Seed Priming

We all want two things from turfgrass — we want it to be beautiful, and we want it now. Selecting the right varieties helps to ensure beautiful turf, and seed priming can deliver germinated seed sooner than traditional methods.

by Judy Brede, Research Associate &
A. Douglas Brede, Research Director, Jacklin Seed Co.

Unfortunately, our most desirable turf species are among the slowest to germinate. For example, Kentucky bluegrass is very slow to germinate, taking several months to fully establish. This gives weeds plenty of time to overtake the sluggish bluegrass seedlings. Likewise in turfgrass mixtures, more aggressive turf species can overcome the slower bluegrass. For example, in a mixture of Kentucky bluegrass and perennial ryegrass, the ryegrass often dominates the slow-to-establish bluegrass. To compensate for this, turf managers may plant 90 percent or more bluegrass in the seed mixture to obtain a 50:50 mix of plants. This can lead to clumping or segregating of the two species.

Turf scientists have tried for years to speed up turf seedlings. There are three methods used to enhance the germination of seeds:

- Presoaking seed in water,
- Presoaking seed in water and giberillic acid (GA), or
- Seed priming.

Presoaking means partially germinating seed before planting. Usually the procedure involves placing the seed in a 55-gallon drum containing water, using an aquarium pump and an air stone to aerate the seed for 48 hours or more, and then planting the seed wet.

Presoaking means partially germinating seed before planting.

The most vigorous seed will usually germinate in the water — here, we define germination as the root and shoot breaking the seed coat. This presents a problem — seed must be planted wet, and wet seedlings are susceptible to physical damage. Furthermore, you must plant presoaked seed into a damp seedbed immediately after treatment or the seed is wasted. Planting into a dry seedbed results in severe desiccation to your most vigorous seed — those that have already germinated or are germinating. Adequate moisture has to be maintained after planting until the stand is established.

Presoaking in water and GA will result in more rapid and uniform germination. This works best with annual ryegrass and tall fescue. This method of presoaking is done by dissolving a very small quantity of giberillic acid in water — 1 ounce of giberillic acid in 75 gallons of water. The seed should be presoaked in this solution for 2 days at 77 °F, while being

Presoaking in water and GA will result in more rapid and uniform germination.

aerated with an air stone and aquarium pump. Again, the seed must be planted wet, so you'll encounter the same problems you had with presoaking in water alone. The advantage of this method is that seed will germinate 3 days sooner than those soaked in just water.

Seed-priming

Scientists in the vegetable industry have developed a method called seed priming to deal with slow-to-germinate crops and weak seedlings. Seed priming or osmoconditioning is a seed pretreatment where moisture is controlled, allowing the seed to be brought through the germination process, just before root and shoot emergence. Nothing breaks the seed coat.

The difference between presoaking and priming is important to understand. In priming, the root and shoot do not break through the seed coat. You can plant the seed dry using traditional methods without any physical damage to the seed. Conversely, in presoaking roots and shoots have emerged from the seed coat in the more vigorous seed, and you must plant the seed wet using a hydraulic seeder.

In priming, the seed is soaked in a solution concentration that makes only a certain amount of water available to the seed. We use solutions containing polyethylene glycol (PEG 8000) or various salts (NaCl or table salt). PEG is a non-toxic thickener found in shampoos and soft drinks. The large molecular size of PEG prevents it from penetrating the seed coat. But, it is very expensive, so we also prime with various salts, such as table salt. Salts present some hazard because they penetrate the seed coat and may be toxic to the seed, as in the case of potassium nitrate.

Testing procedures

Our testing procedure to evaluate potential priming treatments uses petri dishes containing blotter paper, soaked with the experimental solutions. We place 50 seeds in the dishes where they prime in a germinator set at a constant temperature, (usually around 60 °F) for a set period. When priming is complete, we rinse the seed in running tap water and then dry them at 60 °F until they are surface dry. We then place them in petri dishes with blotters soaked in water where we germinate them and test them against untreated seed.

We do daily seed counts to monitor their progress. We also run germination tests in the field using 1 in.-diameter mini-plots, which we monitor daily. The field tests give the advantage of seeing how primed seed performs under natural conditions.

If we plan to store primed seed for any period, we store it in a refrigerator. Priming effects subside over time at room temperature. However, even old primed seed never performs worse than untreated seed. It may eventually equal untreated seed, but it never drops below it.

Various problems arise when we need to prime large amounts of seed using this petri-dish concept. This is because grass seed has several requirements that have to be met if the set is to germinate to its full potential.

- **Grass seed has a light requirement**. Grass seed is photosensitive. That is, it does not germinate as well in total darkness as it does with even a small amount of light. That is one of the reasons why you plant many seeds shallowly. Seeds have the same requirements during the priming process that they have during germination in the field.

- **Grass seed has a high oxygen requirement.** Water does not contain enough free oxygen to meet the needs of germinating grass seed. The seed realizes this and will go dormant in standing water. That's why we aerate the water, preferably with an oxygen supplement.

- **Grass seed excretes toxins that inhibit germination.** When seed *imbibes* (takes in) water, it excretes chemical toxins. In large quantities, these chemicals are harmful to the seed and can inhibit seed germination.

- **The germination rates of grass seed differ among species, varieties and seed lots.** We designed the experimental seed-priming apparatus to meet the needs of the grass seed and deal with the problems of priming large quantities of seed. The aquarium holds 18 clear testing columns, each containing priming solution and seed. A pump supplies a combination of air and pure oxygen through the bottom of the columns to aerate the solution. We fill the aquarium itself two-thirds full with water to create a waterbath, which we heat or cool to maintain a constant temperature. The seed gets adequate light, oxygen, the right temperature and the right water concentration. We change the priming solution every 24 hours to remove all excreted toxins.

Because germination rates differ among species of grass, among varieties within a species, and among seedlots within a variety, it's hard to know how long to prime a given batch of seed. If the seedlot has a long drawn-out germination, priming needs to run longer than if the seed germinates fairly rapidly. It is possible to end up with seed that hasn't primed sufficiently or seed that has primed too long and deteriorated.

Other research

Priming is very successful with other species of grass, such as bermudagrass. Bermudagrass seed has a very impervious seedcoat causing it to have a long, drawn-out germination rate. But, priming has a dramatic effect on bermudagrass. To quantify the germination rate, we used a germination index; the larger the number, the faster the seed germinates, and the more uniform the germination. Our testing showed that priming with an experimental salt was more successful than PEG.

The high germination index numbers we found also demonstrate another advantage of priming. Weaker seeds take so long to germinate that they become targets for fungus and bacteria; however, when we give these weak seeds a boost by priming, the weak seeds develop much faster and our final germination count is higher.

Priming can also aid a slow-to-establish species in competing with a more aggressive species when you plant a mixture. THis is the case with perennial ryegrass and Kentucky bluegrass. We compared Prelude perennial ryegrass with primed and untreated Baron Kentucky bluegrass to test this concept. The primed Kentucky bluegrass started to germinate on the same day as the perennial ryegrass, whereas the untreated bluegrass lagged behind.

To show what this edge can do for Kentucky bluegrass, we set another experiment using Prelude in a mixture with untreated Baron Kentucky bluegrass. After 3 months when the stand was fully established, there was twice as much Kentucky bluegrass in primed lots than in the untreated Kentucky bluegrass plots.

Credit: Hole Notes, July '93

The Construction Dilemma

There seems to be a great deal of renovation going on at clubs across the country. Perhaps the boom in new course construction has placed additional pressure on the older courses to upgrade their facilities in order to remain conpetitive in the quest for members. The most common renovation (other than a new clubhouse interior) is to rebuild the greens. Unfortunately, this decision often results in a serious split in the membership. Almost always, this split pits the older members against the younger crowd, causing hard feelings, harsh words, and even resignations from the club.

What is the basis of this difference in opinion concerning the reconstruction of the greens? There are three very important questions that must be answered concerning a project of this magnitude. The answers to these questions affect older players much differently than the younger group thus fueling the dispute.

Question #1 — "Do the greens need to be rebuilt?"

When the greens fail every year, and after the club has gone through three or four superintendents, almost everyone will finally agree the greens need to be rebuilt. However, seldom does such a clear-cut situation occur. More typically, the greens do fine one season and miserably the next. Some greens fail completely, while others can be "nursed" through the year always on the edge of disaster but never quite taking the fall. Raising cutting heights and accepting slower greens improves the health of the turf dramatically to the point that a major failure in the turf becomes unlikely. Under these conditions, the determination concerning the need for reconstruction is much more difficult. It is more difficult because the answer depends on what the players want from their greens — and the two groups of players feel they have significantly different needs.

Generally speaking, the older players in the club (and often the average women players) see no pressing need for fast, low cut greens. Stimpmeter speeds of 6 to 7 feet are tolerable if not completely acceptable. **If it means raising the cut to prevent failure and avoid reconstruction, then raise the cut!** In contrast, the younger groups of players tend to want faster greens — preferably the fastest in town. Since the lowest handicappers in the clubs typically fall into this group, they can exert a tremendous amount of influence in the club. In order to produce greens acceptable to this group, the best construction and turfgrasses are required.

Which group is right? It's a tough call to say the least. As a rule, I will suggest reconstruction. Not to give the better players faster greens, but more to urge the club to **remain viable** in the face of growing competition. New courses are being built everywhere and they are drawing heavily from the "membership pool". It has been my experience that clubs that constantly improve attract and keep the most supportive members. In these cases I often paraphrase Mark Twain, *"It's great to be on the right track, but if you don't keep moving, someone will come and knock you off."* Understandably, there are those

(continued page 15)

older members who want reconstruction delayed, so it does not infringe on their more limited time left to play (let's hear you phrase this more delicately). However, these same members were probably the founders of the club — the very individuals who had the foresight to build something that would endure for years. By the same token these are the same folks who have probably had the greatest use of the facility over many years. It is a lot to ask of everyone but something that must be done if the course is to improve. And remember, each year there will be a new group of older members that feel the same way.

Question #2 — "How much will it cost?"

There are so many variables involving construction that it is impossible to offer an accurate estimate. Just a few of the variables include:

- Do you want to completely rebuild the greensite including bunkers and mounding or are you simply going to shell out the existing greens?
- How much are materials?
- Are you going to hire a "name" architect?
- Are you going to close the course completely (and sacrifice all revenue) or play on temporary greens?
- Is this to be a "turn-key" job or are you going to do some of the work "in-house"?

Let's assume you are going to rebuild the greens, making a few changes to the bunkers and mounding. Hopefully, materials are of average cost (meaning you are not going to have to truck sand or gravel from the other side of the state). Let's also assume you have hired an experienced architect but not one whose work is likely to end up on the cover of *Golf Digest* anytime soon. You're willing to struggle through playing temporaries during the project and your superintendent and staff will support the contractor in terms of extra labor and the loan of smaller pieces of equipment. In most cases, you can safely figure somewhere between $4 and $6 per square foot of green surface. $5 is a reasonable average. Materials cost and the proximity of a contractor are usually the most influential variables.

Question #3 — "How long will it take?"

It always amazes me how long it takes people to get to the question that really bothers them the most. If I could tell the most financially strapped club that they had a choice between spending $500,000 and losing the course for 6 months, or spending $1,000,000 and losing the course for 2 weeks, they would somehow raise the extra half million! This is undeniably the greatest obstacle to redoing greens — the time people have to give up playing.

I could (and probably should) write a book on the variables involved in how long it takes from starting construction until opening day. Important factors here include:

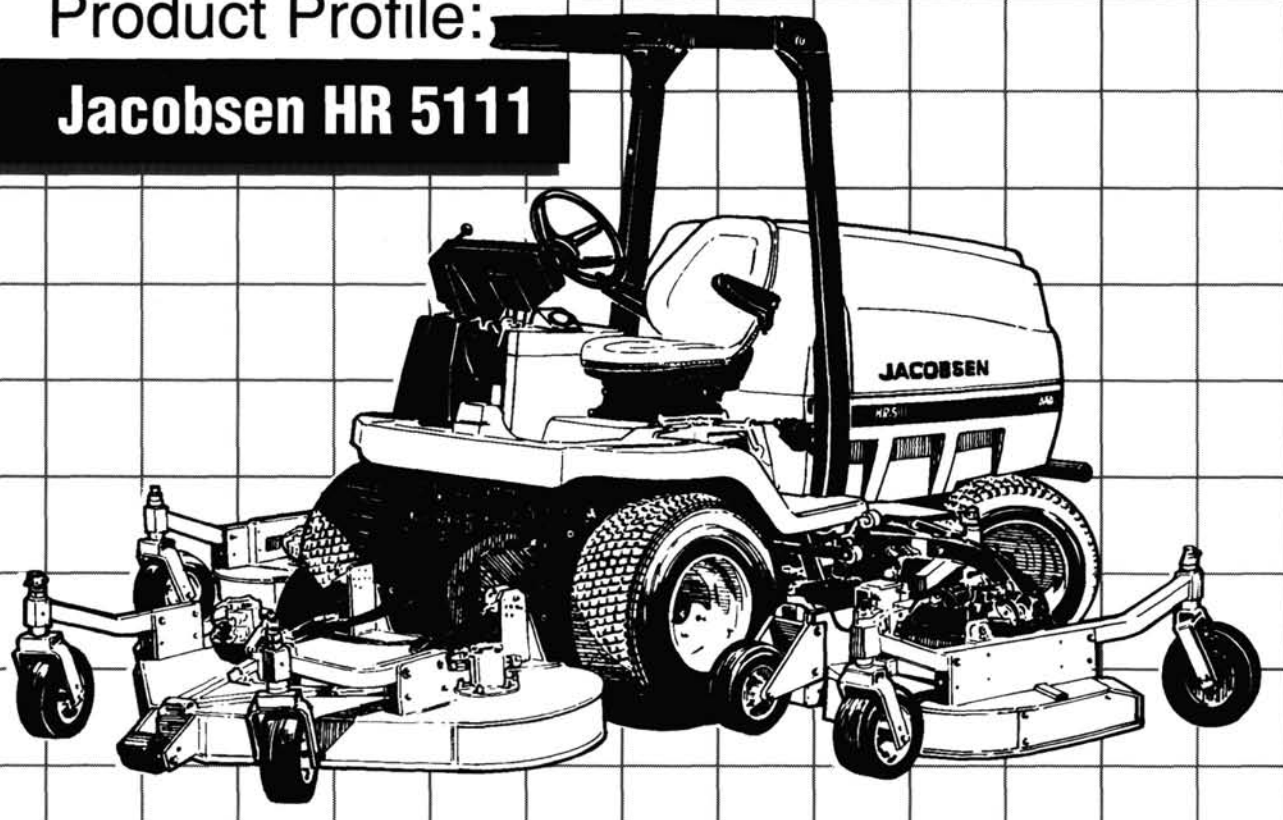
- How large is the contractor?
- How big is the job?
- Are the greens bermudagrass or bent?
- How long is your growing season?
- Are you willing to plant during the right time of the year?
- Are you willing to wait until the greens are mature before opening the course?

You get the idea. For the sake of this article, let's again make a few assumptions. Let's assume you are in the South, grow-

(continued page 18)

Product Profile:

Jacobsen HR 5111



- 11' 6" cut, three ANTI-SCALP decks
- Counter Rotating, rear discharges - CLEAN cut
- Four wheel drive, ALL WEATHER capabilities
- 11" Trimming left and right
- LIGHT WEIGHT, weighs ½ of the 16' rotaries
- PRODUCTIVE, 6.3 acres/hour at 5 mph
- Two year or 1500 hour warranty, BEST in the industry

illinois lawn equipment, inc.

16450 South 104th Avenue • Orland Park Illinois 60462 **708-349-8484**

Technology Backed By Tradition

Upcoming Events — Mark Your Calendar

January 31-February 7 — GCSAA Conference, Dallas, TX
March 5-8 — 45th Canadian Turfgrass Conference
March 14 — MAGCS Meeting at Oak Brook Hills Resort
March 24 — CDGA Green Seminar at Drury Lane, Oak Brook
April 25 — MAGCS Meeting at Inverness C.C.
May 16 — ITF Golf Day at Silver Lake Golf Club
June 20 — MAGCS Meeting at Aurora C.C.
July 11 — MAGCS Meeting at Orchard Valley G.C.
August 13 — Family Picnic & Kane County Cougar Ball Game
August 29 — John Deere Golf Tournament
September 12 — MAGCS Meeting at Seven Bridges
September 26 — Northern Golf Day
October 3 — Pro/Superintendent at Glenview Club
October 10 — MAGCS Meeting at Oak Brook Hills C.C.
November 28-30 — NCTE at Pheasant Run Resort

All meetings, starting in March 1994 will require advance paid registrations.

Steve Cummins reports that his mechanic, Dennis McManaway, died on January 3, 1994. Dennis was 42 years old and had worked for Lake Barrington Shores Golf Club since 1982. The deepest sympathy of the members of MAGCS are extended to the McManaway family.

Raymond Hernandez is looking for a mechanics position on a golf course, his phone number is: 312/539-3199 after 6 p.m.

The MAGCS is losing a loyal and long time member come February 1. Vern Rasher has retired as of that date and has moved to Weeki Wachee, Florida where he is building a new home. Vern was with Roseman tractor for 35 years calling on the golf courses and park districts. He was always there when you needed him and serviced his customers very well. He states that he will try to improve his golf game and maybe even learn how to fish. Vern, we all wish you the very best in your retirement years.

Congratulations are in order for the son of DeAnn and Pete Leuzinger. Their son Jeffrey will be married on February 12, 1994 to Marcy O'Neil in Danville. Jeffrey is presently the 2nd assistant to Bruce Sering at the Glenview Club.

Dean Bemis gave an outstanding presentation at the Arrowhead G.C. on January 10. Dean showed slides and had a handout for the audience on the beautiful flowers that are now available in the industry. He pointed out how many of the flowers have been improved and are presently being improved to give longer blooming times and more vibrant colors and varieties.

Marty Baumann has left Fresh Meadows G.C. as of the first of the year. We hope that he continues to write articles for this newsletter and stays in the Chicagoland area.

We all know that Bruce Williams is pretty sharp. But to plan to have your fourth child delivered on the evening of December 31 is cutting it pretty close. Congratulations to Roxane and Bruce on the birth of Mary Christina Williams who weighed in at 7 pounds, 9 ounces. Both mother and baby are doing well.

Tony Bertauski, a recent graduate from the University of Illinois, with a M.S. degree in Turf is looking for an assistants position. His phone number is 217/344-5169. (You may call or fax the Editor for his resume which will be on file in **The Bull Sheet** office).

Cantigny Golf Club and Evanston Golf Club have captured 1/6 of the awards that were given out for the "Environmental Steward Award" program that is sponsored by Ciba Turf & Ornamental Products, Rain Bird and Jacobsen for 1993. There were only 12 regional winners and these two Chicagoland clubs came out on top. The Environmental Steward Award has a lot to do with your various environmental practices on the golf course. It covers items like your IPM program, recycling, composting, water management and natural control of various pests. It also doesn't hurt if you belong to the Audubon Society and have been certified as both of these clubs are. Congratulations to Tony Rzadzki and Carl & Ted Hopphan for the recognition and work to achieve this honor.

Kevin Knudson, Supt. at Eagle Brook G.C. is looking for an assistant. Please call 708/232-4922.

Hospitality room in Dallas will be in the Loews Anatole Hotel in the Presidential room the nights of February 4, 5 & 6.

Hank Wilkenson will be a speaker at our March meeting held at Oak Brook Hills Resort.

Remember all future meetings are going to require advance registration and payment. Get your check in early.

Paul Voykin spent three weeks in Germany touring the country.

Brian Yeager is looking for an assistant's position. Call 219/947-7124.

A USGA Green Section Regional Conference will be held:

Thursday, March 10, 1994 — 8:00 a.m. to 4:30 p.m.
Meridian Hills Country Club
Indianapolis, Indiana

Thursday, March 24, 1994 — 8:00 a.m. to 4:30 p.m.
Best Western/SteepleGate Inn
Davenport, Iowa

The program will include varied golf-related topics of interest to Superintendents, Course Officials, Golf Professionals, etc. For more information contact:

Jim Sweeney, Manager	Jim Latham/Bob Vavrek
North-Central Regional Affairs	USGA Green Section
858 Celestial Street	11431 N. Pt. Washington
Crescent Springs, KY 41017	Mequon, WI 53092
Phone 606/331-4001	414/241-8742
FAX 606/331-4005	FAX 414/241-0974

(The Construction Dilemma continued)

ing Tifdwarf bermudagrass. You will want to plant at a time of the year the bermuda is growing most actively so the greens will cover as quickly as possible. This means planting in June or July in most cases. Let's assume the contractor can complete the work in 60 days and will therefore begin in April or May. The greens will take about 12 weeks to cover well enough to tolerate a reasonable load of traffic — say a pace equivalent to 35,000 rounds per year. This puts your opening date in September or October, a "downtime of around 6 months".

Now let's assume you are planting bentgrass greens in the Midwest. Ideally, you would plant in the fall giving the bent two growing periods (this fall and the next spring) to mature. A good target for most Midwest locations would be September 1. Again allow the contractor around 60 days, starting construction July 1 (this never happens since EVERYONE has a July 4 tournament). The maturing process on bent greens will in most cases mean waiting until the following spring to open. April 1 is usually a safe bet. This means approximate 9 months of downtime. However, remember that these months include December, January, and February, typically very slow golf months.

There are many instances where courses have opened much earlier (and much later) than the dates I have described above. Sometimes you are blessed with ideal growing conditions and the turf matures very rapidly. Sometimes there are no rain days to slow the contractor and he finishes in less time. Sometimes everything just clicks into place.

On the other hand, sometimes you feel like Murphy was an optimist. First, the plant generating the sand falls behind. Then the contractor can't find the right equipment locally because they are building a new mall across town and every truck for 100 miles is already rented. Of course as soon as the mix is put on the greens a good old "Texas Toad Floater" comes along and washes mix, coarse sand, and gravel into the next county. The seed or sprigs you ordered are nowhere to be found. The members are ready to use the superintendent as pre-plant fertilizer and the contractor and architect are pointing cans of methyl bromide at each other. Murphy never built greens.

Credit: Mid-Continent News, Vol. 5, 9/29/92

REMEMBER TO WEAR YOUR NAME BADGES AT OUR MEETINGS.

Deicing Salt Injury to Plants

by Dr. Bal Rao, Davey Technical Journal

During winter months sensitive plants get injured from the application of deicing salt on roads, sidewalks and parking lot areas. Most deicing salt is unrefined rock salt containing about 98.5 percent sodium chloride, 1.2 percent calcium sulfate, 0.1 percent magnesium chloride and 0.2 percent rock. In some cases, 0.02 percent sodium ferrocyanate may be used as a anticaking agent.

HOW SALT INJURES PLANTS

Excessive amounts of salt in soil near the root system can cause injury to plants. Often salt accumulates from plowing salt containing snow or drift onto the plants. Rock salt prevents much of the moisture in soil from entering roots and can result in a drought-like environment for plants even when there is plenty of soil moisture. This is called physiological drought and may appear as leaf scorch.

When salt dissolves in water, sodium and chloride ions separate and the chloride ions are absorbed by the roots and translocated upward to leaf margins and shoot tips where they can accumulate in toxic levels. This also causes scorching symptoms on leaves. Excess sodium causes soil to lose its capacity to aggregate into clumps and become compacted. Excess sodium also lowers the availability of potassium resulting in potassium deficiency in salt injured plants.

Dr. Hudler from Cornell University reported that salt splash from passing cars and trucks may enter plant cells directly and, as a result, some species can lose cold hardiness and are likely to be killed by freezing. Damage is more evident of the downside of the highway, and branches above the spray-drift zone are not injured or are injured less.

SALT INJURY SYMPTOMS

Salt injury symptoms resemble those caused by drought or root injury. Stunted and yellowed foliage, premature autumn leaf coloration, death or leaf margins (scorch) and twig dieback. On deciduous plants, these symptoms may not be visible until mid-summer.

Needles on affected conifer plants turn yellow or brown in early spring. Browning usually begins at the needle tips and on the side facing the road. Symptoms begin to show up in late February or early March, becoming more extensive through spring and summer. Investigations conducted at the University of Guelph, Guelph, Ontario, indicated that increased amounts of wax or bloomon spruce needles seem to add some protection; the bluer the spruce, the more resistance it has to salt spray. Deciduous shrubs and trees with buds submerged in the twig or with resinous buds are resistant.

If spray is the primary means of salt deposit, discolored needles are soon masked by the near year's growth. However, if salt is also excessive in the soil, the new needles may also show symptoms from chloride ion toxicity.

HOW TO PREVENT OR MINIMIZE SALT INJURY

Although not using salt would help plants, the safety to the public during winter months would not stop this practice. Calcium chloride is reported to be less toxic than sodium chloride, but it is very expensive (eight times). In addition, serious problems with the handling and storing of calcium chloride limits its use by road maintenance personnel. It absorbs moisture and cakes more readily than sodium chloride. Where possible, applications of sand, light gravel or cinders provide adequate results. Sensitive plants can be protected by installing barriers such as burlap or wooden snow fences. Salt application after March 1 is very detrimental to plants and shrubs and should be kept to a minimum. Amending soil with gypsum or activated charcoal helps maintain soil aggregate, improving drainage and minimizing salt accumulation. However, to be effective, these should be there closer to salt application and they require large amounts of material applied over several years. Avoid piling salt contained snow around plants. Where feasible affected areas should be leached with water to remove salt.

Plant salt-tolerant plants in an area where salt problems are likely to occur. Tolerance varies with many factors, including exposure, soil texture and plant age, so use the following list only as a guide.

Low Tolerance

Glossy abelia	Chinese holly
Balsam fir	Black walnut
Red maple	Common privet
Sugar maple	Tulip tree
Smooth alder	Hona crab apple
American hornbeam	Norway spruce
Shagbark hickory	Red pine
Hackberry	White pine
American redbud	Douglas fir
Red Osier dogwood	Rose
Yellow-twig dogwood	European red elder
	American linden
Hawthorn	Eastern hemlock

(continued page 22)