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Expedient Winter Drainage

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Cover Photo:
A sod strip cut through the low area of a putting green moves water away more quickly to help reduce winter injury.

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With care, heavy equipment can be used to remove ice and snow when greens are frozen.

Putting Greens: Dealing with Snow and Ice Accumulations

by JAMES T. SNOW
Northeastern Agronomist, USGA Green Section

WINTER INJURY IS among the more frustrating types of damage a golf course can experience, particularly when it is associated with snow and ice cover not only on greens, but also on other areas. At least other types of turf problems result from controllable or preventable causes to some extent, like diseases, insects, wilting, poor drainage, or compaction and wear from heavy traffic. Even other kinds of winter injury, such as desiccation, winter diseases, and winter traffic effects, usually can be explained, if not always easily prevented.

For the golf course superintendent, injury caused by snow and ice accumulation is a problem in a class by itself. Winter damage is impossible to predict; if turf is lost, the superintendent can be in a precarious situation with club officials because so little is known about the nature of the injury. Even though criticism often is unjustified, it's no wonder that club officials sometimes become suspicious about the superintendent's ability to deal with winter injury. The fact is that there are many questions which remain unanswered.

There remains much confusion concerning the actual mechanism of turfgrass kill associated with snow and ice accumulations. A number of theories have been proposed, and some of them are contradictory. One theory popular

When ice and snow are carefully removed, the turf comes through much sooner.

in the 1960s suggested that turf died from suffocation caused by the buildup of respiratory carbon dioxide gas under the ice sheets. This idea has been challenged by Dr. James B. Beard, of Texas A&M University. His studies indicate that this type of injury rarely occurs. Some authors proposed that winter scald is part of the problem, caused by a lens effect when sunlight passes through ice or standing water, thus scalding the leaf. Others have suggested that the solubility of arsenical, mercury, cadmium and other compounds increases under anaerobic conditions and contributes to turf losses. In an article appearing in the November, 1972, issue of the USGA GREEN SECTION RECORD, Dr. Beard stated that, "The winter injury most commonly associated with extended periods of ice coverage occurs during freezing or thawing periods when standing water increases the crown tissue hydration and subsequent injury of the turfgrass plants when temperatures drop rapidly below 20° F."

Most researchers and observers agree about two things, however:

1) Greens with poor surface and internal drainage are more susceptible to this type of winter injury than well-drained greens, and

2) *Poa annua* is much more likely to succumb to winter injury than any of the bentgrasses.

Therefore, providing good drainage and developing strong stands of bentgrass should be the goals of every course which suffers regularly from winter injury.

A QUESTION that requires a good deal of judgement and experience is when to begin to remove ice and snow accumulations from the greens. Whether or not even to attempt to do this could be argued, but research and field experience have shown that ice removal is worth the effort if the accumulations have persisted for a prolonged period.

Turfgrasses can withstand various periods of continuous ice coverage without significant damage, from 60 days for annual bluegrass to 150 days for Toronto creeping bentgrass. Generally speaking, however, bentgrasses are quite tolerant of ice coverage. Annual bluegrass, on the other hand, is readily susceptible to ice injury, while the Kentucky bluegrasses fall somewhere in the middle. When to begin to remove the ice from greens or tees, therefore, will depend greatly upon the species composition of the underlying turf. Ice removal should begin 50 to 60 days after an ice cover has been established on greens composed primarily of *Poa annua*, whereas removal need not be started for 100 days on predominantly bentgrass greens. Regardless of the number of days it has been since a solid ice cover has been established, however, ice and snow should be removed from any green with characteristically poor surface drainage just prior to an anticipated thaw. Snow melts during a thaw, and water accumulates in the low, poorly drained pockets on the green. A sharp drop in temperature may then kill the turf in these pockets, so the advantages of removing the snow before the thaw are quite obvious. All the ice and snow should be removed except for perhaps half an inch to an inch, which will protect the turf from desiccation and low temperature extremes.

It's easy enough to recommend snow and ice removal after a certain period of time or just before a thaw, but anyone who has tried it knows that it is very difficult. Access to the far reaches of the golf course with equipment and materials during winter may be impossible, and in winter the size of the maintenance crew is usually small. This

often leaves the superintendent with no choice except to clear just a few of the greens, those with the worst problems or easiest access.

As an alternative to complete clearing, trenches can be dug through the snow and ice in the low areas of the remaining greens, thereby providing a drainage pathway for excess water. If ice removal or trenching cannot be done, it could be of some benefit to break up ice sheets with sledge hammers and picks. This should at least cause the ice to melt faster. Where weather conditions make mid-winter clearing work difficult or impossible, a sod strip is sometimes taken in the green during late fall. A neat drainage trench can be easily dug in the green simply by using a sodcutter to remove the sod. The sod can then be entrenched in a sand bunker to preserve it over the winter, and it can be replaced safely the following spring. Unfortunately, this technique produces only variable results and leaves a visible scar which remains for most of the golf season.

IT IS UNLIKELY THAT two superintendents will agree completely on the best method of snow and ice removal. Some are very successful in using bulldozers or front-end loaders on their greens. This can be a risky operation, though. Care must be taken not to come too close to the turf surface, especially on greens with prominent undulations and contours. Others use picks and shovels for snow and ice removal, but this is time-consuming, and it obviously limits the number of greens which can be cleared or trenched. The use of machinery on the greens in late winter will depend to some extent upon the depth of frost in the soil.

Another good technique is to apply a dark-colored material to the surface of the snow and let the sun's energy do the work. The dark material absorbs the incoming radiation and causes the snow beneath to melt faster. This method takes longer to work, but is often very effective. Topdressing is often used for this purpose, sometimes mixed with activated charcoal, soot, or fertilizer. A rate of about two cubic yards to 5,000 square feet can be applied. This method has other advantages. Once the topdressing has reached the turf surface, it provides protection from subsequent desiccation weather. Dark-colored organic fertilizers are also popular topdressing materials; they can be quite effective when used at a rate of about 20 pounds of material per 1,000 square feet.

An intriguing idea which may be worth trying is to apply a good wetting agent to the surface of the snow to promote faster melting. A thick film of water tends to develop at the surface and delays the melting process. Applying a wetting agent reduces surface tension and encourages water movement down through the snow, thus promoting faster melting. It is often impossible to apply a sprayable material during the winter, but with the advent of the new granular wetting agent formulations, this idea may be more feasible. Using the granular wetting agent in conjunction with a dark-colored topdressing material, enabling you to pre-mix these materials, is a convenient way to get the best from both of these programs.

On greens where a history of winter injury is apparent, snow and ice should be removed during late winter. A number of techniques can be employed to reduce the potential for winter injury, but none can guarantee complete success. The wrong sequence of weather conditions may produce extensive turf losses on golf courses in local or wide regional areas, despite precautions.

Ay, there's the rub

by WILLIAM S. BREWER, JR.
Northeastern Agronomist, USGA Green Section

"THOSE WHO DO NOT remember the past are condemned to repeat it." George Santayana said this — or something like it — but he left out one vital element. He didn't mention responsibility! Only as we feel personally responsible are we moved to at least attempt to direct events which become history. In any successful venture, plenty of people are willing to take credit — at the end — for whatever may have been achieved. How many of them, though, had their necks stuck out from the beginning when the outcome was still in question?

The history of any enterprise, whether it fails or succeeds, may sometimes even turn on luck. A golf course, for example, may be blessed with particularly favorable weather that greatly moderates or erases the effects of some serious mistakes. So pin a medal on the weatherman! The astute golf course superintendent knows wherein the determining bit of credit lies.

What we are all interested in achieving, however, is such consistency in conditioning that the course will hold together even in a season with adverse weather. Probably every good golf course superintendent realizes how thoroughly nature can stack the deck, and not a one of them would willingly gamble that next year will bring about such happy circumstances that the golf course under his care will thrive in spite of deficiencies in the resources for providing that care. Yet club officials, owners, and administrators consistently seem to misread the situation.

Almost always the superintendent is held to be ultimately responsible for everything bad that happens on or to his golf course. Without meaning to take away at all from the superintendent's rightful degree of accountability for his golf course, club officials must

There's always someone who just knows it can be done.

Just cooling it off, Boss.

recognize and assume their own share of responsibility — before the fact — for the events to come in the history of their golf courses. They are the policymakers; it is they who set the limitations of resource and authority. Often it is front office actions either taken, postponed, or overlooked that have, in the end, forced an unhappy decision to make a change. Only a college football coach seems to have chosen a more precarious career than a golf course superintendent.

For a simplified example, consider a golf course hiring a new superintendent early in fall to maintain greens, tees, collars and fairways that were predominantly annual bluegrass. That winter the course suffered extensive winter turf damage. Very early in the spring, when the time was right for overseeding damaged greens and such, it was also discovered that the irrigation system required some $30,000 worth of work to make it effectively operational. That expenditure was not authorized until June, well past the time of critical need. The course subsequently experienced a most disappointing season. The superintendent was fired. The policymakers had succeeded once again in failing to take the responsibility to act when the time was appropriate. They succeeded once again to misplace the blame for the consequences of their mistakes.

Something roughly equivalent to this sad scenario is played out at many golf courses each year, and it will very likely be repeated at most of them through several cycles until new leadership arrives with a proper perception of how things function in any undertaking that involves a chain-of-command. The field general is granted a certain amount of authority, and he must assume an equivalent amount of responsibility. However, to at least the extent that the front office places restrictions (financial and otherwise) upon the field general, it retains ultimate responsibility (acknowledged or not) for the outcome as well. The field general may or may not be guilty of failing to make the most effective use of those powers and resources which are given to him, but to hold him solely responsible is a mistake that is all too easily made by those at the top.

Other than pointing to additional obvious instances where front office mistakes significantly contributed to disastrous golf course conditions, which were then made to reflect only upon the golf course superintendent, is there any evidence that this sort of misunderstanding of organizational responsibilities is widespread in the management of golf courses? Yes, if certain inferences be granted, some compelling statistics support a contention that top management must "get its act together" and accept its rightful responsibility for golf course conditions if it expects consistency from its field generals.

Would it be reasonable to assume that, as a group, the top 100 golf courses, as ranked in the November, 1979, *Golf Digest*, represent excellence in conditioning as well as in challenging design? Certainly. What is interesting to know in this context is that a club from

One might forgive the first set of ruts — but the rest . . . ?

this group is over six times more likely to avail itself of the consultative assistance of the USGA Green Section's Turf Advisory Service than a course selected at random from among all the nation's golf facilities.

There may be a number of factors involved in explaining these data, but coincidence has nothing to do with it. It would even seem a not-unwarranted conclusion to find in this a more enlightened concern with course conditioning among the nation's premier golf facilities. Why else pay even so modest a fee as $200 for an annual tour of the course and a follow-up written report by an agency whose only mission is precisely to foster more consistently fine playing conditions? The management of these facilities is not afraid, in other words, of what an impartial but critical eye may see. They prefer to be made aware of such existing or potential problems as may be found in time for corrective action to be taken, rather than to remain blissfully ignorant of troublesome situations that may be developing and which, if not addressed early, will very likely become costly to deal with once the effects have become compounded to the point where deteriorating golf conditions are unmistakable even to the casual observer.

There is a further point that begs to be cleared up. Club officials occasionally seem to be surprised that some of the very same points raised by the Green Section have already been presented to them by their superintendent. A degree of skepticism in the face of problematic news is to be anticipated, but it should also be comforting to find such instances of confirmation. Remember that both the golf course superintendent and the green section agronomist have expertise in the same field and are dedicated to achieving the same ends. It is true that they each bring a different perspective to the situation — because of the differing nature of their jobs and of their professional backgrounds — but it is by far the more desirable situation to have these orientations mesh smoothly and for this relationship to be harnessed by the responsible top management, forming a kind of triumvirate with respect to setting a course for the future.

The photographs illustrate one of the problems which seems to be getting more out-of-hand: the employment each year of a high percentage of inexperienced people on golf course crews and the resultant increase in mistakes. Although this is generally perceived as a funding problem, it is more likely a question of policy and the allocation of funds. Given a fair chance, no superintendent in his right mind would want a preponderance of new workers every year, particularly if his permitted workforce was also smaller than in the past. But this is being forced upon him at an alarming number of courses. We know of at least two instances last season when not only was the entire crew new, but also it was the superintendent's first year as a superintendent. Anyone who fails to appreciate the difficulties inherent in this sort of situation is simply out of touch with reality.

The point which would be well taken from this argument is simple: it is necessary for a golf facility to employ a good golf course superintendent, but that alone is not sufficient to ensure a good long-term result. There needs also to be a top management that is aware of problems and responds to the fundamentally important requirements of the golf course.

A GREEN SECTION RESEARCH PROJECT

Influence of Mowing Procedures On Roll Speed of Putting Greens

by R. E. ENGEL, A. M. RADKO, and J. RICHARD TROUT*

SINCE PUTTING IS a major factor in the golfer's score, the speed and quality of the greens becomes of great concern to the game. More than any other characteristic, mowing procedures are the focus of attention when considering why a green putts well or poorly. Recently, the GREEN SECTION RECORD[3] listed speed standards for several tournament courses. The practice outlined in this article embarked the golf course superintendent and green committee into an era of more specific evaluation of putting green speed. The purpose of this study was to determine variations in speed and the influence of several mowing factors on green speed.

Green speed was measured on an assortment of golf courses from six states (largely northeastern United States). The primary source of courses was those visited for various other purposes during the test period, along with a few chosen randomly. Also, six courses where USGA competitions were scheduled were included.

The common turf conditions at the time of speed readings on non-tournament courses were: measurements taken within four hours of mowing, essentially on a dry surface and generally on a sunny day without severe heat.

All greens were classified as creeping bentgrass type with varied amounts of annual bluegrass. The height of cut was based on the growers classification. The reported cutting height of 3/16 inch was predominant. The height of grass on three of the courses was listed at 1/4 inch.

The Stimpmeter was used for all speed readings. The ball-roll distance from the chosen spot on the green was averaged with the distance the ball rolled on return toward the original spot. Readings were taken on adjacent mower strips with and against the mower direction. The data were analyzed to determine variability among greens as well as among golf courses.

TABLE 1 SHOWS differences in green speed between courses which ranged from a low of 75 inches to a high of 111 inches. The least significant difference (LSD) at .05 is 12 inches. This range in green speed attests to the fact that there is much variation in green speeds between courses despite modern, sophisticated maintenance practices. Four of the courses with reported settings of 3/16 inch cut did not differ appreciably in green speed from the average speed of the courses with mowers reported at 1/4 inch. This could be due to several factors, including differences in bench setting vs. actual field cut.[1] The green speed of the 18 greens of tournament courses ranged from 96 to 109 inches with an LSD at .05 of 3 inches. (Table 1).

The differences in speed of greens on a given course are of greater concern

FIGURE 1
Mower Direction Effects on Roll of a Golf Ball at Two Heights of Cut on Bentgrass-type Putting Greens

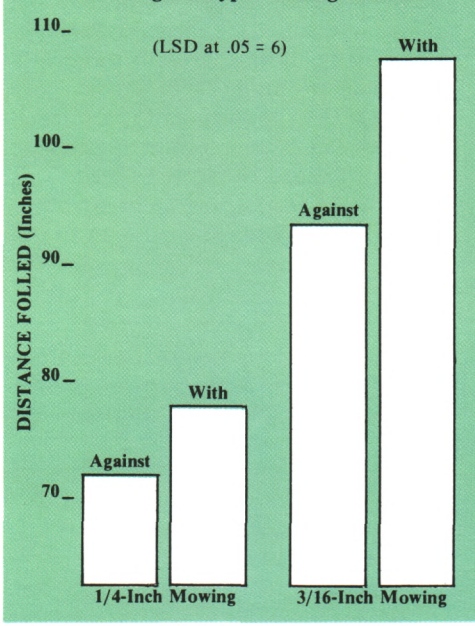
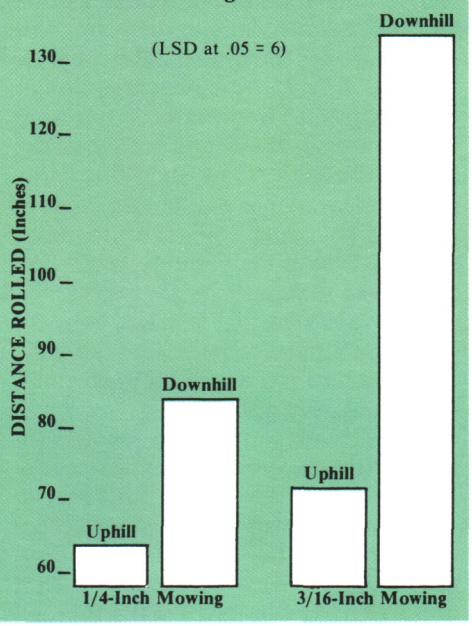


FIGURE 2
Uphill and Downhill Slope Effects on Roll of a Golf Ball at Two Heights of Cut



than variation in green speed between different courses. Average speed readings between the three greens ranged from 5 to 25 inches on the courses studied (Table 2). Courses with the larger variation force the golfer to attempt adjustment during his round of golf. The six tournament courses (Table 2) had green speed ranges varying from 8 to 15 inches for each group of 18 greens. The standard deviation among greens of the tournament courses was 4.3 inches vs. 8.4 inches for the non-tournament courses. This shows that double-mowing and adjustments in other management practices can add significantly to the uniformity of putting surfaces on any given course.

FIGURE 1 SHOWS 6- and 14-inch increases in green speed for the 1/4- and 3/16-inch cuts respectively, when the ball rolls with mower direction as compared with rolling against mower direction. Note this difference in speed approaches those that occur between golf courses and between greens on a course. Fortunately, a majority of the putts do not occur with and against the mower grain.

Figure 2 shows green speed differences that occur between the uphill and downhill roll. These readings were taken on the milder slopes of the greens. Note the 75 percent increase in green speed, or a distance of 59 inches, for the downhill vs. the uphill roll. Considering that these readings represent the level areas of the green, much greater differences in green speed awaited the golfer on the same greens.

Why does the green speed vary from course to course? Because of an assortment of reasons. Among these are variety or species of grass, differences in mowers, differences in interpretation of mower height, frequency of mowing, thickness of bedknife and growth of the grass as influenced by such factors as nutrients available to the grass, top-dressing program, soil moisture, wind exposure, site temperature and percentage of shade.

When the question is asked, why do greens on a given course differ, the same reasons apply except that mowing equipment is usually not a factor.

The difference in green speed with and against the mower direction was expected, but the amount of difference in speed was surprising. This was especially true for the closer height of cut of 3/16 inch. This result, along with other parts of the test results, like all research, answers some questions and raises others. More tests are needed to learn about factors that affect green speed. More information will help the golf course superintendent make helpful adjustments that are not too costly and time consuming.

The USGA's reporting of green speed distances has been interpreted as a step toward standardizing green speed. This is not so. The purpose of the Stimpmeter is to encourage each club to decide upon a speed its members are comfortable with, and then work toward speed uniformity for all greens on its course. Whether for regular membership play or for tournament play, with reasonable management adjustment, all greens on many individual golf courses would putt more uniformly during most of the playing season. The speeds designated for tournament and regular membership play have been defined by the USGA[2] as follows:

USGA Green Speed Test Comparison Table

	Regular Membership Play	Tournament Conditions
Fast	102″	126″
Medium Fast	90″	114″
Medium	78″	102″
Medium Slow	66″	90″
Slow	54″	78″

Using the Stimpmeter, three golf balls are rolled in one direction and averaged, then the process is repeated in the opposite direction . . . then the average of the two directions provides the speed of the green.

TABLE 1
Differences in Green Speed (Roll Distance with the Stimpmeter) Of Putting Greens on Various Golf Courses with 1/4" or 3/16" Cut.

Golf Course	No. Greens Sampled	Golf Ball Roll (Inches) Distance
70	3	82
74	3	75
75	3	96
43	3	111
65	3	95
66	3	81
67	2	85
68	1	92
69	3	92
71	3	91
72	3	86
73	2	83
77	3	106
	LSD at .05	12
Tournament Courses		
23	18	109
25	18	96
76	18	96
79	19	100
80	18	104
81	18	106
	LSD at .05	3

TABLE 2
Range of Differences in Green Speed for Individual Greens On Various Golf Courses.

Golf Course	No. Greens Sampled	Range in Difference Between Greens (Inches)*
75	3	10
70	3	8
74	3	7
43	3	14
77	3	25
65	3	21
69	3	5
71	3	7
72	3	7
66	3	11
	*Standard deviation among greens = 8.4	
Tournament Courses		
23	18	11
81	18	8
80	18	8
79	19	10
25	18	15
76	18	9
	*Standard deviation among greens = 4.3	

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[1]Hoos, D. D., and Faust, W. W. (1979). "Putting Greens — The Height of Cut." *USGA Green Section Record*, 17:1-4.

[2]Radko, A. M. (1977). "How Fast Are Your Greens?" *USGA Green Section Record*, 15:10-11.

[3]Thomas, Frank (1978). "The Stimpmeter and the Open." *USGA Green Section Record*, 16:7-9.

Hydroseeding underway.

The Flowers on The Hills of Industry

by **WILLIAM H. BENGEYFIELD**
Industry Hills Golf Courses

IT PROBABLY BEGAN with John Chapman. From the hills of western Pennsylvania through the forests of Ohio and Indiana, "Johnny Appleseed" conjures up the picture of a skinny fellow sowing seeds, left and right, as he walked through the wilderness territories of the early 1800s. Indeed, John Chapman was a seedsman, and he did establish a chain of seedling fruit tree nurseries along the freeways of early western-bent settlers. Today, he wouldn't recognize the seed business.

The scene now shifts to 1980, to Southern California and Industry Hills. Here a new and different public golf and recreational facility is being developed by The City of Industry, about 20 minutes from downtown Los Angeles. This project has been in the planning and maturing stages for more than a decade. The complex, sprawling over 640 acres, not only will offer 36 holes of public golf, Olympic-size swimming pools, tennis courts, bridle and hiking trails, but also conference and convention facilities for the developing City. In the years to come, few of us will remember that these wooded, gentle hills were once barren and brown, their canyons filled with garbage and refuse — some over 150 feet deep!

Turning a dump site into a recreational area is not new, but this one is different. It has even been likened to the Taj Mahal; i.e., one of a kind. Representing a $60 million investment, Industry Hills may well be a precursor of things to come. Since no one is making land any more, more and more marginal land must come into use. The trick, of course,

is to turn a once ugly duckling into Cinderella. That's where hydroseeding (hydromulching) comes onto our scene, and that's why we speak of a new turn in the seed business.

In its beginnings, hydroseeding was used almost exclusively for erosion control, principally along highway rights-of-way, but now it has moved into beautification and landscaping, a means of establishing permanent plant covers for difficult slopes, soils and changing climatic conditions. Selecting plants with wide adaptation capabilities is surely one of the secrets of today's successes in hydroseeding. That such plants are even available, is a tribute to the worldwide plantsmen who have made the initial native selections.

Steven Ormenyi, landscape architect for Industry Hills, knew of at least one firm specializing in procurement and preparation of native and/or adaptable plant species for hydroseeding purposes. Mixes may consist of ground covers, small and large shrubs and trees. Ron Pecoff has spent years searching out plant materials adaptable to difficult, adverse conditions. Because early information was meager and little or no research data was available, Pecoff gathered his own information. He had dealt with planting in coastal marshes, in soils dredged from the ocean, steep cuts, landscape fills, and desert plants. He has made a number of native selections and became familiar with their requirements and peculiarities. The factors of soil types, pH, nutritional needs, rainfall, humidity, slopes and grades, day length and the ability of a seed to establish itself through hydromulching techniques are learned best by experience. The ability of a seeded species to compete with native but undesirable plants is a major consideration in plant selection. There are now over 350 species of seeded plants that have proven their worth for hydroseeding. Included are annual flowers, ground covers, shrubs, trees and even ferns for all climates. From cedars, pines and redwoods for the mid-latitudes to Eucalyptus tree species (having two million live seeds per pound) for the sub-tropic and tropic latitudes, new data and new adaptable plants are being added to the success list each year.

To achieve a reasonable stand of hydroseeded plants, 12.5 million live seeds per acre is recommended. Sounds like a lot of seed? Not really when one considers, for example, that less than two percent of the seeds will survive. Compare this to the 90 percent or more success in greenhouse plantings.

Hydroseeding success is now virtually assured if all planting requirements are met. The largest hydroseeding project currently proposed is the reforestation of 25,000 acres by helicopter in the Sudan. Another 7,000 acres at Jeddah International Airport, Saudi Arabia, is scheduled to be seeded in 1980. Desert plant species collected from Australia, the American deserts, South America and Saudi Arabia itself will be used. Effluent water will furnish the necessary irrigation.

Hydroseed mixes frequently call for special seeds not commercially available. In such cases, they must be ordered 8 to 12 months in advance. This permits seed collections to be made from stands of native plants wherever they may be.

ONE OF THE MAJOR difficulties in hydroseeding establishment is competition from native weeds. The first step, therefore, is to remove as many of the weed seed producers (mature plants) as possible. Good weed control, prior to hydroseeding is a key to success.

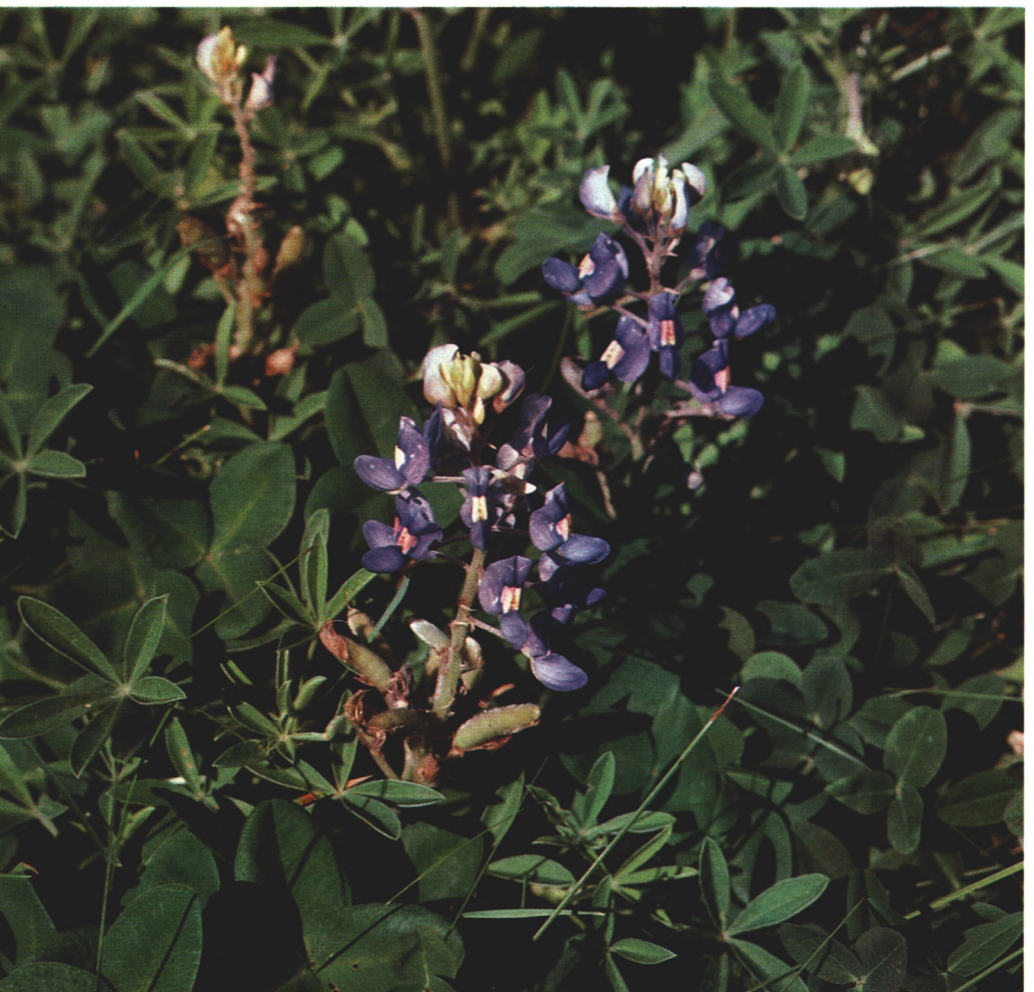
Surprisingly, certain weed seeds such as the tumbleweed require nitrogen for germination. All weed seeds, however, will benefit from fertilization, and, therefore, fertilization becomes the next step in the weed-control plan. A complete fertilizer is generally used.

Natural rainfall or irrigation must then furnish enough water to bring about good germination. A minimum of three weeks is needed and up to two months is necessary sometimes (of course at the right time of the year) to produce the required weed development.

Once a good stand of young weeds is achieved, Diquat or similar type contact weed killer is applied. If grasses are present, Roundup or similar grass her-

Did Johnny Appleseed start it all?

Fiber cover after hydroseeding. Pen points to actual seeds.



bicide must be used. Grasses are a major deterrent to the establishment of other cover crops.

When treating weedy areas with herbicides, professionals recommend vegetable dye in the tank. This tells the applicator where he has been and approximately how much herbicide has been applied to a given area. If the initial weed kill is not completely successful, hand weeding at a later date (after hydroseeding) may become necessary.

WITH WEED COMPETITION knocked out, seeding time is at hand. Recommended seeding rates range from 30 to 60 pounds per acre, depending on the type of plant cover desired. Present techniques also call for a complete fertilizer (such as 14-14-7) to be added to the seed slurry in the hydroseed tank. In addition, enough fiber material (available commercially and artificially colored green) is added to the tank slurry as a carrier for the seed and to show what areas have been covered and how intensely.

Within a day or two following seeding, the balance of fiber must be applied for an average total of 1,800 pounds of fiber per acre. The actual amount of fiber will vary depending on the degree of slope. The addition of glue or some kind of stabilizing emulsion is also frequently added to the tank at this time.

Having destroyed the weeds and applied the seed, fertilizer, fiber and glue, all that remains is assuring a moist fiber until germination. In areas depending on a natural rainfall, proper timing of seeding and the use of a carefully designed seed mixture is very important. Germination is always a critical stage and much of the crop can be lost if things become too dry.

One hundred thirty acres of hydroseeded area were developed at Industry Hills during the last year. An evolution of color and plant growth has followed. At first there were alyssum, lupines, clover, California poppys, daisies, gazanias, and other wild flowers. Within months we began to see the shrubs, pampas grass and seedling trees emerging by the hundreds. It would be seemingly impossible to gain the same results from hand planting and hand seeding. Under

(Top left) The first spring after hydroseeding and some of the results.

(Left) Lupines, clover six months after hydroseeding.

our circumstances at least, hydroseeding has wrought a miracle!

WHAT OF THE COSTS? Figured on a square foot basis, actual seed costs seem almost infinitesimal. They may range from $.0069 per square foot ($292 per acre) to $.011 ($470 per acre) or more depending on the seed mixture desired. If tree seeds are used, the cost will be inevitably greater. At Industry Hills, eleven different mixes were used; each containing ten or more different plant species. The mixes ranged from a meadow grass and flower mix to a virtual reforestation program. The average seed cost per acre was approximately $600. Add another $1,500 per acre for herbicides, fertilizer, fiber and glue for a total materials cost of $2,100 per acre.

The basic figure per acre for labor and equipment costs is approximately $2,500. This includes the labor application costs of herbicides, seed and fiber, fertilization, irrigation, hand weeding, etc.

Expensive? Well that depends upon your perspective. When hydroseeded areas produce seedling trees ranging from 8 to 12 feet within 18 months and an attractive ground cover is established on marginal soils and under adverse conditions within a few months, the results justify the expenditure. This is especially true if the area is for public use and early erosion control is essential. Conventional hand installation and planting methods are, in the long run, even more expensive, and it usually takes four to six years to realize similar results.

Hydroseeding may not be for everyone, but each year more and more landscape architects are recognizing its possibilities. The golf course superintendent and golf course architect may want to take note. Difficult soil and difficult landscape problem areas seem to yield to this new technique. Blowing desirable plant seeds in a water and fiber solution from a gun; having them establish themselves, compete and eventually take over an entire area is truly a modern miracle. It is also an accomplished fact. Johnny Appleseed may have started it, but he would never recognize the turn the seed business has taken today.

Typical seedling Eucalyptus and hydroseeded cover.

TURF TWISTERS

DAMAGE TO MOWERS

Question: Our golf course superintendent has been concerned with careless golfers not keeping their shoe spikes firmly fastened. He complains, and rightly so, that they ruin his mowers. Do you have literature on keeping the course policed and neat? (Washington)

Answer: Your superintendent is correct! A little effort, cooperation, and common sense pay off in the member's role in course care. If a golfer should see a shoe spike, metal bolt or nut, or any type of small metal object on the turf, it would be very helpful to pick it up and place it in the trash receptacle on the next tee. Metal of any type raises havoc with precision cutting mowers . . . it could throw the reel out of alignment, badly nick the cutting blades on the reel so that they need regrinding, or damage the reel to the point that it has to be replaced.

As for literature on the subject, no, we have none but a new USGA film addressing itself to the subject of the responsibility of the golfer in course care will be available for rent at a nominal fee beginning in February, 1980. Its title is "The Golfer and the Course."

CHEWED-UP SOD

Question: We're looking into resodding the practice tee from time to time as it becomes chewed-up badly from heavy use. Do you have any figures to indicate how many man-hours are required to lay sod expertly? (Illinois)

Answer: We can only provide information given to us by a prominent superintendent from your state who has done extensive sod work on his fairways. His records indicate that it takes 25 man-hours to lay 1,000 square yards of sod using a fork lift to move the sod to and around the area being sodded.

SANTA TO THE RESCUE

Question: Any final wishes for the coming year? (Superintendents everywhere)

Answer:

Dear Santa Claus:

Please leave at our club 18 greens that will be proof against wear and tear, diseases, bugs, unreasonable members, and other pests.

Please leave at Tom Smith's home one durable, soft rubber putter which may be cast violently on the ground without injuring the turf on our greens when he misses his putt.

Please leave at Ed Jones' house one digging fork and a spade in order that he may have something to dig with in his back yard to satisfy his craving for digging and thus relieve the strain on our tees.

Please leave some message of inspiration with the USGA and the R&A which will encourage them to adopt a new cup with a diameter of at least 10 feet so that in the future it may be feasible, if there are any missed putts, to blame them on the player rather than on the green committee.

Please leave your message of goodwill firmly fixed in the haughty hearts of our club members and make it last for many months, and make it possible for members of our committee actually to enjoy a visit to the club within a month after we have found it necessary to close the course to play for a single day.

If you will do all this, dear Santa, you need not visit our houses. We'll take care of the kids this time.

Humbly yours,

THE GREEN COMMITTEE.