of these fabrics worked, but "side" costs, such as installation time, and replacement and disposal costs, made the concept of covers unfeasible.

Negative attitudes toward covers were also an important element in their early experimental failures. Covers did not conform with then current management techniques of golf courses and athletic fields.

Over the years, however, it was proven that covers worked. Still, the challenge of developing covers without side costs and application inconveniences remained. Plus, they had to be versatile— they had to work in various climatic conditions, from northern Canada to the southern United States.

Today's products were developed for the turf industry through input from turf specialists and universities, as well as improved manufacturing technology.

The benefits of proper covers are many. Regardless, of their application, they save money and time in areas such as:

1. Earlier Openings—Courses closed during the winter months can be ready up to two or three weeks sooner in the spring. In these applications, covers protect the greens from wind or ice desiccation, while reducing the damage caused by foot traffic during the winter. The cost of spring cleanup is also drastically reduced because the covers shield the surface from debris while remaining clean themselves. Transparent covers also create a greenhouse effect, which accelerates root development and protects the plant from shock that occurs during the spring periods of "freeze-thaw" cycles. This is why they are used in many southern regions for frost protection. Winter application protection benefits include increased revenues from earlier openings, reduced costs in opening preparation, and reduced risks of turf destruction posed by vandalism, animals, or abnormal weather conditions.

Transparent covers also create a greenhouse effect, which accelerates root development and protects the plant from shock that occurs during the spring periods of "freeze-thaw" cycles. This is why they are used in many southern regions for frost protection.

2. **New Construction**—New sports fields and golf courses must be constructed quickly and within budget. Covers accelerate seed germination while reducing seed loss due to rain or wind erosion. The savings of seed "under cover," as opposed to sodding, are substantial. In addition, facilities are able to open months in advance with excellent playing conditions. If proper covers

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Going Under Covers

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are purchased for new construction, they can be used for many years for winter protection or ongoing maintenance.

3. Ongoing Maintenance—Even though new construction grows worldwide, it barely keeps up with demand. Play on existing golf courses and athletic fields continually increases. Not only are superintendents battling weather changes and course conditions, but they must now control the increased flow of people and the damage they leave behind. Covers are a common, effective tool for a "quick fix." In heavy-use areas, such as tee boxes, driving ranges, or center play portions of sports fields, covers are placed over the repaired areas and within days they can be back to playing condition.

The key to covers is choosing the correct one for the specific job. All covers will not work in all applications. For the best results, look for the following features:

- Covers must be multi-purpose for new construction, winter protection, and ongoing maintenance.

The key to covers is choosing the correct one for the specific job. All covers will not work in all applications.

- Covers must have one-piece construction in order to reduce handling.
- Covers must be available in a range of standard sizes to satisfy small areas, such as tee boxes, or larger areas, such as 10,000-square-foot greens.
- Special sizes must be available for custom fits. Covers that are either too long or too short are not cost-effective.
- Covers must be non-absorbent. Covers that are absorbent become dirty and heavy, which reduces their performance as well as increases handling and storage costs.
- Covers must be light in weight to reduce handling and storage area requirements.
- Covers must allow the proper mix of air, water, and sunlight penetration.
- Covers must be compact for easy indoor or outdoor storage.
- Covers must be able to last five to 10 years with little or no loss in performance as they age.
- Covers must be strong enough to withstand heavy winds and remain in place rather, than blowing off the area of application.
- Covers for sports fields, often 20,000 square feet or larger, must be especially lightweight—but strong. (At Mile High Stadium, for example, only three Evergreen covers were used to cover the entire field.)

Like mowers, sprayers, and utility vehicles, covers are vital turf management tools. They save time and money, while improving turf quality and expediting new sports field and golf course construction. Covers work—their role continues to increase. ❑

Editor's Note: Peter Hinsperger is president of Hinsperger Poly Industries, Ltd., based in Ontario, Canada.

SETTING UP A PREVENTATIVE MAINTENANCE PROGRAM

Next time you are tempted to grumble about what a pain it is to track preventative maintenance, consider what breakdowns have already cost your facility.

Idle workers by the side of their disabled truck waiting for a tow truck produced angry customers and overtime to cover the missed work. The cost of new equipment was an unpleasant surprise, especially when you had hoped the equipment would last two to three years longer.

Many landscape contractors make the mistake of thinking that their fleet size and differing types of equipment make them too small and unique to maintain a preventative maintenance (PM) program. They also believe that a good PM program will be too complicated and expensive to generate any real savings, given their limited resources.

Good, regularly scheduled preventative maintenance for your vehicles and equipment will save you many times over *and* it does not need to be complicated or difficult to administer,

How to Begin

There are many ways to establish a PM program. Some people use notebooks while others use computers. Use a method you know your employees will follow. Computer programs have the added advantage of not taking up filing cabinet space. Also, once the program is setup, the computer does the calculations for you.

In general, a PM program consists of setting up routine maintenance schedules, conducting the maintenance and tracking equipment performance. The following is one way to set up a program. ■**Schedule Inspection Intervals.** Establish PM intervals for the different types of equipment you are maintaining. Inspect all equipment and vehicles at certain fixed intervals. These can be time (days, weeks, months) intervals, hourmeter intervals, and/or mileage intervals.

The easiest and most practical intervals to start with for a beginning PM program are time. Base the intervals on an inspection every few weeks or months. Starting with time-based PM intervals eliminates the need to be dependant on meter readings, which much of your equipment may not have. The equipment service manual is a good place to refer for recommended service intervals. The manual will contain the manufacturer's recommendations for items, such as oil changes, component replacements, and adjustments. If different intervals are suggested for light, medium, or severe service, always choose the severe service interval.

Some manufacturers may suggest multi-level intervals that you do not have the maintenance staff to handle. If this is the case, set PM intervals that will maintain clean oil, keep the warranty in force, and guarantee safe operation. Ask your maintenance personnel to contribute input as to optimal intervals.

Sell your staff on the *proactive* approach of preventative maintenance rather than *reactive* approach making costly repairs. You can tell them that PM programs have proven their cost sayings at every level of equipment maintenance over a broad spectrum of industries and businesses.

■ **Inspection Records.** After you set PM intervals, the second step is establishing a PM inspection record. Start this by using a loose-leaf binder, with each page being a PM record for a separate piece of equipment. Enter the equipment number and description and PM interval at the top of the page and enter the date, PM type, and meter reading (if applicable) as each PM step is completed. At the beginning of each week, check each page to see which pieces are due that week.

Alternate methods include using a large blackboard schedule or a PC-based PM software program. Typically, if your equipment base (licensed vehicles, off-road equipment, chain saws, string trimmers, etc.) exceeds 75 units, it will be much more time efficient to use a computerized program.

■ **PM Checklists.** The third step is to establish PM checklists to follow the PM for different types of equipment. For example, you may have a 25-step inspection procedure for a pickup truck (change oil and filter, grease chassis, rotate tires, etc.) and only a six-step inspection for a chain saw (check oiler operation, replace spark plugs, sharpen chain, etc.).

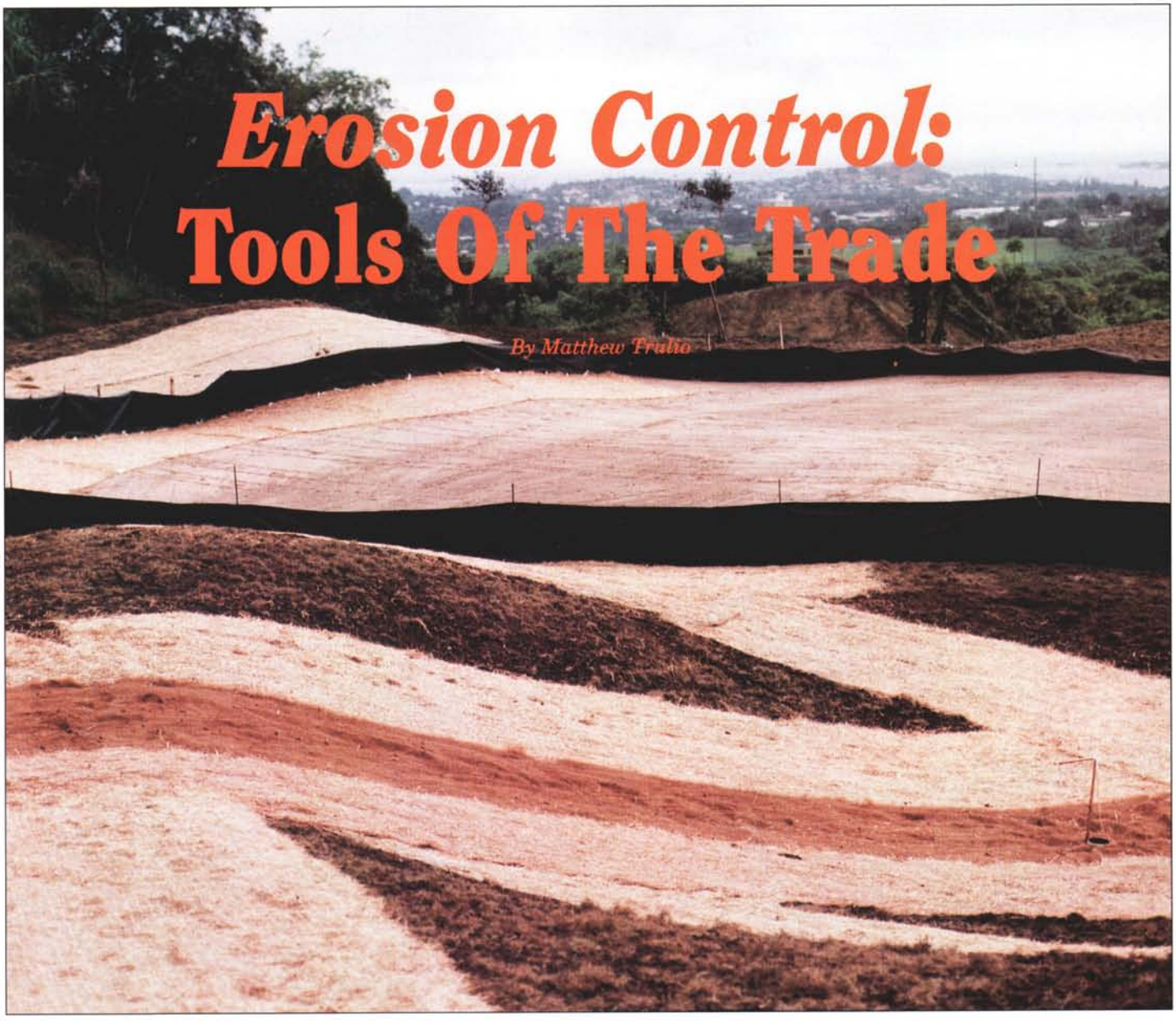
■ **Repair History Logs.** The fourth step is to establish a repair history log for each piece of equipment. This can be as simple as recording the date and a short description of the repair in a loose-leaf binder. For a larger equipment base, it will probably be more time effective to use some type of computer-based log. This log is your feedback mechanism to determine if the PMs are being done correctly or alert you to change or to *fine tune* the checklist. For example, if you are seeing a large amount of broken chains in the repair log for your saws, you may want to change the inspection checklist to include, "Inspect for bad links and replace as necessary."

A preventative maintenance program for your equipment need not be an overwhelming or expensive process. It does take a certain amount of discipline, commitment, and clerical effort. Its benefits in increased productivity and decreased expenses will repay these efforts many times over. Your equipment will last much longer, you will have fewer field breakdowns and major component failures, and your operators will be safer and more productive. ❑

Technical Credit: Computerized Fleet Analysis, Inc., Addison, IL.

Erosion Control: Tools Of The Trade

By Matthew Frulio



Silt fences and North American Green erosion control blankets were used to control runoff during construction of Minami Golf Course on Oahu, HI.

Triggered by water or wind, erosion is the prime mover of sediment on construction sites. New golf courses and sports fields are not exempt from erosion's forces—they too face, and must combat, erosion's detrimental effects.

Perhaps the worst of these is displaced sediment, which can contaminate watersheds, obstruct natural and manmade channels, and cause flooding. Sediment disturbs natural habitats and, left unaddressed, can cut the life of a reservoir or holding pond in half.

"Whenever you have a new construction project, you're probably going to be disturbing the ground," says Ben Northcutt, executive director of the International Erosion Control Association based in Steamboat Springs, CO. "When that happens, there is strong potential for sediment to leave the site."

A site is most susceptible to erosion and the resulting displaced sediment during its first season of construction and weather activity, says Northcutt. That makes it imperative to attack potential erosion sooner instead of later.

"It's better to control erosion from the beginning than worry about it after it become a problem," he explains. "If you put it off, not only can you do significant damage to watersheds and downstream drainage, but it will be more expensive to correct the problem than it would have been if you'd addressed it in the first place."

Tools For Stability

Because no two sites are exactly alike, there is no single "recipe" for efficient erosion control. Stabilizing the banks of a streambed running through one project, for example, may be quite different than stabilizing those of another depending on the degree of slope, soil type, high-water mark, and more. However, site-specific choices for controlling erosion hinge on a general understanding of the basic tools of erosion control and their applications. These tools include:

Silt Fences. Silt fences act as filtering systems for sediment. They are generally made of woven geotextiles, although straw bales are often used for the same purpose, with varying degrees of success. Attached between two wooden posts, silt fences are typically two to three feet high. The bottom six inches of the fabrics, Northcutt emphasizes, must be buried for these tools to be effective.

Silt fences can be installed anywhere on a construction site where water is likely to exit. However, they are *not* dams and should not be used in areas where water velocity is high. Instead, they should be seen and used as filters, allowing water to pass through while holding sediment behind.

A site is most susceptible to erosion and the resulting displaced sediment during its first season of construction and weather activity, says Northcutt.

Hydraulic Mulching And Seeding. In hydraulic mulching, wood fiber or recycled paper products, and water, often combined with a "tackifier," (natural glue), are mechanically sprayed onto an area for erosion control. Since the applicator can spray the mix, under the correct conditions, to areas hundreds of feet away from the spraying equipment, hydraulic mulching is ideal for erosion control in inaccessible areas.

Hydraulic seeding, as the name implies, involves spraying seed mixes onto areas for both erosion control and revegetation. Establishing vegetation is vital in long-term erosion control.

"Hydraulic mulching and seeding are probably unsurpassed in applying mulch and seed to slopes," says Northcutt. "These methods are generally most effective on slopes that are 2:1 or less, including flat ground, although other methods may be more cost-effective on flat terrain.

Seed mixtures selection varies with the site and region. Naturally, some mixtures are better suited to some projects than others. Yet there are a few basic points to keep in mind regardless of the specific site you're treating. For example, a water-loving grass on a south facing slope probably won't last long, much less provide soil stability.

"In terms of the seed mix, it's better to have more than one species involved because you have a better range of

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Erosion Control

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adaptability," Northcutt advises. "That's particularly true on large sites, which may have their own range of soil and microclimate conditions."

Covers, Blankets, and Mats. From jute netting to synthetic mats, these products serve as "coverings" for areas at risk to erosion. They are best used and most cost-effective, says Northcutt, on steep slopes 3:1 or greater or areas with relatively low velocities of "channelized" flowing water. Natural blankets are often constructed of jute, coconut, or straw fibers, or even recycled paper products. Synthetic mats can be made of various plastics or geotextiles. Both natural and synthetic products have their strong points.

"In the correct application, both work very well," says Northcutt. "Which you choose may depend on your budget, as well as your feelings on what should go into the ground. Synthetic products last longer than natural products, but they also cost more. Natural can do the jobs as well as synthetic products and are biodegradable, but they don't last as long."

Realistic Approaches

Becoming familiar with the various products and their applications, working with hydrologic engineers and erosion control specialists, and hands-on experience are all vital to understanding and implementing erosion control. Still, no matter how thorough the control plan and its implementation, a certain amount of sediment will always escape from a construction, says Northcutt. To expect to retain *all* sediment to remain on the site is unrealistic. The idea is to *minimize* it and, in doing so, minimize environmental impact.

"Synthetic products last longer than natural products, but they also cost more. Natural products do the jobs as well and are biodegradable, but they don't last as long."

"You're not going to be able to control all the sediment, but you can control it to the point where our natural systems can handle it. There are environmental and economic impacts to not controlling it, whether that means spending tax dollars to clean water, dredge a reservoir, or even return soil to its original site.

"Sediment is the number one pollutant of our waterways now, and some of that comes directly from construction site erosion, whether the site is a future shopping mall or sportsfield complex," he concludes. "We must be aware of the effects of uncontrolled erosion on the sites themselves, as well as surrounding wildlife." ❑

Editor's note: The International Erosion Control Association's Conference will be held February 23-26, 1993, in Indiananpolis, IN. For more information contact Ben Northcutt at the IECA office, (303) 879-3010.

WORLD CUP GRASS FIELD TESTS SUCCESSFUL IN SILVERDOME

The initial phase of fine tuning the grass that will become the playing field for the games of the 1994 World Cup at the Pontiac Silverdome in Pontiac, MI, is complete. The successful seven-week trial ended August 3. The Silverdome games will be the first indoor matches in the history of the World Cup—the largest single sporting event in the world.

Scientists from Michigan State University conducted several experiments in the Silverdome over the seven-week period. Various types of grass were tested under conditions, ranging from daily Silverdome conditions without light enhancement, to substantial light enhancement. Although the turf will need to be maintained for only four weeks in 1994, the additional time used allowed the MSU experts to further their experimental process. In addition, research was conducted involving several types of growth regulators that may be used with the final product.

"The initial Silverdome testing was conducted in conditions worse than will be present for the games in 1994," says Dr. John Rogers, assistant professor, crop and soil science, MSU. "We are very confident with the results. Failure is the most successful portion of any research. We intended to have grass fail in the Silverdome. Provisional use of special lighting was interrupted for one week during the recent *Guns and Roses* rock concert at the Silverdome. There is no question that grass will stand the test of play. We will now move our experiments to a new facility at MSU and continue to work with many combinations of grass, soil, and lighting to ensure that the final product is world class."

In addition to the MSU soil experts, Phil Szostak, vice president and director of sports facility architecture, NBBJ North Carolina, Inc., has been retained by World Cup USA 1994, Inc., to assist in the overall grass process.

"The initial phase of turf experiments conducted within the Silverdome was successful," says Szostak. "We set out to subject various types of turf and soil combinations to various conditions with and without the supplemental lighting that will be used in 1994. The test grass was in the stadium for seven weeks as opposed to the four weeks necessary in 1994.

"We will continue to test a wide range of turf and soil combinations at Michigan State in the future. The grass products that have been tested in the Silverdome represent phase one of the final product."

In addition to four first round World Cup 1994 games, the Silverdome expects to host at least one match of the 1994 U.S. Cup in which the U.S. World Cup team will face major international competition. The U.S. Cup game(s) will be played on grass in the Silverdome and serve as a dress rehearsal for the 1994 World Cup games.

"The MSU and NBBJ experts assure us that the only question regarding the grass is what type of soil, turf, and lighting combination will ultimately be placed inside the Silverdome," says Roger Faulkner, Detroit host committee president.

Limited Water Seed Priming

By A. Douglas Brede, Ph.D

The ideal container for limited water seed priming is the same poly bag in which most seed comes. Photos courtesy Jacklin Seed.

Seven-day growth demonstration of primed and unprimed Glade Kentucky bluegrass.

Visualize the following experiment. It's an experiment I've repeated numerous times over the past eight years, most recently in a field near Lewiston, ID.It's springtime, the weather is good, and the soil is a bit too cool to plant yet. In spite of the temperature, the east side of the field is being seeded with Classic Kentucky bluegrass. On the west side, primed Classic seed is sown.

Under cool soil temperatures, bluegrass seed is slow to germinate and usually procrastinates until warmer conditions arrive. But this time, things are different. After only 10 days, a green fuzz can be seen on the western, primed half of the field. It looks as though all the seed in the field was choreographed to germinate on the same day. At 20 days after planting, the primed seedlings are an inch tall. On the untreated half of the field, seedlings can be seen just starting to break ground.

Seed priming can make a noticeable difference in seed establishment rate. Priming enables seed to germinate in about half the time normally required.

Seed priming is a pre-plant seed treatment that gets seed ready to grow even before it hits the ground. It's a process that involves partially wetting the seed, allowing it to progress through several steps of seed germination, and then drying it back for planting. Priming takes seed past the innate dormancy mechanisms that prevent or slow it from germinating under less-than-optimal conditions.

Seed priming is not the same as pregermination. Pregermination is a process of germinating seed in a tank of water before sowing. After pregermination, roots have already broken the seed coat and an occasional leaf blade may be seen. Pregerminated seed must be planted immediately after treatment or the seed (now seedlings) withers and dies.

There is a subtle but important difference between pregermination and priming. In seed priming, the quantity of water fed to the seed during treatment is limited. Because the seed does not have enough water to fully germinate, the root and shoot do not emerge. But there is enough water to get the seed started through the initial physiological steps of germination.

Another important difference is that primed seed can be dried back and even stored. Because it can be dried, it is easier to plant through conventional spreaders.

Do-It-Yourself Priming

Numerous techniques have been devised for priming seed. Some involve water baths with special chemicals, others combine seed with a moist clay. Most are tricky for the do-it-yourselfer.

All priming methods are alike in one basic concept: seed is fed a limited quantity of water. Priming methods differ in how the water quantity is limited.

Two years ago, while experimenting with tedious water baths, an idea came to me: Why not just mix a limited quantity of water with a given quantity of seed? It worked. I call this process the "limited water priming" method.

The limited water method adheres to the same basic premise of priming as do the other, more complex methods, but it's much easier to perform, especially on a small lot basis. The technique can be used with virtually any quantity of seed. But for simplifying the following explanation of how to do it yourself, I'll assume that you're going to prime a 50-pound bag of Kentucky bluegrass seed.

We found that the best container for priming seed is the same poly bag that most seed comes in. The woven poly allows air and light to penetrate the bag—two elements essential to good priming.

Dry the seed by spreading it on a clean surface, preferably on a sunny day. Turn the seed with a shovel as the top dries. You'll need to dry it all within one day or the seed may begin to sprout.

The first step in do-it-yourself priming is to wet the seed. As a suggestion, dump the seeds into a wheel barrow. Add five gallons of water and stir. A pinch of wetting agent (the non-ionic kind used with ag chemical spraying) helps to wet the seed faster. After the water is absorbed, shovel it back into the poly bag. It should remain in the bag at room temperature for five days.

Each day, you'll notice that some water oozes out of the bottom of the bag. Replace the water as it escapes by pouring it into the top of the bag.

Although it's not absolutely essential, an air delivery system will help supply oxygen to the priming seed. It will also help cool the seed as it primes. All damp organic materials self-heat by spontaneous combustion. You've probably noticed this phenomenon with grass clippings. Clippings left in a pile for several days will become hot and black in the center. The same kind of thing happens with damp, priming grass seed. To cool and ventilate the seed, we've used an air hose, stuck into the middle of the bag. The hose can either be hooked up to your shop air compressor or a small squirrel-cage fan. Very little air quantity is actually needed to keep the seed cool. Too much air will dry the seed prematurely.

After priming, the seed is ready for drying. If you're going to plant the seed via a hydroseeder, no drying is needed. Traditional spinner and drop-type spreaders require reasonably dry seed before they'll flow,

Dry the seed by spreading it on a clean surface, preferably on a sunny day. Turn the seed with a shovel as the top dries. You'll need to dry it all within one day or the seed may begin to sprout. Once the seed is dry enough to flow through a spreader, it's ready to use.

Unlike pregerminated seed that has a minimal shelf life, primed seed—if properly dried—can be stored in a cool, dry place for up to two months without major loss of potency.

Each species that you prime will require a different length of priming period. Kentucky bluegrass requires five days of priming, for example, while perennial ryegrass gets by with just two. Dr. Akers, the lettuce priming researcher had a good rule of thumb for determining when to stop priming and dry the seed. On the day you start priming, also start some seeds of the same lot in a germination test. Place a pinch of seeds on a wet paper towel inside a sealed glass jar. As soon as you see the first seeds start to germinate in the jar, immediately cease priming.

Not A Panacea

The Lewiston, ID field described is a good example of how dramatic seed priming can be. It's also a good example of the limitations of priming.

At 10 and 20 days after planting, the effects of priming were clear. Seedlings on the primed, west side of the field emerged in about half the time at the untreated side.

At six weeks, the story was different. The primed half was now about three inches tall and quite thick. But so was the untreated half. Even with close inspection, it was nearly impossible to tell the two halves apart.

Nature is a great equalizer. Priming may give seed a five or 10 day jump in emerging. But all seeds—treated or not—seem to grow equally well after

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Limited Water Seed Priming
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emergence. The priming advantage rapidly dissipates.

So, why use primed seed at all?

Priming is not suited to every turf establishment situation. It is useful in three specific cases:

1. Where you need to get a stand established as rapidly as possible—perhaps on an athletic field in advance of the next game.

2. Where you're sowing into soil too cool for germination. Priming tends to override the temperature sensors in seed; it germinates "no matter what."

3. Where you're sowing a mixture of a slower establishing grass with a faster establishing one. Kentucky bluegrass-perennial ryegrass mixtures have been shown to benefit when the bluegrass is primed. Priming equalizes the germination rate of the two species, allowing creation of a more balanced mixture in the mature stand. ❑

Editors Note: Dr. Doug Brede is a research director for Jacklin Seed Company, Post Falls, ID.

Three Commercial Methods Of Seed Priming

Since its inception more than 20 years ago, there have been numerous techniques developed for priming seed. Some have been patented, while others were released by public sector scientists. All of the methods are alike in one key element: a limited amount of water is made available to seed—not quite enough water to allow the seed to germinate. The various priming methods differ in *how* the water is limited.

Water Tank Priming

Priming got its start in tanks of water. Early priming techniques closely resemble pregermination, which had been around for years.

To limit the quantity of water available to the seed, an osmotic agent was added to the water. Polyethylene glycol and salt were typical osmotic agents that prevented the seed from soaking up too much water. Even though the seed is sitting in a tub of water, the osmotic agent prevents too much water from entering the cells of the seed by osmosis.

After priming, the seed is rinsed with clean water to get rid of the salt, and dried back.

Matrix Priming

Matrix priming is a fancy word to describe a simple concept. In matrix priming, you take damp, inert material, such as calcined clay, soil, kitty litter, sawdust, or straw and mix it with seed. Because the inert matter contains only a small amount of water, the seed can only draw a limited quantity. After priming, the inert matter is sieved out and the seed is dried and used.

Limited Water Priming

Perhaps the simplest of the priming methods, the limited water priming method contains the fewest moving parts. Limited water priming entails dousing a given quantity of seed with a given quantity of water. After priming, the seed is then dried and ready to use.