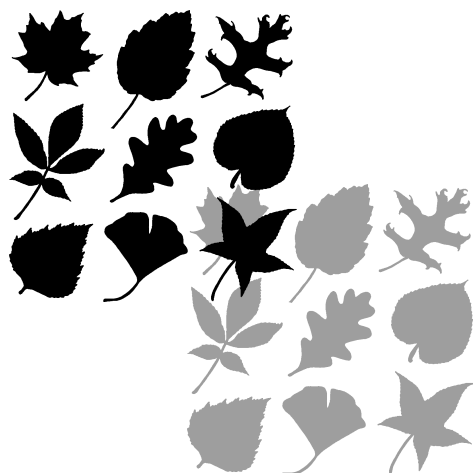


PLANT & PEST ADVISORY

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INSIDE

Improve Soil Quality Through Leaf Mulching This Fall	1
NJ Growers' Irrigation Log Book Available	2
Residual Cranberry Fruit as a Soil Amendment	3
Crop Residue Management	4
Composting - The Natural Solution for Fall Leaves and Lawn Clippings	5
Classics from the Organic Book Shelf	5
Screening Mites from Honey Bees	6

Improve Soil Quality Through Leaf Mulching This Fall

Daniel Kluchinski, Mercer County Agricultural Agent

Leaf mulching is the application and incorporation of collected municipal shade tree leaves on agricultural land. Research conducted by Rutgers University has shown that leaf can improve soil quality. Soil organic carbon and organic nitrogen concentrations increased with three consecutive years of application. Calcium levels were significantly increased and there was no decrease in soil pH.

Therefore, leaves can provide a desirable source of organic material for soil improvement, add organic matter and nutrients, and can provide additional income through tipping fees paid by municipalities. However, careful planning and specific crop management must be followed. If you are interested in starting an on-farm leaf mulching operation, these ten steps should be followed to ensure success:

Get the facts: Review Rutgers Cooperative Extension (RCE) Fact Sheet 718 *On-Farm Use of Leaf Waste: Regulations* available through the RCE web site at: <http://www.rce.rutgers.edu/>. Then, contact your county solid waste or recycling office to determine what permitting or approval process is required, as the process varies from county to county. Approvals may take several months, so plan accordingly.

Follow the rules: Leaf mulching is state regulated. Leaves can be accepted and spread on farm fields at a depth of 6 inches annually, cannot be stockpiled at the farm for more than seven days, and must be incorporated into the soil by spring.

Push the pencil: Determine the fields to which leaves are to be applied and determine the total acreage. The six-inch application rate is equivalent to approximately 800 cubic yards of leaves per acre. Calculate the total amount of leaves you would need. Initially, consider accepting small quantities of leaves or operating on a limited acreage.

Plan, plan, and plan: Have an all-weather road for truck traffic and a site for unloading. Remember that leaf deliveries will quickly "add up," especially if wet or freezing weather delays spreading.

Find a leaf source: Ask county solid waste/recycling officials about municipalities who are looking for farmers to accept leaves, or contact potential leaf sources directly.

SEE LEAVES ON PAGE 2

New Jersey Growers' Irrigation Log Book Available

Rutgers Cooperative Extension (RCE) has developed a convenient pocket-sized New Jersey Growers' Irrigation Log Book. In addition to the log section, the book contains examples, tips on irrigation methods, conversions and resources for further information. The log book is free and available from your RCE County Office.

For growers who prefer to keep records on a full page format, log forms on 8 1/2 X 11 paper can be obtained from your County Agent.

The purpose in creating this practical record keeping booklet is to assist growers in complying with the New Jersey Department of Environmental Protection (DEP) Agricultural Irrigation Certification record keeping requirements. Voluntary reporting will help keep the growers' certifications free and reduce the need for further DEP regulation.

Rutgers Snyder Research & Extension Farm sustainable agriculture education funds paid for the publication costs for these guides. □

LEAVES FROM PAGE 1

Form an agreement: Ask any supplier if an agreement or contract stating the specific terms of the agreement can be made. Consider the following factors:

- ❖ length of agreement
- ❖ time period when leaves will be delivered
- ❖ amount of leaves to be delivered
- ❖ tipping fee (dollars per cubic yard or ton of leaves) to be received
- ❖ location(s) leaves are to be unloaded
- ❖ delivery schedule
- ❖ acceptable quality standards/conditions upon which loads can be rejected
- ❖ responsibility for removal of non-biodegradables and other trash
- ❖ responsibility for damage to fields from delivery trucks
- ❖ methods for dispute arbitration

Educate: Make it clear to the leaf supplier why farm fields should not be driven on, or how bottles or trash can break equipment or injure animals. Explain that the leaves must be collected, handled and delivered properly to insure quality.

Experiment: Test different spreading and incorporation equipment. Consider a manure spreader and chisel plow which have been shown to work well. Try different application rates. Research has determined that leaf mulching can increase soil moisture retention, increase surface residue, and may extend lower soil temperatures in early spring. This may affect planting or crop establishment. Leaf application may temporarily tie up soil nitrogen. Experiment with different crops, seeding rates, or combinations of nitrogen supplying materials such as manure. Consider legumes or low nitrogen use crops immediately after incorporating leaves, or transplants versus direct seeding.

Plan for problems: Have written contingency plans should problems arise. For example, if odors become a problem with stockpiled leaves, will you apply limestone to neutralize odors? Move the material off site? Spread it immediately? What will happen if your spreading equipment breaks down and you cannot spread the material in a timely manner? Will you spread it by a different method? Be able to stop deliveries until the equipment is repaired? Plan ahead and have a response ready for any problems that may occur.

Keep good records: Record leaf deliveries, application rates, spreading and incorporation methods, cropping practices, crop vigor and yields. These records will help you to determine the effects of the practice. In addition, they can be used to illustrate your successful use of the practice should problems arise, such as local opposition to or inspection of your operation.

These guidelines should help you prepare to start on-farm leaf mulching. Obviously, the success of such an operation depends on a good plan and proper execution. For additional information, contact your local Extension office; municipal, county or state solid waste management office, or other farmers practicing leaf mulching. □

Residual Cranberry Fruit as a Soil Amendment

Saratha Kumudini, Assistant Research Professor, Plant Physiology

The New Jersey Department of Environmental Protection (NJDEP) has issued a Certificate of Authority to Operate (CAO) to New Jersey cranberry growers to use the excess cranberries from the 2000 harvest as an organic soil conditioner/fertilizer off-site for a three-month period. Soybean and corn growers near Bordentown, NJ have spread pressed cranberry fruit + rice hull supplements on their acreage with success. The New Jersey Department of Agriculture cited the growers as reporting improved soil tilth and increased yields (N applications may need to be amended).

Plant organic matter is also a source of mineral nutrients. It is important to note that the use of plant or other organic residues as a nutrient amendment differs from mineral fertilizer use. Mineral fertilizers provide nutrients in forms that are rapidly available for plant uptake without the added benefits of improved water holding capacity or increased cation exchange capacity of the soil. Furthermore, the rapid rate of mineral fertilizer delivery may not correspond with plant nutrient demand, resulting in poor plant utilization of mineral fertilizer.

A soil-mediated process converts nutrients in organic matter before they become available for plant use. It is through the decomposition of organic material that the nutrients in the organic matter are released to the soil. Soil-borne organisms convert the organic material into mineral form as part of their life cycle. Therefore, the chemical and physical conditions that impact the soil organisms also impact the rate at which the residue material releases its nutrient content. Soil organisms that "mineralize" organic material are stimulated by warm and moist conditions, which also stimulate plant growth. In this manner, plant residue can effectively work as a slow-release fertilizer and provide more nutrients during warm, moist conditions (growing season) and less during cool, dry conditions (fall/winter). Organic growers generally use the incorporation of organic material as a means of adding nutrients to their soils.

Soil-Mediated Organic Matter Decomposition

Plant organic residues are degraded by some types of invertebrates such as millipedes, sow bugs, snails and slugs, as well as by soil microorganisms. The invertebrates shred the plant materials, creating more surface area for action by soil microorganisms such as fungi, bacteria, and actinomycetes. The soil microorganisms do most of the work of breaking down organic matter to produce carbon dioxide, water,

heat, and humus (relatively stable organic end product). The grower, by incorporating the fruit or mechanical break up of the fruit material will therefore aid the soil microorganisms to do their job more effectively.

Of the many elements required for microbial decomposition, carbon and nitrogen are the most important. Carbon provides both an energy source and the basic building block making up about 50 percent of the mass of microbial cells. Nitrogen is a crucial component of the proteins, nucleic acids, amino acids, enzymes and co-enzymes necessary for cell growth and function.

The ideal C/N ratio for rapid decomposition is 30:1, or 30 parts carbon for each part nitrogen by weight. The optimum ratio is 30:1 because at lower ratios, nitrogen will be supplied in excess and will be lost quickly to leaching or as ammonia gas. Higher ratios mean there is not sufficient nitrogen for optimal growth of the microbial populations, so organic material degradation will proceed at a slow rate and may lead to sequestering of nitrogen, lowering nitrogen availability. Calculations of the C/N ratio of cranberry fruit suggest the value can be as high as 80:1. Organic material of high C/N ratio as in cranberry fruit are generally recommended for fall applications (Plante and Voroney, 1998). The high C/N ratio will result in lower availability of nitrogen and other minerals both from the organic matter as well as the soil during the fall. It is expected that death and decay of the microbes will occur the following spring, releasing the nutrients in time for the growing season (Voroney, personal communication) when nutrient demand is high.

Particle Size

Microbial activity generally occurs on the surface of the organic particles. Therefore, decreasing particle size, and increasing surface area, will encourage microbial activity and improve the rate of decomposition. The process of incorporating organic material into the soil would increase the surface area of material in contact with the soil.

Aeration

Oxygen is essential for the metabolism and respiration of aerobic microorganisms, and for oxidizing the various organic molecules present in the organic material. The tillage operation to incorporate the material will help aerate the soil for increased microbial activity. Low aeration may lead to anaerobic decay of organic residues (fermentation of organic residues is what is generally thought to cause odor problems in composts).

Moisture

A moisture content of 50-60% is generally considered optimum for decomposition. Microbial induced

SEE CRANBERRIES ON PAGE 4

decomposition occurs most rapidly in the thin liquid films found on the surfaces of the organic particles. Moisture limitation (<30%) inhibits bacterial activity, whereas excess moisture (>65%) results in slow decomposition, odor production in anaerobic pockets, and nutrient leaching. The moisture content of cranberry is high (85-88%). Mechanical means of breaking the outer fruit coat would accelerate the drying process and incorporation processes should attempt to mix the fruit with the drier soil to generate a soil layer which approaches the desired moisture content. It is recommended that the spreading of organic material be attempted on a dry morning. The length of the day and the dry conditions will help the organic material dry quickly.

For further information on this use of cranberries, see the Oct. 5 issue of the Cranberry edition of the Plant & Pest Advisory. Topics include NJDEP's Cranberry Utilization Guidelines for NJ's Crop Year 2000, Soil Acidification: Possible Effect of Residual Cranberry Fruit, and Composting of Cranberry Fruit and Leaves. The newsletter can be obtained on Rutgers Cooperative Extension's (RCE) website at: <http://www.rce.rutgers.edu/pubs/plantandpestadvisory/2000/cranberry.html> or on RCE's faxback system at 732-932-6767 as document 2004.

Growers interested in using cranberry fruit for composting or as a soil amendment may contact:

Brenda Conner
 American Cranberry Growers Association
 1 Pasadena Rd.
 Browns Mills, NJ 08015
 Tel: (609)893-0969
 Mobile: (609)364-0921
 Fax: (609)893-2316

E-mail: brendac@bellatlantic.net

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Crop Residue Management

Joe Ingerson-Mahar, Vegetable IPM Coordinator

Now that the growing season is coming to an end, it seems that it is too early to begin thinking about next year's crops and management. The reality, of course, is that it is not. How this cropping year wraps up could have a significant impact on next year's crops and pest levels.

A good example of this is the fall of 1999. We had a very wet fall, starting with Hurricane Floyd that broke the drought conditions for us. Unfortunately, the weather remained wet and cool. Poor crop quality and prices meant that some crops were left in the field. Field corn especially, was a victim of both weather and prices. As a result, there was standing corn in fields even into late spring of this year. The problem was that one of our primary vegetable pests, **European corn borer**, overwintered in the corn stalks, leading to large surges in the first generation of corn borer in some areas of the state.

The same thing can happen with other insects and plant diseases. Undisturbed plant residues may contain disease pathogens that overwinter and reinfect susceptible crops in the spring of the following year. That is why our production recommendation books include residue management practices such as mowing and plowing, and in some cases, burning of the residue. In situations where the crop residue can't be turned under or burned, crop rotation in the following year becomes more of a factor. If the previous crop residue can't be broken down, then move susceptible crops to other locations on the farm.

In the IPM crop guidelines (available at the RCE website, under the vegetable pest management program) residue management is one of the high priority items to be done by growers to manage disease pests.

Of course, for those with sloping ground, you must be aware of erosion problems that could be compounded by fall plowing. If erosion is a severe problem, then you may require the assistance of either your county agent or local Natural Resources and Conservation Service representative to help plan the best way to manage both crop residue and soil conditions. □

Table 1: Nutrient composition of cranberry fruit

Components	Application at 1 Ton/acre (20 barrels/acre) lbs/acre	Application at 20 Ton/acre (400 barrels/acre) lbs/acre	Application at 60 Tons/acre (1,200 barrels/acre) lbs/acre
Nitrogen (N)	1.50	30	90
Phosphorous (P)	0.14	2.8	8.4
Potassium (K)	2.00	40	120

Composting – The Natural Solution for Fall Leaves and Lawn Clippings

Jim Willmott, Camden County Agricultural Agent

Bountiful precipitation has favored plant growth and promoted a bumper crop of leaves, grass clippings and other debris. While many will curse this, it should brighten our fall days with vibrant foliage colors and provide great opportunities for producing an organic gardening necessity – compost.

In healthy natural ecosystems, countless numbers of organisms produce and decompose organic matter. However, our urban/suburban landscapes have limitations compared to complex natural ecosystems. Without our help they fail to maintain themselves. For example, deficiencies in the decomposition process leads to accumulation of organic debris including leaves. Also, our aesthetic standards do not permit accumulation of unsightly landscape debris. As a result, disposal has been a serious issue for decades, with many viewing this valuable organic resource as waste. Today many individuals and communities are taking composting seriously.

Let's consider a few points about composting. First, it is a process that depends on the activities of living organisms - mostly microbes such as bacteria and fungi, but also bigger creatures like insects. All of these require resources for growth including oxygen, water and organic matter. All of these resources can be provided in a properly constructed and managed compost pile. There are many ways to construct composting units - some are extremely simple and others somewhat elaborate. Units need not take up much space and they should not produce objectionable odors if properly managed. Any organic debris of plant origin can be added. At this time there are plenty of leaves and grass clippings. Together, these make an ideal combination. Clippings contain plenty of nitrogen to promote the breakdown of tree leaves. The combination is great for the microbes. Remember, in managing compost, you are managing an entire living community of organisms.

Act now to have lots of rich dark compost for next year's growing season. Compost helps soils to retain nutrients and water, improve structure and control plant diseases. Also, consider applying compost to turf including lawns and sports fields. Apply no more than about $\frac{1}{4}$ inch of fine textured compost. Greater amounts may result in the formation of thick surface layers that will be prone to drying while limiting root growth into the soil. Next, incorporate compost into the soil. This can be accomplished by aerating, with a hollow tine aerator, and raking compost and soil cores back into aeration holes. For large areas use a heavy drag mat.

For years the benefits of compost were known, but unexplained: Organic gardeners have observed productive gardening results for generations, but researchers have just begun to reveal the chemical, physical and biological reasons. Yes, it is true that some organic gardening practices such as the use of compost can produce good results. Should this be a surprise? Organic gardening has always been nature's choice!

For more information on composting contact your county Rutgers Cooperative Extension office. □

Classics from the Organic Book Shelf

Joseph R. Heckman, Specialist in Soil Fertility

In this day of fast growing markets for organic food, there seems to be little awareness of the origin of the modern system of organic agriculture. Sir Albert Howard (1873-1947), who is generally regarded as the founder of organic farming, is not exactly a household name among the current generation of organic enthusiasts. Lately, there appears to be so much attention focused on developing the official "rules" of organic farming that the process of "rule making" has circumvented the original focus on building soil fertility as a foundation for plant and animal health as was taught by Sir Albert Howard. As the "rules" of certified organic farming are being finalized, organic growers and other growers considering conversion to organic, may at this time want to revisit the almost lost classical writings on organic farming.

The organic growers' reading list should most appropriately begin with two books written by Sir Albert Howard, although they are out of print and have to be sought in used book stores:

1. *Agricultural Testament* (NY: Oxford University Press, 1945; PA: Rodale Press, 1972)
2. *The Soil and Health: A Study of Organic Agriculture*, NY: Schocken Books, 1972)

A book published in 1911 entitled "Farmers of Forty Centuries or, Permanent Agriculture in China, Korea, and Japan" by F. H. (Franklin Hiram) King (London: J. Cape, 1926; PA: Rodale Press, 1973 c1011) is a classic work on sustainable agriculture that influenced Sir Albert Howard. Another classic work written by Evelyn Barbara Balfour, entitled "Living Soil and the Haughly Experiment" (London: Faber & Faber, 1975; NY: Universe Books, 1976) describes the work of followers of Howard and their observations on organic systems.

SEE CLASSICS ON PAGE 6

A recent book, too new to be a classic, entitled "Cultural Boundaries of Science: Credibility on the Line" (IL: University of Chicago Press, c1999) by Thomas F. Gieryn devotes 102 pages to an historical overview of the development of organic farming by Albert and Gabrielle Howard. This book, which is written by a professor of sociology, focuses on the social context during the early development of organic farming. At that time, so-called artificial fertilizer was relatively new and much controversy surrounded its promotion as a replacement for natural manures and compost. Sir Albert Howard referred to this controversy as a "War in the Soil."

The tension that exists between organic and conventional agriculture has been and continues to be a competition between different philosophical, political and scientific ideas and ideals. This competition can be a creative force to stimulate new lines of agricultural research when there is open communication and the prevailing agricultural paradigms are allowed to be questioned. The results will hopefully be a more environmentally sensitive and sustainable agriculture whether it is organic or conventional.

Although some of the concepts in the above titles are not in agreement with current agronomic theory, the basic assumption that soils are living systems and that there is a connection between fertile soil and plant and animal health appears to be a sound concept that is supported both by scientific data and empirical observation. □

Screening Mites from Honey Bees

Sarah Tarshis, Information Specialist, USDA Agricultural Research Service (ARS)

Reprinted from Bee Aware, September, 2000, Mid-Atlantic Apiculture Research and Extension Consortium (MAAREC)

Battling the varroa mite has become a sticky job – literally. Entomologist Jeff Pettis, who is with the ARS Bee Research Laboratory in Beltsville, MD, has been looking for a way to snag mites that have been threatening honey bees for years. Through his experiments with sticky paper, a nonchemical control evolved.

The mites, which attach to and feed on bees, can become dislodged through the bee's self-grooming or from smoke and chemical treatments applied by beekeepers. Pettis used sticky paper at the bottom of bee colonies to collect the dislodged mites for experiments.

We noticed that many of the mites on the sticky paper were still alive and that they could easily reattach as the bees reentered the colony and walked across the bottom board," said Pettis. As a result, he created something called the Beltsville screen insert to help control the mite population.

The screen insert works by creating a 1- to 2-inch gap between the bottom board and the hive bottom. The insert's wire mesh allows the mites to fall through the screen and onto the hive bottom so they can't reattach to bees. Monthly samples of the fallen varroa showed that the screen insert reduced the mite populations by about 15 percent. Though not sufficient alone, the Beltsville screen insert can contribute to integrated pest management practices.

Honey bees produce \$270 million worth of honey, beeswax, and other hive products and pollinate nearly \$10 billion worth of crops annually. Their conservation is of national and international importance. Improved varroa mite control will be valuable to people involved in the US beekeeping industry, including hobbyist and commercial beekeepers who rent their colonies for pollination services.

Researchers are continually developing and improving the screen, but it's already being advertised for sale.

"It's wonderful to be working with Beltsville scientists in selling a product that keeps us from having to rely totally on chemicals," says Steve Forrest of Brushy Mountain, a beekeeping supply company in Movarian Falls, NC. Forrest says the screen is selling very well and hasn't generated any returns or complaints from beekeepers.

Varroa mite infestations have become such a serious problem that maintaining bee colonies without chemical treatment is virtually impossible. Currently, the common pesticide approved for use as a parasitic mite control for honey bees is Apistan – a strip that contains the chemical tau-fluvalinate. Varroa, however, have begun to show resistance to the chemical, so scientists are looking for alternatives such as the screen.

As safe and effective chemical controls continue to be researched and developed, the screen insert will complement Apistan in assisting beekeepers with the control of invading varroa. □

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