This strategy of split application is particularly attractive when N prices are high as it allows an opportunity to adjust N rates to reflect crop size.

Another method to apply supplemental N is via foliar application. Orchards and vineyards may benefit from foliar applied N, particularly when relatively low rates of N are applied to the soil in the spring. Foliar N can be applied if deemed desirable based on crop load and other factors. Urea is the most efficient form of N for foliar feeding. Typical rates are up to 5 lbs N per acre per application. Foliar applied N will rarely meet the entire needs of the tree, and should only be considered as a supplement to soil applied N.

Table 1. Nitrogen Rates (lbs N/tree) for Orchard Crops

Orchard Age in Years	Apples and Pears			Stone Fruit
	Trees / acre			Trees / acre
	80	250	500	130
	Pounds of N / Tree			
1	.05	.05	.04	.07
2	.10	.10	.08	.14
3	.15	.15	.08	.21
4	.20	.20	.08	.28
6	.30	.22	.08	.42
8	.40	.22	.08	.56
10	.50	.22	.08	.62
12	.60	.22	.08	.62
Mature (lbs N/tree)	.75	.22	.08	.62
Lb. N per Acre	60	55	50	80

Nitrogen for Grapes

Most mature juice grape vineyards require about 50 lbs N per acre annually. Most Midwest vineyards for wine production use less. Young plantings require about 15 to 20 lbs N per acre for each year in the field. Vigorous vineyards on double curtain trellis systems may require 75 to 100 lbs per acre. Adjust N rates for each vineyard by observing vine growth, fruit soluble solid content and degree of winter injury. Over-fertilized vines are often too vigorous, low in fruit soluble solids, and more prone to winter injury because wood does not harden off in time for winter. Petiole analyses will aid in adjusting N rates.

Application timing can affect efficiency. Vines absorb N relatively slowly between budburst and bloom, most rapidly between bloom and veraison, and somewhat reduced between veraison and harvest. Multiple applications may be needed to maintain sufficient N in the root zone over this extended period, particularly on

sandy soils.

Efficiency may also be affected by fertilizer placement and rate. Greatest absorption may be achieved when fertilizer is applied over the areas containing the most grapevine roots (under the trellis). This may be most important in younger vineyards without extensive root systems. As a general rule, the percentage of fertilizer N absorbed by crops decreases as the rate increases. Some growers apply high rates of N in a single application. We suspect they could obtain the same response from moderate rates banded beneath the vines in multiple applications when the vine demand is high.

Nitrogen for Blueberries

Most Midwest blueberries require annual N additions for optimum production. Inadequate N limits bush growth. New shoot growth is reduced and often only one flush of growth occurs. Few new canes are initiated. Leaves are pale green (chlorotic) rather than the lush, dark green of adequately fertilized plants. The chlorosis is uniform across the leaf, with no mottling or pattern. The older, lower leaves usually develop the pale color before younger leaves at the tops of shoots. Leaves of deficient plants often develop fall colors and drop off early. Yield is usually reduced. Excessive N causes abundant vigorous shoots and large, dark green leaves. Bushes may produce several growth flushes, the last of which may be too late to harden off properly before winter. Tips of these shoots are often winter killed. Bushes receiving too much N often produce lower yields of small, late ripening berries.

Blueberries differ from most other fruit crops in that they absorb ammonium (NH_4^+) more readily than nitrate (NO_3), so use only fertilizers that contain ammonium. Urea is suggested if the soil pH is sufficiently low (below 5.0), and ammonium sulfate (which is more acidic) is recommended if the pH is slightly higher than desired (above 5.0). Nitrogen rates vary depending on the age of the plants (see Table 2). Mature plantings generally require about 60-70 lbs N/ acre.

Recommended N rates are averages across most conditions and need to be adjusted for specific plantings based primarily on soil type. Plantings on very sandy soil with little organic matter will require higher rates because there is greater leaching potential and less native N reserves. Plants on organic soils may require much less N because considerable N is supplied naturally through mineralization.

Time fertilizer applications for efficient use. Fertilizer should be applied to maintain adequate soil N levels during the period of peak demand, which lasts from about petalfall to the end of harvest, a period of two to three months. Because fertilizer N does not persist in the root zone this long, split applications are recommended; applying half of N prior to bloom and half at petalfall. Split applications may be most effective on sandier soils.

Efficiency of fertilizer use can sometimes be enhanced by proper placement. The root systems of young blueberries are generally confined to the area beneath the canopy. Placement of fertilizer in a three foot wide band beneath plants may optimize recovery by young bushes, whereas N applied outside this area may not be used. As plants mature, the roots colonize a greater area. In old plantings, roots may reach across rows. Consider the location of the roots and spread your fertilizer evenly over this area.

Table 2. Nitrogen Recommendations for Michigan Blueberries (lbs/acre)

Age (yrs)	Nitrogen	Urea	Ammonium Sulfate
2	15	35	75
4	30	70	150
6	45	100	215
8	65	150	300

Nitrogen for Raspberries and Blackberries

Most bramble plantings need annual nitrogen (N) applications. Urea (46% N), ammonium nitrate (33% N) and calcium nitrate (15.5% N) are suitable N sources. Nitrogen can also be supplied as a complete fertilizer containing P and K, such as (12-12-12), or manure, though these sources are often more expensive than those supplying only N. Use complete fertilizers with a 1:1:1 or similar ratio if the soil has not been sampled to determine fertility levels.

Fertilize newly set plants two to three weeks after planting by sprinkling the equivalent of 15 to 20 lbs N per acre (1/2 lbs N/100 feet of row) around individual plants, keeping the fertilizer 3 to 4 inches away from the base of the plants. Repeat this application in midsummer. Apply 25 to 30 lbs N per acre (3/4 lbs N/100 feet of row) in April or May of the second year in a 4 foot wide band over the row. Plantings 3 years old and older generally require 50 to 60 lbs N per acre (1 1/2 lbs N/100 feet row) each year banded over the row.

The variety and soil type determine the exact amount of N required. Vigorous varieties (Brandywine and Royalty purple raspberries, Eastern Thornless Blackberries such as Chester and Hull, and primocane fruiting types such as Heritage) usually require 50 to 100 lbs more N. Plantings on light, sandy soils require higher rates than those on heavier soils. Generally, red raspberries should be fertilized to produce canes 5 feet tall, and canes of purple raspberries should be taller than 5 feet. New black raspberry canes should reach a height of 2.5 to 3 feet by harvest time. Blackberry primocanes should be tipped at the appropriate height (3.5 to 4 feet) and lateral branches should be well developed by the end of the season.

Nitrogen for Strawberries

Strawberries are a shallow rooted crop often grown on sandy soils. This combination can make efficient N fertilizer use a challenge, since N readily leaches out of the reach of roots. The general recommendation for the planting year is to incorporate 30 lbs N per acre prior to planting, apply an additional 20-30 lbs N per acre in June if growth is weak or the soil is very sandy, and a third application in early-mid August.

Recommendations during harvest years call for no N fertilizer in the spring, although light rates (10-15 lbs N per acre) may be used on very sandy soils. Fertilize with 50-70 lbs N per acre at renovation (early-mid July) and an additional 20-30 lbs N per acre in August on sandier soils or during very wet summers.

Here again, the primary ways to maximize efficiency are to apply smaller rates more frequently, avoid over irrigating which leaches N from the root zone, and use appropriate rates for your soil type. Nitrogen can also be applied as a supplement through the overhead irrigation at about 5-10 lbs/a, usually in the form of urea.

Upcoming Meetings:

April 26 - Twilight fruit meeting, Kercher's Sunrise Orchards. Goshen, 6.30 pm. Contract Jeff Burbrink (219-533-0554).

May 2 - Twilight fruit meeting, Minnetrista Cultural Center, Muncie. 6.00 pm. Contact Harold Brown (phone 765-747-7732).

May 10 - Northeast fruitgrowers meeting. Location to be announced. 6.00 pm. Contact Ricky Kemery (phone 219-481-6826).

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