

1980

## Fall 1980

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Robert N. Carrow

James O'Kelly

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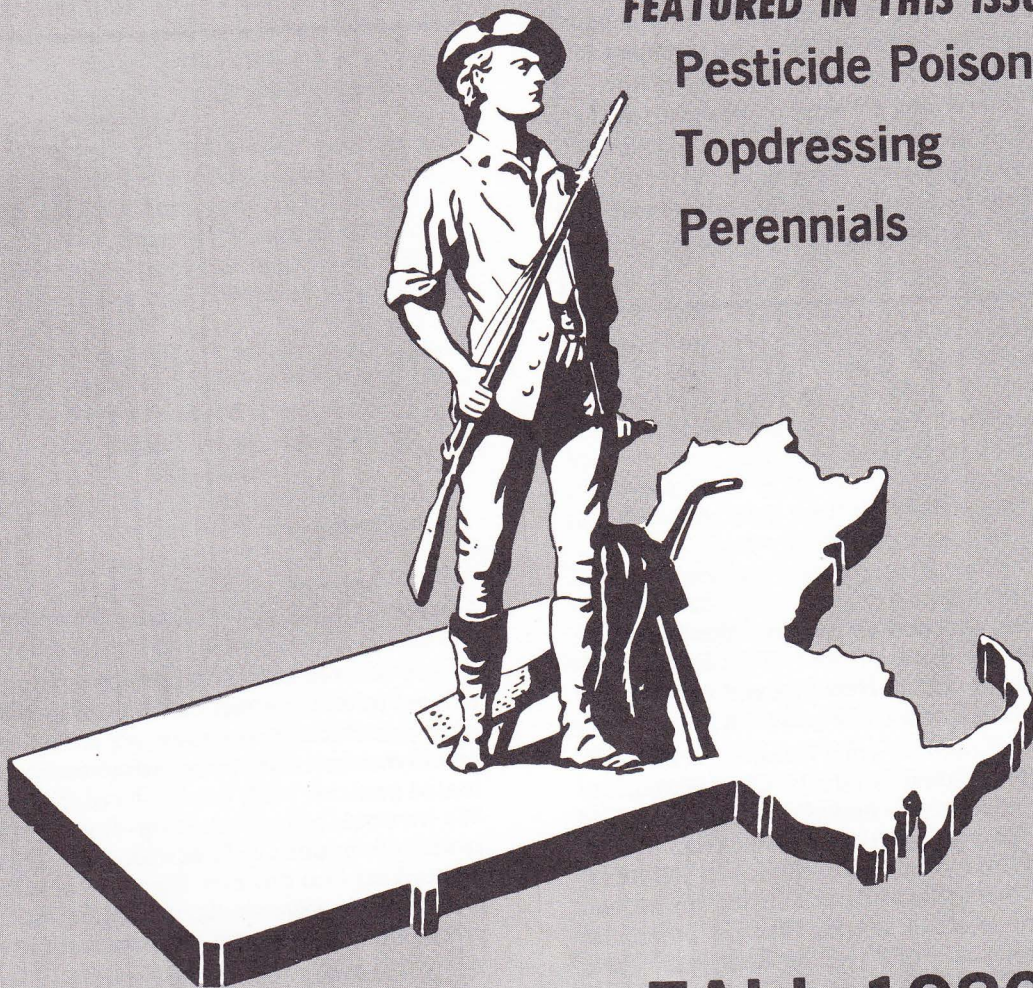
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# TURF BULLETIN

MASSACHUSETTS TURF  
AND LAWN GRASS COUNCIL  
I N C O R P O R A T E D

**FEATURED IN THIS ISSUE:**  
Pesticide Poisoning  
Topdressing  
Perennials



**FALL 1980**

**BETTER TURF THROUGH RESEARCH AND EDUCATION**



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**Fall 1980**

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**Dear Readers,**

I am still waiting for the Fall rain in order to put the finishing touches on this issue of the "BULLETIN." Although the reservoirs in central New England are very low we have had just enough rain to keep the turf green.

We have added to our turf grass research facilities the field work of two new graduate students. Charles Mancino will investigate the relationship between Anthracnose and *Poa Annua*. Dave Bell is going to examine the relative competitive qualities of *Poa Annua* and improved Perennial Ryegrass cultivars. Steve Rackliffe is starting his second year investigating the effect of altering nitrogen potassium ratios on the heat tolerance of Creeping Bentgrass. Chris Brooks has completed his work on cold tolerance of Perennial Ryegrass and a complete report of his findings will appear in the next "TURF BULLETIN." The Bulletin congratulates our student aid Frank Chaffee on his acceptance of the position of Assistant Superintendent of Tavistock

Country Club, Haddonfield, New Jersey. Good luck Frank.

A new phenomenon has appeared at our research facilities. In mid-summer our Bluegrass (all varieties) developed pale chlorotic rings ranging from one half foot to five feet in diameter with three inch to ten inches bands. We initiated pesticide trials the results of which are inconclusive. We were able to mask the rings for ten to twenty days with Iron Sulfate; not Chelated Iron. Dr. Troll and Dr. Hurto are looking into this new Bluegrass pest, which we suspect is a Basidiomycete similar to "Fairyring", and would appreciate any information or observations you may have.

I thank all those readers who have kept in touch with the Massachusetts Turf and Lawn Grass Council and encourage all of you to take advantage of our assets.

*Malcolm J. Chisholm, Jr.*



## Chronic Organo-Phosphate Poisoning

By Alan Bebka  
TechniTurf  
South Berlin, MA

What I say today may save your life. I hope I have your attention because I really mean it.

There are over 70 organo-phosphate pesticides, among them are TEPP, Bidrin, Vapona, Dibron, Dylox, Parathion, PennCap M, Diazinon, Systox, Phosdrin, Baytex, VC 13, Ronnel, Dursban, Co-Ral, and Mo-Cap. If you are engaged in any agricultural or horticultural pursuit you probably will come in contact with them.

Almost everyone here has had his vocabulary involuntarily expanded in the past two years when they prepared to take pesticide applicator tests and I will assume you know what terms like LD57 mean but I want to make sure you know the difference between chronic and acute poisoning.

Alcohol is a very familiar poison. Every once in a while we read about someone dying from acute alcohol poisoning. Because it is rare, it makes the papers. Someone manages to chug-a-lug a fifth of vodka and slows his brain down to a dead stop. A hangover is a symptom of less than fatal acute alcohol poisoning.

Chronic alcohol poisoning, on the other hand, is not rare, in fact, it is probably the third largest cause of death in the Western world and is an important contributing factor to the first two. We recognize the advanced symptoms readily but most of the early ones are hardly noticeable, are easily hidden by the victim or are revealed only by laboratory tests.

The comparison of alcoholism to chronic organo-phosphate is very apt. Organo-phosphate poisoning, too, is incidious, vague, and hard to connect to its source. I will not be talking about the falling down, foaming at the mouth, and vomiting kind of poisoning.

A good way to begin is to describe how organo-phosphates affect the nervous systems of living organisms by inhibiting the enzyme cholinesterase.

The nervous system sends all of its messages in the form of impulses. When the message reaches the synapse of nerve end, acetylcholine is released and the muscle or gland or whatever responds. Within the next 1/500 second cholinesterase must destroy the excess acetylcholine. If supplies of cholinesterase are low, proper muscle control, etcetera, will not be achieved. This applies to involuntary as well as voluntary systems.

The endocrine system, particularly the liver, is affected in a different way. In addition to manufacturing cholinesterase and other enzymes the liver is a detoxifying or cleaning center. In trying to remove these toxic materials the liver can be overworked to the point of losing efficiency or being damaged. Alcohol, of course, can do the same thing.

Now the amount of chemical needed to do damage varies not only with the specific compound but with the species being exposed. Furthermore individuals within a species have a varying tolerance. As if this weren't enough, an individual's ability to cast off the effects of small doses

of organo-phosphates will change according to the way he is living at the time. We have had individuals whose levels of pseudo-cholinesterase increased above base level during spraying operations. This means you can never be really sure how any one individual will react to a given amount of exposure at any given time. Just because you have been using organo-phosphate for years and have no indication of ill effects doesn't mean you can't have it tomorrow.

You may be wondering how it happened that we got so deeply involved in this subject. Like many things in life it was partly a matter of chance. I was attending the Penn State Turf Conference last winter and tired of listening to the speaker tell us about his vacation, I wandered over to the library and decided to look up what they had on organo-phosphates. I found D. F. Heath's book, "Organo-Phosphate Poisons." He discussed the entire subject in detail and as a result, when I returned to Massachusetts we decided to set up a testing program.

We ran our first test before any spraying began in the spring. This was to establish norms against which to judge tests made during the season. We found that the quote - "normal"-unquote levels of blood constituents we were interested in varied widely from one individual to another. It is absolutely necessary to begin testing before spraying begins for the results to have any value.

A month after we began spraying we ran a 2nd test and hit our first snag. There are two different tests for pseudo-cholinesterase and our test results came back for a different test the 2nd time. It was difficult to compare the two but by comparing the results of people who had not been actively spraying during this period with those who had, we were able to identify several persons who seemed to have a large drop in pseudo-cholinesterase levels. We had them spraying until we tested again.

When I met with the lab personnel they explained that they had not had requests for pseudo-cholinesterase tests in years and the first tests were sent out to a lab in Boston. When it became apparent that we would continue testing they set up for it themselves but switched to the other test.

At this time someone rummaging through a file ran across Dow Bulletin #134 366 77R entitled "Dursban Insecticides. . . Suggested handling procedures for custom lawn spray application". It was one of those flyers that a salesman leaves on your desk, in this case Fred Heyliger, which you give about 2 seconds of your time. We should have given it two days.

Reading through it we found that we were on the right track in setting up our blood tests, and that the pseudo-cholinesterase enzyme is the most sensitive to organophosphates and therefore the most important one to monitor. This explained why that enzyme was the only one that fluctuated in our tests. Since then pseudo-cholinesterase is the only enzyme we have monitored regularly, at intervals of a month or less.

The results of this testing also prompted us to examine



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our daily routine and pinpoint the routes of exposure. The first thing we did was isolate all chemicals in an area away from our daily routine. Then we decontaminated the entire work area. Next we examined the actual spray procedure and noted all phases where contamination occurred. The complete operation as well as the equipment used was modified to reduce exposure. The risk involved in handling concentrate was also reduced. This was accomplished by repackaging pesticides in containers with premeasured amounts coinciding with our spray tank capacity. Only one person then handled concentrate and greatly reduced amounts of concentrate were carried on each truck. After filling each sealed container is again decontaminated.

When it became apparent that management was very concerned about exposure, all employees caught the concern as if it were chicken pox. No more whinnying about stuffy suits and hot rubber boots. Now we had to contend with every headache or cough being interpreted as over-exposure. Each day silicon creme is applied to hands, arms, neck and face, rubber boots, rubber gloves, goggles, a charcoal-type respirator with a dust filter and a PVC rain suit are provided.

At the end of the work day all safety equipment is dipped in a dilute bleach solution and then in rinse water. Items too large for this, such as truck interiors, are sprayed with the same solution and rinsed after a brief interval.

In using bleach as a decontaminant, be extremely careful that you do not mix it with ammonia, or ammonia-type fertilizers. If you do you will release chlorine gas immediately and it is deadly.

**All clothing should be discarded for washing at the end of each day and the person spraying should shower, paying particular attention to the hair before dressing in uncontaminated clothing.**

After implementing this program pseudo-cholinesterase levels returned to normal and stayed there.

Next I want to relate to you some personal experiences I had during this same period. The ideas, guesses, theories and conclusions we have drawn from them are open to

question and rebuttal. They are by no means final.

About 1½ years ago I began to experience problems with dizziness, coordination, fatigue, vision, shaking and cramps bad enough to prompt me to go to my family doctor. To him my complaints indicated a possible fault in sugar metabolism -diabetes or hypoglycemia. We went over work habits and environment and then he decided I should take the usual series of fasting sugar tolerance tests. The results were inconclusive and contradictory so he decided I needed the attention of a specialist. This specialist turned out to be an instructor at a medical school here in Massachusetts. Again the series of tests and again the inconclusive results. His next suggestion was that I go into the hospital for exploratory surgery. This scared the hell out of me and I asked my family doctor to try someone else. This time it was a world famous clinic specializing in disorders in sugar metabolism. By now my weight was dropping and other symptoms were getting worse. The doctor who considered my problems at this clinic went through approximately the same routine as the first two but his treatment consisted of a very strict diet designed to quell violent fluctuations in blood sugar. By this time my weight had dropped a great deal. I was 35 pounds lighter than when my illness started. Meanwhile back at the office, my boss and a co-worker spent many hours discussing the situation with me. By now we were well aware that many of my symptoms were also those of organo-phosphate poisoning and on one trip to the clinic I brought the matter up with the doctor. Our conclusion, in simplified form, was that since I was exposed to insecticides much less than any others and the symptoms continued unabated even during the winter months, the doctors were right in not picking up on the exposure as a possible cause.

My visits to the clinic had been reduced to periodic checkups. It seemed that I had been assigned to that vast army that has to live the rest of its life with a sugar metabolism problem on a severely restricted diet. Some of the requirements of the diet I had been given seemed a bit strange and I was able to improve on it by incorporating some of the ideas from a book called "The High Energy

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Diet". My weight stabilized and began going up very slowly but the other symptoms remained and any laxness about the diet would send me into a tailspin.

Then an entirely unexpected thing happened. From the time we began the severe hygiene in our shop and on our trucks my symptoms began to fade. For many months now I have had no symptoms and I have been able to abandon the diet. Yet two doctors walked right by the insecticide exposure problem when it was mentioned to them and a third even sent a letter to us denying the possibility of such a thing.

If insecticides were involved, and again, I must emphasize that this is by no means a certainty, I must be one of those persons with a very low tolerance for organophosphates.

If you have come to the conclusion that a strangely lax situation exists here, you are right. We are at present working with doctors from the Commonwealth Board of Health and hopefully guidelines such as those we have suggested today will be sent out to other people using agricultural pesticides. Meanwhile, you are on your own.

To sum up, if you are using organo-phosphates insecticides you surely should take steps to protect yourself and your employees.

Know who the physician is you will have to contact if you get into trouble. Better yet, become acquainted with him now. If you find the doctor at the local poison panic center too busy or too indifferent, get another one. Hunt until you find one who will really listen to you. You will probably have to educate him. At the least show him this

paper when it is printed in the Proceedings. Let him read the Dow folder and give him the name and title of the book mentioned earlier.

Next locate a lab that can make your test for you and establish a base before the spraying season begins. This has to be done through the doctor you choose, since a doctor must authorize the tests. Our doctor has left a standing order so that we can obtain a test anytime we want.

Keep an accurate record of the tests so you can see what is happening. Set up a de-tox program similar to the one we have outlined earlier. This season we will include on premises clothing change and are now exploring the idea of a chlorinated dip tank or swimming pool at each of our shops.

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## Care of Clothing Exposed to Pesticides

Pesticide residue is picked up on the clothing worn during pesticide application. The clothing need not be dirty or wet to have picked up the residue. You will not be able to see most residue. Because pesticides can enter the body through the skin, careful attention to clothing contaminated by drift or spills is required.

Clothing worn while applying pesticides should be washed daily. Do not mix pesticides contaminated clothing with other laundry. Store your clean clothes along with other pesticide safety equipment, i.e., respirators, goggles, etc., in a cabinet away from pesticides. Do not store them with other clothing. Do not reuse clothes that are torn or that have been worn thin.

- Clothing which has full strength pesticides (right out of container) spilled on them should be washed twice.
- Normal procedures for heavy soiled laundry will remove the pesticides from the clothing.

Clothes should be washed as part of the clean-up process, and not put off until tomorrow. They should be placed right in the washer immediately after they are removed. If this is not possible, place them in a plastic bag and store them away from children or pets.

- Use hot water, 140°, and normal or full water level.
- Use the manufacturer's recommended amount of heavy duty phosphate-based detergent.
- Thoroughly dry the clothes in an automatic dryer for 30 minutes at the regular fabric setting.
- Remove any leftover pesticides from the washer by running the machine through the complete laundering cycle, using detergent without clothes.

These recommendations are based on the results of research conducted at Iowa State University. Typical fabrics, such as denim and chambray were used. Representative pesticides (one insecticide and one herbicide) were used to contaminate the fabrics, which were then washed and dried following the procedures outlined above. Fabric and water samples were then tested for pesticide residue. Results showed that the normal laundry procedures were most adequate in removing the pesticides. More than 99.3 percent of both the herbicide and pesticide were removed from the two fabrics tested.



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## Perennials

By Professor Alfred Boicourt  
Plant and Soil Science Dept.  
University of Massachusetts  
Amherst, MA

Surprise your golfers with a variety of perennial flowers for the club house grounds. This may seem like a wrong time of year to stress perennial planting or planning when many flowers are past their prime. However take a look around your community and you will note chrysanthemums, New England asters, rudbeckias and other flowers in bloom or just ready to pop.

Annual flowers are very useful for providing a bold splash of color. Unfortunately, as the season progresses annuals, sometimes, become monotonous, whereas perennials change with each day.

It is not too late to plant hardy mums. Last year I bought two dozen mums to border my front sidewalk. They were colorful until mid-November, in spite of several frosts. Some gardeners question their hardiness. I mulched mine with sorghum even though I would rather have had salt marsh hay, often considered the ideal winter mulch. Salt marsh hay gives good insulation and allows moisture to penetrate into the soil without being absorbed by the mulch. An additional advantage is that it can be stored and reused another year. I used a pitch-fork to loosen the mulch during a Spring thaw, plus preventing rotting of the crowns. By May each clump of chrysanthemums had produced many new shoots that I divided and replanted. Many gardeners fail to divide their mums in the Spring. Undivided clumps will result in spindly growth and inferior flowers. Also as the soil dries out in the Mid-Summer it doesn't contain enough moisture to supply top growth and the whole clump will wilt repeatedly. All you need for a division is one 4" to 6" stem with one root at the base of the stem. The divisions should be spaced 8" apart in well prepared soil, using plenty of compost and peat moss. A four inch layer of both may be applied to the surface before tilling.

Another trick in producing beautiful mums is to pinch out the tips of the shoots several times before August 1st. A soft pinch at the very tips encourages healthier breaks than a hard pinch lower on the stem. Frequent pinching will result in shorter, more useful bedding plants that do not require staking.

Why stop pinching the Mums August 1st.? Most varieties of mums start producing flower buds about the third week in August. Generally, the mums should produce six inches of new growth after pinching for healthier flower bud production. This will depend upon the time of bloom and vigor of the variety. If you stop pinching August 1st. most varieties will grow less than 18" in height and yield large flowers.

Mums require at least three applications of a fertilizer such as 5-10-5, 5-10-10, 4-12-4 or similar analysis from early Spring to flower bud formation. Two pounds of fertilizer per 100 sq. ft. at each application is adequate.

Obviously, the soil should be irrigated during dry periods. Drought will often cause premature flower produc-

tion and hard woody stems. After the plants have had a check in growth they never seem to return to normal healthy growth.

What do you do after hardy mums bloom? Cut back the old stems to the ground and add winter mulch. Also label each variety. If you don't know the variety at least, designate the type and color of the flower on the label. This little extra effort comes in handy when dividing the plants in the Spring.

If I had room on my property I would prefer to line out divisions two feet apart in a row. Cultivating, fertilizing and pinching is a lot easier, then in the Fall lift the plants and plug them into the flower borders. If you can't line them out plant hardy mums in front of common iris (*iris germanica*). By July the fresh dark green foliage of mums screens the dying foliage of the iris. Also, you can plant mums next to bleeding heart (*Dicentra spectabilis*) which dies down in July leaving a three foot bare space in your border.

Why not spend the winter planning your new perennial border? Then when Spring arrives you will be ready to

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buy a large assortment of young plants from your local garden center. Be sure to select perennials that require little care. For example, may I suggest daylilies, astilbe, gas plant, campanula, peonies (single flowered types won't fall over or require staking), hosta, coral-bells (heuchera) and garden phlox.

If you plant only mums to begin with the border does not need to be wide, however, as you plant other perennials you may prefer to widen the border to eight to ten feet. Perennials come in a broad range of height from very low to well over six feet. Obviously, the taller plants should be placed near the rear of the border.

The border is more attractive if it extends away from the club house terrace, viewing it lengthwise or diagonally. With right angle viewing the bare spots, weeds, and withered old flowers are more visible.

The border is more beautiful with a background of hedge, mixed shrubs and evergreen, or fence. A four foot turf strip between border and background will give a "3D" effect and will allow for easy maintenance.

Most perennial flowers should be planted in large bold groups using, at least, three plants. Repeat the groups three times throughout the length of the border to give a harmonious effect and balance. Single plants will appear spotty.

Don't plant too close to the turf edge because the plants will interfere with the mowing. I have always recommended an 18 inch margin around the entire border that is left devoid of plants. This marginal area is not as bare as you might think because plants either spread or lop-over giving a informal, natural appearance. Unless you plan in the beginning to allow an 18 inch margin you may buy too many plants. Even with a 9 foot wide border you plant only 6 feet. Maintenance is reduced by installing some edging material such as steel, aluminum, or redwood band, 3 to 4 inches wide. Steel strapping that is often used for bordering asphalt sidewalks is probably the best for durability and neatness. Aluminum bends too easily, at least the type I used for bordering my gravel walk. Redwood boards 3 or

4 inches wide have been very satisfactory for 15 years on my own border. Other woods treated with wood preservative may last nearly as long as the redwood.

What about the brick edging? Brick has several disadvantages. First: a brick edge is seldom permanent. In our climate freezing and thawing causes the surface to flake. Second: bricks harbor weeds between them and when you pull the weeds the bricks are moved out of line. Result, you install them again. Third: cultivation equipment, like a hoe will dislodge the bricks. Flat stones placed on end for turf edge are worse than bricks and spells doom for lawn mower blades.

Throughout I have mentioned suggestions for reducing maintenance. Keeping weeds out of a perennial border is the greatest problem and labor cost. No herbicide is effective or safe on a variety of perennials. Thorough cultivation followed by summer mulch may be the most desirable method for controlling weeds. An additional-advantage is that the mulch will retain moisture in the soil. A two inch layer of sphagnum peat moss will squelch most weeds, improve the appearance of the flowers, and can be worked into the soil at the end of the growing season. This year I tried wood chips mixed with horse manure on the University of Massachusetts border. For two months the flower border was relatively free of weeds, but by September there were several healthy weeds that could be pulled easily. I would be interested to know if any of you have tried black plastic mulch on perennials covered with woodchips. I tried clear plastic the first year we planted the border with disastrous results. The weeds grew faster under the plastic and the wind blew the plastic off taking many young plants with it. After that experience we returned to hoeing. I still think that a thorough hoeing and removal of all weeds may be the cheapest in the long run. Preventing weed seed production will eventually reduce weed population.

While hardy mums are at their peak of bloom I sincerely hope you will be encouraged to try mums and then later, add other perennial flowers. Your club members and the whole community will appreciate your effort.



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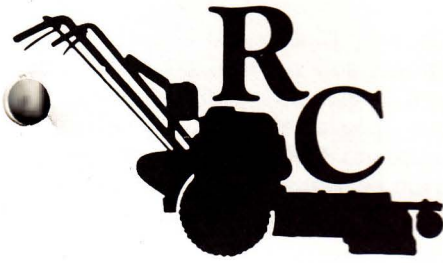
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# Topdressing

By Dr. Robert N. Carrow  
Kansas State University  
Manhattan, KS

Topdressing is the application of a thin layer of soil or soil mix to the surface of a turfgrass stand. Reasons for topdressing include.

- a. Smooth or level the playing surface. This is especially important on close cut turf.
- b. Thatch control. Microorganism activity can be enhanced by improving the thatch microenvironment.
- c. Modify the soil surface. Heavy soils prone to compaction can be modified by a good topdressing and cultivation program.
- d. Winter desiccation and low temperature protection. A heavy topdressing can provide insulation for the turfgrass crown.
- e. Cover stolons or seed. A heavy topdressing after stolonization or seeding enhances establishment.
- f. Reduce grain on greens.
- g. Promote water infiltration.
- h. Reduce disease incidence on heavy soils.

When the correct mix is properly applied and at the right frequency, topdressing is beneficial. However, serious problems can develop when turf managers err in their topdressing program. Possible problems that may occur are:

- a. **Layering.** The topdressing mix should intermingle with existing thatch or soil. When sand is applied to a heavy soil, mixing must be promoted by cultivation. Distinct layers of sand, thatch, organic matter, or soil are to be avoided since they drastically interfere with aeration, infiltration, and rooting.

- b. **Cost.** Labor, material, and equipment inputs are required.
- c. **Availability of materials.** Sometimes good topdressing components are difficult to obtain.
- d. **Mixing.** Mixing two or three components into a uniform size is difficult.
- e. **Knowledge of what to use.** Much confusion exists as to what to use. Sometimes this has led turf managers to adopt poor topdressing practices or avoid it altogether.

Except for layering all the other problems are associated with economic or education aspects. Only layering is important to the plant and it is the only agronomic consideration. Topdressing is definitely beneficial if the turf manager will devote time and effort to developing a good program.

Application rates vary depending upon the purpose for topdressing and frequency. With applications every 2-4 weeks, rates of 1/16 inch (0.2 cu. yd.) per 1000 ft<sup>2</sup> have been used. Heavy rates of 3/4 inch (2.3 cu. yd.) per 1000 ft<sup>2</sup> are only applied for covering stolons or seeds. When topdressing once or twice a year, rates of 1/8 - 1/4 inch per time are common.

## COMPONENTS OF TOPDRESSING MIXES

Many different topdressing media have been utilized by turf managers; however, the basic components are sand, organic matter, and soil. Each of these contributes certain physical, chemical and/ or biological properties to a mix (Table 1). Thus, when developing a suitable mix, at-



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tention should be given to what properties an individual component contributes. For example, a 100% sand topdressing adds little with respect to chemical or biological activities. In fact, these aspects are decreased over time. On the other hand, a 100% organic matter topdressing will exhibit poor physical properties but adequate chemical and biological characteristics.

**Table 1. Components of topdressing mixes.**

Component	Properties contributed to a mix	Volume used <sup>a</sup>
Sand	Physical—water infiltration, aeration, drainage, flowability when applying	70 - 100% <sup>b</sup>
Organic	Chemical—CEC <sup>c</sup> Physical—moisture retention Biological—biological activity	0 - 20%
Soil	Chemical-CEC Physical—moisture retention, reduced aeration and infiltration Biological—biological activity	0 - 15%


<sup>a</sup> Mix by volume due to variations in weight of components.

<sup>b</sup> Old mixtures were often 33-33-33%.

<sup>c</sup> CEC = cation exchange capacity or nutrient retention.

Before a good media can be formulated, the turf manager must select components. Each component can vary greatly in properties depending on the source. Properties and selection of components are discussed in the following sections.

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## Sand

Sand is any inorganic particle within the 0.5 - 2.00 mm diameter range (Table 2). A good set of sieves can be used to determine particle-size distribution of sand. When purchasing sand, the particle or sieve size should be specified. Confusion results when sands are classified by general terms (concrete, mason's, etc.) instead of specific particle size. A concrete sand in one location may be much different from one in another site. General terms often used by firms selling sand are:

- Concrete sand. Generally these have a wide particle size range, are not uniform, often contain gravel and some silt or clay. Usually they are not acceptable.
- Mason's sand (mortar). Similar to concrete sand but without gravel. May be acceptable in some locations.
- River sand. Varies greatly with source, often contains gravel and/or fines.
- Dune sand. Often has a narrow particle size distribution and is clean. Acceptable if within the right size.

**Table 2. Soil separate classification.**

USDA Class	Size Range mm	US. STD. sieve
Fine gravel	2.00	10
Very coarse sand	1.00 - 2.00	18
Coarse sand	0.50 - 1.00	35
Medium sand	0.25 - 0.50	60
Fine sand	0.10 - 0.25	140
Very fine sand	0.05 - 0.10	270
Silt	0.002 - 0.05	---
Clay	0.002	---

For topdressing purposes (and green construction) guidelines to follow are:

- Distribution. A minimum of 75% of the particles should be in two adjacent particle size ranges. A wider range will result in a hard or compact mix, since the smaller particles fill voids between the larger ones. Medium (0.25 - 0.50 mm) and coarse (0.50 - 1.00 mm) sands are best; however, some fine (0.10 - 0.25 mm) is acceptable.
- Fines. Clay and silt particles are called fines. These plus soil pores and reduce aeration, infiltration and drainage. No more than 8% fines is recommended with maximum limits of 5% silt and 3% clay. Sometimes a higher percentage of clay is acceptable if the clay is well aggregated.
- Coarse particles. No particles over 2.00 mm are allowable and preferably no more than 10% larger than 1.00 mm. Coarse particles do not integrate into the existing sod, especially on golf greens. As a result they dull mowers, interfere with putting, and are unsightly.
- Shape. Round sands are preferred since they will not form a compact mix. Angular particles shift and fit together closely which results in a hard mix.

Sands vary in chemical composition and not all are good growing media. Silica or quartz sands are old, highly weathered, and hard. These are excellent for topdressing,



sand traps, and root zone mixes. Young, less weathered sands may be available. These are usually feldspars, micas, apatites, or ferromagnesium minerals and are highly colored. Young sands are acceptable as long as they possess good mechanical stability. Pumice sands are from volcanic pumice and lack mechanical stability. Coral sands originate from coral deposits and are often white. These contain lime and bicarbonates which interfere with nutrient availability. Their mechanical strength is fair to good.

Other materials are sometimes used in place of sands. Calcined clay and expanded shale are acceptable if graded to proper size. They have internal porosity and retain some water; However, the water is not plant available. These materials are generally more expensive than local sands. Vermiculites and perlite should not be used. Vermiculite is easily compressed under traffic into a plate-like shape, which reduces infiltration, drainage, and aeration. Perlite lacks mechanical stability. Slag may be acceptable if graded, checked for toxicities, and of reasonable cost; however, long term stability is not known.

### Organic Matter

Various organic materials may be used in topdressing mixes, such as peat, sawdust, manure, sewage sludge, and crop residues — rice hulls, cocoa shells, peanut hulls, straw. Except for peat the other materials require composting before use.

Peat is the most widely used organic constituent. There are a variety of peats and not all are acceptable. Acceptable peats for topdressing and rootzone mixes are:

- Sphagnum moss (peat moss). These contain over 75% (oven dry weight basis) of sphagnum moss fibers. They are only partially decomposed and will break down quickly in the soil. Their fibrous structure makes mixing difficult unless milled.
- Hypnum peat. At least 50% hypnum moss fiber must be present in these peats. They are partially to moderately decomposed and have a felty to pulpy structure. These are acceptable for topdressing if their structure permits good mixing. Milling a felty hypnum peat will result in a finer structure.
- Reed-sedge peat. These must contain at least 33% reed, sedge, or grass fibers. Decomposition is moderate to good and structure is generally pulpy which allows good mixing. These make very good peats for topdressing media.
- Peat humus. Peats that are well decomposed and contain less than 33% fiber content are classified as peat humus. They have a granular structure which facilitates mixing. Peat humus makes a good organic component for topdressing.

Some peats or peat-like materials are not acceptable. These are:

- Sphagnum moss (top moss). Top moss consists of fresh, undecomposed plant material and has a very open, fibrous structure. If top moss is composted, it can be used.
- Sedimentary peats contain excessive quantities of silt, clay and/or muck. They reduce drainage and aeration.
- Muck soil. A muck is an organic soil which contains no identifiable plant fibers. It is highly decomposed and has many fines. Mucks often shrink and swell upon drying and wetting.
- Black soil, black humus, organic loam, etc. These are general non-specific terms used in advertisements. They can range from a mineral soil rich in organic matter to a sedimentary peat.

When selecting an organic component for a topdressing mix, primary requirements are: moderate to well composed, fine enough structure to allow mixing, absence of fines, cost, and availability. If a suitable peat is not available, a turf manager can develop a composting system and use other organic materials.


### Soil

Turf managers often like to include some soil in topdressing mixes. Normally 0 - 15% soil is used. When selecting a soil, guidelines to follow are:

- Avoid soils containing high quantities of silt. Silt does not contribute any positive qualities to a mix and can enhance compaction. Loamy sands, sandy loams, and loams are preferred.
- Use a well aggregated soil, especially if more than 3% of the total mix is clay. Aggregated clay does not disperse throughout the whole mix and clogs soil pores.
- Obtain pest-free soil, especially soil free from noxious weeds such as *Poa annua*, quackgrass, field bindweed, and bermuda.

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### TYPES OF TOPDRESSING MIXES

A wide variety of topdressing programs have been used; however, these can be placed into three categories — high sand, pure sand, low sand mixes. Each has advantages and disadvantages.

#### High Sand

A high sand topdressing mix would contain 80 - 95% sand, 5 - 15% organic matter, and 0 - 15% soil. These have become popular in recent years, especially on heavily trafficked turf. The mix would be similar to the USGA Green Section golf course green rootzone mix specifications.

An advantage of high sand mixes is their balance of properties. The sand contributes excellent physical properties such as good water infiltration, aeration, drainage, alleviation of compaction, and flowability when applying. Organic and/or soil components will provide chemical activity (CEC) and microorganism activity necessary for thatch decomposition, nutrient release, soil aggregation, and pesticide degradation. If properly formulated, they will have characteristics similar to those of the original rootzone mix (assuming it is good) and therefore reduce layering problems. On heavy soils a high sand topdressing program can be used to modify the existing soil with minimal chances of layering; however, cultivation is still desirable. In some areas of the country, such as the Central Plains, the soil component may be eliminated due to natural windborne silt fallout.

Difficulty in obtaining good sand, organic matter, and soil components is a disadvantage. Also, much time, labor and equipment are required to thoroughly mix components. Depending on an organic matter source, a 3-12 month composting period may be necessary prior to use. Each of these disadvantages is economic and not agronomic in nature.

#### Pure Sand

Dr. John Madison from the University of California has suggested a 100% sand. The best results are with fre-

quent (2-4 weeks) and light applications (1/28 - 1/16 inch) which may contain fertilizer, seed, lime, and pesticides if needed. Application rate and frequency are adjusted to thatch accumulation. Just enough topdressing is applied so that it intermingles well with thatch, which avoids layering. Another advantage is savings in time, labor, and equipment for mixing and composting.

Lack of chemical and biological characteristics is a disadvantage. Theoretically the thatch decomposes and leaves sufficient organic matter to provide these attributes. In humid regions where the thatch microenvironment remains humid for a long period after each irrigation, thatch decomposition does appear to occur at a reasonable rate with 100% sand topdressing. However, in arid/semiarid regions or sandy greens with good air circulation, high evaporation rates quickly dry the upper thatch zone. Under these conditions, thatch accumulates even though topdressed. This results in a continuous buildup of a thatch-sand mixture. While layering would not be a problem in this situation as long as the practice is continued, it would develop if the turf manager changes to a different topdressing program.

#### Low Sand

Topdressing mixes containing 33 - 75% sand, 5 - 33% organic, and 10 - 33% soil were commonly used prior to the 1960's and still are by some turf managers. Chemical and biological properties of such mixtures are dominant and therefore nutrient retention and microorganism activity are quite good. An additional advantage is that selection of individual mix components is less critical.

A serious detrimental aspect of low sand mixes is lack of good soil physical properties. On golf greens, which receive sparse traffic, such mixes can be used if the turf manager does not over-irrigate or -fertilize. However, many golf greens are heavily trafficked and must be maintained at a high level to insure adequate recuperation from disease, wear, and mowing. When utilizing low sand topdressings under heavy traffic, soil compaction soon re-

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sults. Compaction reduces turfgrass vigor and predisposes the sod to a variety of stresses including disease, scald, high temperature, cold, and drought. Also, irrigation is difficult due to low infiltration rates and aeration is often deficient. These mixes can be difficult to apply unless the soil is friable.

### TOPDRESSING PROCEDURES

Two situations often encountered by turf managers are (a) topdressing a golf green which possesses a good rootzone mix, and (b) topdressing a heavy golf green with the goal of improving its physical properties. Turf managers are sometimes confused about what topdressing program to use.

#### Sand Golf Greens

If the existing rootzone media is good, the golf superintendent will desire to keep its character. Using a topdressing mixture exactly the same as the existing soil is recommended. In regions where appreciable silt is blown onto greens, a topdressing sandier than the existing soil is desirable. Only quantities which mix into the thatch well without a distinct sand layer should be applied at any one time. More frequent, light applications are preferred over heavy, infrequent topdressing due to layers which can develop with the latter program. Topdressing should be only as needed. Periodically the turf manager needs to look at the soil profile and see if any layers are evident that may prohibit water movement or rooting. If a layer is developing, he should initiate a coring program and reevaluate his topdressing regimen to determine the reason.

#### Heavy Golf Greens

Through careful topdressing and coring programs a heavy green soil can be gradually modified into a mix less prone to compaction. If the green has no thatch problem, a 100% sand can be used for the first 2-3 years. After this period, a 90% sand, 5 - 10% organic matter, 5 - 10% soil mix may be utilized. A good coring program should be fol-

lowed, which may be 2-4 times per year. This will result in mixing of the 100% sand into the existing soil and eliminate layering. After several years the existing soil will be buried 2-3 inches deep and coring will no longer be needed as frequently; also, this would be the time to start using a high sand topdressing instead of 100% sand. Topdressing should be as frequent as the sand will integrate into the thatch.

When modifying a heavy green that has an excessive thatch accumulation, starting with a high sand plus some organic matter may be a better choice than 100% sand. This would be especially true in semi-arid/arid regions. Frequent coring would still be necessary.

Do not expect instant results. Even with frequent topdressing, improvement may not be noted for 3 to 5 years. Once a good mix has been developed at the soil surface, compaction problems will decrease. However, internal drainage will always be a potential problem since a heavy mix is under the green.

### HOW TO OBTAIN A GOOD TOPDRESSING MIX

Great care should be exercised in developing a topdressing mix and program. The growing media will have a direct effect on the persistence, vigor, and competitiveness of the turf. A poor topdressing program often produces conditions worse than before.

Each component should be carefully selected based on agronomic as well as economic considerations. Choose several local sand, organic, and soil sources and evaluate them individually and in combination. If in doubt, consult with the USGA Green Section or University personnel. Sometimes when a single local sand is not acceptable turf managers can mix two together and create a good sand.

Individual components need to be inspected periodically to insure uniformity, especially when being purchased in bulk. Great care in mixing is required. A slightly moist sand is much easier to mix with peat than a dry one. A soil shredder does an acceptable mixing job if materials are properly metered into it. When the organic matter is not a

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good peat, composting may be necessary for several months before good handling properties are achieved.

In some locations commercially prepared topdressing mixtures are available. These should be evaluated and detailed specifications provided. While time and labor savings are possible, little advantage is achieved if the mix increases compaction or layering problems. Do not use a commercial mix unless it meets your needs.

#### EQUIPMENT FOR TOPDRESSING

Units which apply uniform topdressings are commercially available both in self contained and truckster mounted models. These are the best for topdressing.

Drop and cyclone spreaders have also been used. These are more time consuming and less uniform. Also, the media must be very uniform for good application.

For home lawns, parks, general grounds, and many athletic fields topdressing units are not available. However, these sites can be topdressed by coring and dragmatting the soil back into the sod. This is quick, inexpensive, and provides aeration.

The last method for applying topdressing is by hand. Uniformity and time requirements are problems. OH! MY ACHING BACK!

*Reprinted with permission from "Turf Clippings 1979" published by University of Massachusetts, Amherst, MA*

## Winter Problems of Shade Trees

Once you have ruled out insect, disease, or environmental stress factors, the cause of your tree's troubles may very well be some type of winter injury.

Temperature stress is the major factor causing winter related injury to shade trees. Trees in the urban environment are exposed to large variations in temperature, making them more susceptible to injury from temperature extremes and rapid changes in temperature than those trees growing in the forest.

**Frost injury** or cold temperature injury is usually the result of a late frost during the spring when trees are decreasing in hardiness. Frost injury can cause considerable damage and even mortality of trees. The severity of frost injury increases towards the later part of spring when new growth is well advanced. This type of injury is most common on flowering trees such as crabapple, shadbush, or lilac. The symptoms of frost injury include wilting, browning, and death of newly emerged shoots, leaves, and flowers of deciduous species, or reddening of needles and defoliation of coniferous trees. Trees growing in frost pockets may encounter this injury on the lower parts of the tree only. Native trees that have adapted to northern temperate climates are not usually injured by cold temperature or frost. Trees planted north of their hardiness zones are more susceptible to frost injury. Frost injury cannot be controlled but it can be prevented by planting trees in their proper hardiness zones. High-nitrogen fertilizers applied in the summer may cause excessive foliage production and delay hardening. Fertilizers rich in potassium help trees against winter injury.

**Soil freezing** can also be detrimental to trees, especially those growing in containers. During winters such as this year's when there is little or no snow on the ground for insulation, tree roots are apt to be frozen to death in the soil. Tree roots do not harden off like the parts above ground. They depend on the insulation of the soil for protection against sub-freezing temperatures. Soils with a high humus content are more resistant to low temperatures. Mulching heavily around the base of trees and shrubs can protect them against soil freezing.

**Winter sunscald** or Southwest injury is caused by rapid changes in bark temperature during cold and sunny winter days. Exposed bark on the sunnyside of the tree (southwest side during maximum solar radiation) becomes much warmer than the air during the day, then rapidly cools differ from any other type of winter injury because you can't recognize any exterior symptoms on the tree. You may have a tree that looks normal but is structurally weak due to separations in the wood.

**Physical damage** from snow and ice is one of the more obvious problems trees face during the winter. Breaking and bending of branches from heavy snow, ice, and winds creates wounds which are infection centers for disease and insects. Broken branches should be properly pruned to allow the tree to heal quickly.

**Injury from deicing compounds** (roadside salts) is a major problem of street trees. Sodium chloride and calcium chloride are the two most commonly used chemicals



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for deicing purposes. These salts enter the soil around roots of trees and shrubs in runoff, or coat the foliage, stems, and branches from salt spray blown by traffic and winds. Salts in the soil around trees make water and essential nutrients difficult to absorb by roots, which affects trees similar to drought. Sodium and chloride taken up from the soil by roots can cause injury to plant cells. Salt spray on foliage and branches draws water out of plant tissues causing dehydration. Salts may also be toxic to these plant tissues. The symptoms caused by salt injury vary due to the different ways salt reaches plants and the different responses of plants to salt. The absorption of salt contaminated water will result in a general decline (early fall coloration, small leaves, heavy seed load, twig die-back). The inability of roots to absorb water will result in drought symptoms such as interveinal necrosis, small leaves, early leaf drop, and twig and branch dieback. Salt toxicity results in tip or marginal necrosis which may progress to decline. Salt injury can be prevented by keeping salts away from trees and shrubs, and by planting salt tolerant species in areas that are subject to salts.

**Animals** also cause injury to trees, especially in the winter when other sources of food are not available. Animals such as mice, rabbits, squirrels, porcupines, and beaver are responsible for most wounds associated with chewing. These animals often feed on young seedlings in nurseries or newly planted trees. They may completely remove the bark and girdle young trees beneath the snow. Animal repellents can be applied in the fall to control chewing by rodents. In some cases hardware cloth fencing should be placed around the base of trees from the ground up to above the snow line.

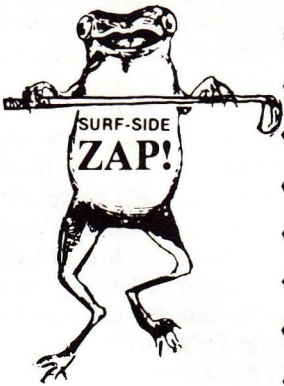
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## Fall Color

By James O'Kelly  
Graduate Plant and Soil Science Dept.  
University of Massachusetts

Yes, the season of color is upon us again. The Golf Course Superintendent can answer the poets question as to the purpose of fall with a variety of replies. Typically, it is the season which is ideal for many phases of turfgrass management such as aerification, over-seeding and in some complete renovation. Others will say it is just what is needed to relax and recover from the grueling summer which they have experienced. Still others will say that it's that time of year again "to sweep and blow all those damn leaves." But, most often the direction of the replies is toward how very beautiful our golf courses are at this time of year. This is due of course to the many trees which are in great abundance across New England. Trees contribute quite a lot to the playing as well as the aesthetic quality of a club. They have no equal in adding characters, beauty, interest and strategy to a golf course.

Nowhere on earth does nature color the countryside so vividly as in New England each autumn. The display of color results from a combination of climate, species of tree, and topography which shows the autumn colors to their full advantage. In short, the physiological mechanisms of the plant hold the more brilliant colors in check throughout the spring and summer months.

This evokes our admiration and stimulates curiosity as to the reason the brilliant tints develop and why the change from green.

The fundamental green that is the predominant color of vegetation is in two forms of leaf chlorophyll. This is a complete substance essential to photosynthesis; the process by which, with the energy supplied by sunlight, the leaf takes inorganic elements from the air and from the sap and turns them into sugar. This is the most important manufacturing process in the world, and all life as we know it depends on it. Chlorophyll, once formed, lasts only a few days. Leaves stay green because chlorophyll is continually being formed as well as broken down. As long as the supply of water and necessary mineral elements is adequate, the rate of synthesis and the rate of destruction of chlorophyll stay in balance and the leaves are uniformly green. When chlorophyll dies and disintegrate due to the natural aging process of the leaf, colors appear from two types of pigments which are masked by the dominating summer green.

The reds and purples are attributed to a substance called anthocyanin. As previously noted, light is essential for the production of chlorophyll and also necessary for the production of anthocyanins in some plants. This pigment forms in the presence of sugar, especially when temperatures are low. If there is not enough light, then the maximum amount of sugar produced will be decreased and consequently the amount of anthocyanin made.

During the summer months, green leaves manufacture their own type of sugars during the daylight hours. At night, most of the food is moved out of the leaves and stored elsewhere within the plant. When the nights become

cooler, the nighttime transfer slows down and the sugars are trapped in the leaves. There it is turned into anthocyanin.

At this point it must be noted that whether the color comes out red or yellow or some shade in between depends upon the genetic make-up of the tree or plant, the light intensity during the autumnal day and the type of sugar trapped within the leaves. The sugar type may vary so that a particular tree may tend to have yellowish leaves, but some years they will be more reddish. Leaves also turn redder when the days are very bright. Anthocyanins are not produced except in the presence of strong light so a tree may have red leaves on one side and not on the other.

The yellows are due to two pigments known as xanthophyll and carotene, which colors carrots, corn and butter. These are present in the leaves all the time, possibly with a function in the food cycle. Proteins in the leaf cells break down leading to bleaching of the chlorophyll which reveals the hidden yellows. An example to illustrate this point which is familiar to all of us is grass which loses its green color under an object such as leaves and turns yellow.

Light is unnecessary for the formation of carotenoids. When the cells get old or certain mineral nutrients are deficient, chlorophyll is no longer made as rapidly as it is destroyed. The yellow carotenoid pigments start to show. If no anthocyanins are made, the leaf becomes yellow. If they are, the leaf becomes orange or an orange-red.

The browns that are visible on some species of plant are from two main types. One is made up of chemicals formed while the leaf cells are living and the other when the cells are dying and become conspicuous only when the cells are dead. Some trees and shrubs only turn brown when the leaves are almost dead or have fallen off the tree.

There are differences in the inherited abilities of different kinds of plants to produce the different pigments. There are genetic differences both within species as well as between species in the capability for producing the leaf pigments. Therefore, a large number of kinds of plants have genes for anthocyanin production that give vibrant reds.

As I stated earlier, climate plays a major role in foliage coloration, especially the intensity of sunlight and day and night temperatures. Anthocyanin producing genes are affected in the daytime by cloudiness and the shorter period of sunlight and reduced intensity of infra red radiation that reaches the earth's surface when the Northern Hemisphere is farther from the sun.

The most intense colors are produced when the temperatures are high and there is sunny weather.

The most intense reds come when a sunny day is followed by a cool night. This is due to the slow sugar translocation (a chemical process slower with colder temperatures) causing a high concentration of sugar in the leaf cells and more anthocyanin is made. Also, hereditary regulators and other responses to the changing season have an effect.



A gradual fall best allows leaves to fully develop their brilliant colors. Too sudden coming of a hard frost kills leaf tissue and the leaf itself turns a dead brown and falls from the tree.

Leaves are short-lived on deciduous plants. Many leaves are formed in the terminal and lateral buds in one year, expand, function and die.

Leaves fall because of a compound produced within; a hormone known as auxin. As long as a leaf produces enough auxin, it will stay on its stem. When it gets old; the days become shorter in autumn; the auxin supply decreases, and the leaf drops.

As for the fall; well, the drought which took its toll on

many New England courses this past summer will also have an adverse effect on the foliage. The color change and leaf drop is certain to be very quick, regardless of any amount of rainfall we may receive this fall.

Golf courses are a pleasure for both Golf course Superintendents and members at this time of year. My intention for this discussion was to give you all some idea of what goes on when leaves change color and hopefully heighten your enjoyment of this unique season. So, don't get disgruntled if a curious member may query into why the leaves change color. Just remember the words of Henry David Thoreau; "On a pleasant autumn morning, all men's sins are forgotten."

## Trees and Shrubs with Fall Colors

### LARGE TREES

#### Yellow:

Norway Maple — *Acer platanoides*  
 Silver Maple — *Acer saccharinum*  
 Birch — *Betula* spp.  
 White Ash — *Fraxinus americana*  
 Tulip tree — *Liriodendron tulipifera*  
 Maidenhair tree — *Ginkgo biloba*  
 Larch — *Larix* spp.  
 Yellow wood — *Cladastis* spp.  
 Cucumber tree — *Magnolia acuminata*

#### Red:

Red or scarlet maple — *Acer rubrum*  
 Sugar maple — *Acer saccharum*  
 Sweet gum — *Liquidambar styraciflua*  
 Pepperidge — *Nyssa sylvatica*  
 Northern red oak — *Quercus borealis*  
 Scarlet oak — *Quercus coccinea*  
 Pin oak — *Quercus palustris*  
 Sassafras — *Sassafras*

### SMALL TREES

#### Yellow:

Tatarian maple — *Acer tataricum*  
 Katsura tree — *Cercidiphyllum, aponicum*

#### Red:

Amur maple — *Aces ginnala*  
 Japanese maple — *Aces palmatum*  
 Pagoda dogwood — *Cornus alternifolia*  
 Flowering dogwood — *Cornus florida*  
 Franklinia — *Franklinia alatamaha*  
 Sourwood — *Oxydendrum arboreum*  
 Photinia — *Photinia villosa*

#### Orange:

Hawthorn — *crataegus crus-galli, nitida*  
 Stewartia — *Stewartia* spp.

### SHRUBS

#### Red:

Chokeberry — *Aronia* spp.  
 Japanese barberry — *Berberis thunbergii*  
 Cotoneaster — *Cotoneaster* spp.  
 Winged evonymus — *Evonymus alatus*  
 Sweetspire — *Itea virginica*  
 Leucothoe — *Leucothoe* spp.  
 Sumac — *Rhus* spp.  
 Vanhoutte spirea — *Spiraea vanhouttei*  
 Blueberry — *Vaccinium* spp.  
 Currant — *Ribes* spp.  
 Broadleaf lilac — *Syring oblata*  
 Arrow-wood — *Viburnum dentatum*  
 Wayfaring tree — *Viburnum lantana*  
 European cranberry brush — *V. opulus*

#### Yellow:

Five-leaved aralia — *Acanthopanax sicboldianus*  
 Fringe tree — *Chionathus Virginia*  
 Sweet pepperbush — *Clethra alnifolia*  
 Fothergilla — *Fothergilla* spp.  
 Witch-hazel — *Itamamelis* spp.  
 Spicebush — *Lindera benzoin*

#### Yellow or Red:

Royal azalea — *Azalea schlippenbachii*  
 Pinkshell azalea — *Azalea Vaseyi*  
 Serviceberry — *Amelachies* spp.  
 Enkianthus — *Enkianthus* spp.  
 Heavenly bamboo — *Nandina domestica*  
 Parrotia — *Parrotia pessiaca*  
 Photinia — *Photinia* spp.

#### Orange-Red:

Bridalwreath — *Spiraea prunifolia*

#### Purple:

Forsythia *Viridissima*  
 Regel privet — *Ligustrum obtusifolium regelianum*  
 Common privet — *Ligustrum Vulgare*  
 Mapleleaf viburnum — *Viburnum acerifolium*  
 Withe-rod — *Viburnum cassinoides*



**FROM**



## **Join Your Massachusetts Turf and Lawn Grass Council**

**For more information write:**

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