When Charles Craig decided to renovate 35 acres of this college campus with Roundup® herbicide in 1977, he knew that if it didn't work, he'd probably have to "hide under a rock."

But, fortunately, Charles didn't have to go into hiding because just 7 days after he applied Roundup he was able to reseed right into the dying grasses.

"Yes, I put my career on the line, but I felt all along that Roundup was going to work," Charles says. "There was no doubt in my mind."

As horticulturist for Mercer County Community College in Trenton, New Jersey, Charles Craig depended on Roundup for the broad spectrum control he needed for tough grasses like quackgrass, orchardgrass, tall fescue and others. And since Roundup has no residual soil activity, he was able to reseed in a matter of days.

"Seed germination was terrific, especially with the weather we had," Charles told us. "Everyone always says it looks nice."

Charles still uses Roundup for touch up jobs around cracks in the pavement, parking lots, buildings, tree bases and flower beds. Taking precautions against spray drift, Charles has no fear of harming surrounding vegetation with Roundup.

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EQUIPMENT

Princeton Turf Equipment

Princeton Turf Equipment originated under the cooperative efforts of Woodrow Wilson of Eastside Nursery in Canal Winchester, Ohio, and Wiley Miner of Princeton Turf Nurseries in New Jersey. Miner displayed the harvester during a turf field day at Rutgers in 1966. An improved version of that harvester became the first Princeton harvester. Today, Princeton has a number of models of harvesters, including an extremely sophisticated large harvester with enclosed cab and minimal sod handling needed. In addition to harvesters, Princeton manufactures a fork lift called the Piggyback and a harvester that is attached to the tractor in an easily detachable hitch arrangement freeing the tractor for other duties. It also makes a turf vacuum and a stolon planter. Princeton designs to serve both cool and warm season sod production.

Wilson says that every harvester he has ever sold is still in use today, attesting to the reliability of his product.

Princeton harvester *can harvest up to 2,500 square yards per hour and has a floating cutterhead for cutting in mineral or peat soils and in rolling conditions.*

The advantage of the Princeton harvester is that the weight of the machine is over the blade, not to the side, according to Wilson. He attributes this and other design advantages to the success of the Princeton harvester. Wilson continues to work on improvements to his harvesters and to develop and manufacture other pieces of sod equipment, such as the fork lift, grass vacuum, and sprigger.

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METRIC SOD

The U.S. conversion to metric, although slow, is occurring. At the same time, sod production technology developed in the U.S. and Canada is going worldwide.

Gerry Brouwer of Brouwer Turf Equipment Ltd. estimates that the demand for improved sod technology will grow in areas still strongly based in pasture sod. Areas such as South Africa, Australia, Holland, Germany and the United Kingdom are buying harvesters.

Canadian sod producers currently sell sod in .8 square meter rolls, which is the same as a square yard. The Nursery Sod Growers Association of Ontario pushed for the conversion to metric in 1978. So golf course superintendents, landscape contractors, and homeowners now must think in terms of meters instead of yards.

Although it would make sense to go to the square meter over the .8 square meter roll, sod producers say the full meter roll is too heavy to handle. Since nearly two-thirds of Ontario's bentgrass sod is sold to U.S. users, the acceptance of metric conversion will spread to northern states quickly.

No talk of converting machinery to the metric units has been proposed. But conversion is eminent and a little lesson in metric is appropriate.

CONVERSIONS:
area in square yards x 1.0451 = the number of 0.8 square meter rolls
area in square feet x 0.11612 = the number of 0.8 square meter rolls
area in square meters x 1.25 = the number of 0.8 square meter rolls

with other turf organizations, and a willingness to try new methods. Marketing techniques can be improved to increase demand, increase price, and solidify the image of sod as the surest way to have a quality lawn. Support to university research is critical, either by individual contributions by estates of those who lived comfortably from the sod industry or by organizational grants. Purchasing new machinery that has been improved, chemicals that make savings possible, and seed that exhibits improved characteristics will provide the commercial sector with the will to experiment and develop new products.

Future sod production will be an agronomically complex skill. It has come a long way from the pasture to the highly mechanized, irrigated, blend and mixture , and chemically complex profession. It has also become a sophisticated business with marketing and planning critical to growth. It will take study in addition to inventiveness to succeed in sod production in the future.

The continuously growing strength of the American Sod Producers Association will play a major role in accomplishing needed research and maintaining commercial interest in the market by suppliers. By making industry statistics available to potential suppliers and showing that its membership is receptive to new ideas ASPA can generate a tremendous commercial interest in sod production. This will encourage private research as well as public research on sod methodology.

ASPA is increasing its service to warm season sod producers in an effort to represent all U.S. growers. Recalling that two of the original five producers behind ASPA were growers of warm season grasses, southern growers should not categorize ASPA as for northern growers only.

Perhaps the most present challenge is marketing of sod. Full participation in the Landscape Industry Association Council (LIAC) could faciliate support from landscape architects and contractors, and to benefit from basic marketing problems of the Green Industry. Sophisticated promotional campaigns and record keeping could extract further market potential for sod. That potential, if realized and funnelled back into research and the supplier will assure continuous growth.

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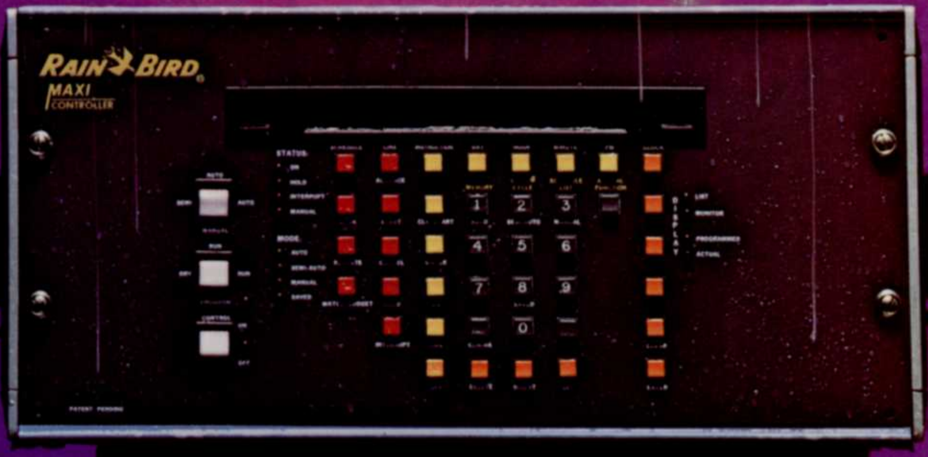

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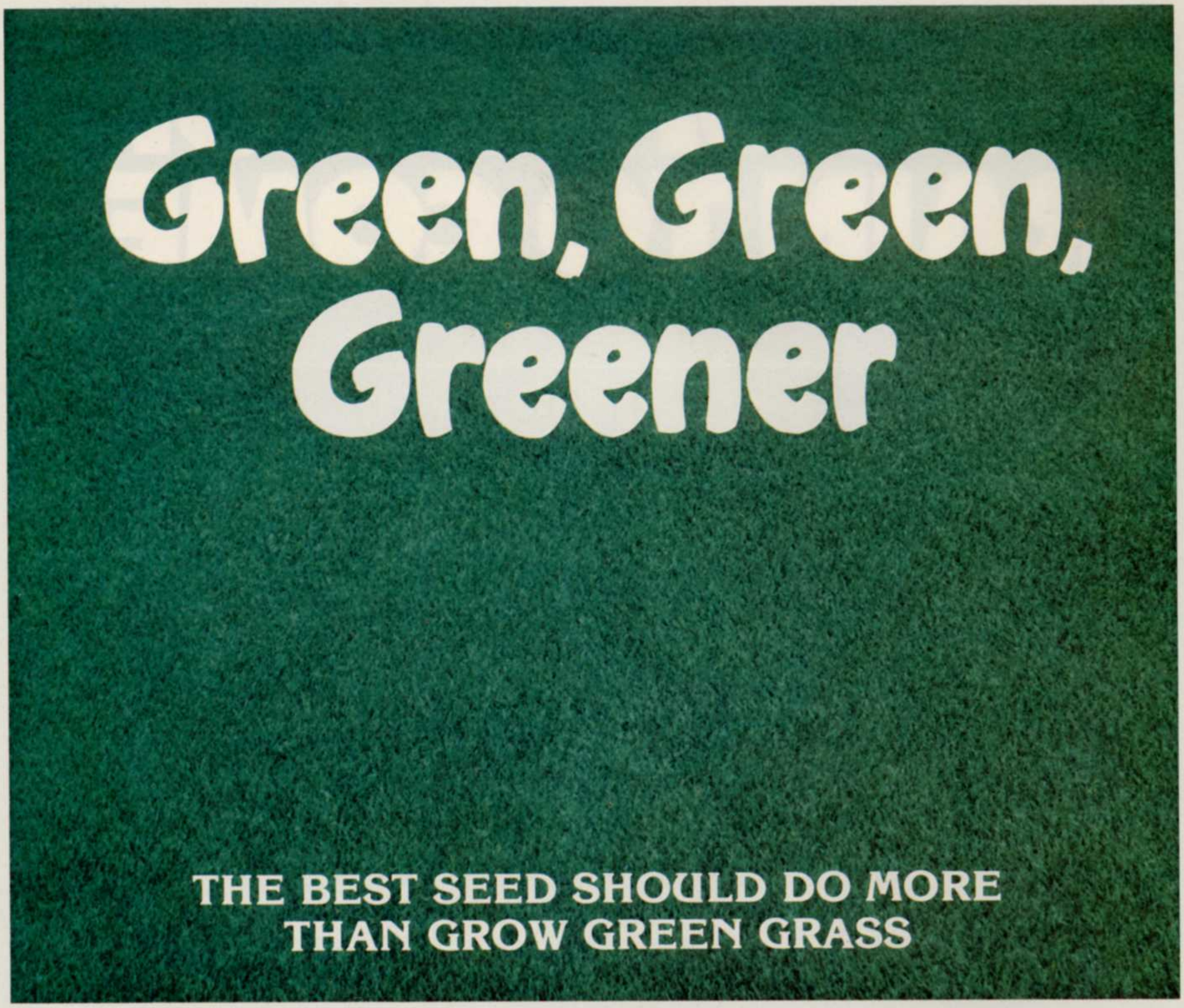

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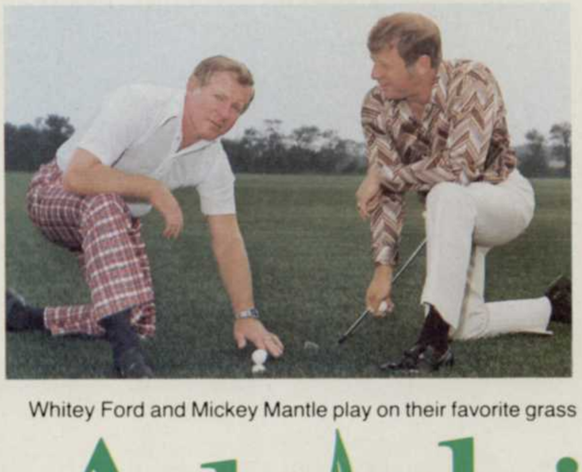

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53 ☐ $15,000 to $30,000 58 Other______

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TURF PAVERS: WEAR PROTECTION WITH AWARENESS OF SPECIAL CARE

By Robert C. Shearman, Turf Specialist, Department of Horticulture, University of Nebraska

Turfs exposed to vehicular traffic are subject to wear injury and compaction stress. The severity of turfgrass injury in heavily trafficked conditions depends upon the traffic type and intensity, turfgrass species or cultivar used, environmental conditions, and the cultural practices employed. Turf managers should select wear and compaction tolerant grasses and employ cultural practices that enhance the ability of turfs to grow under these conditions. In addition to these aspects, physical factors that protect the turfgrass plant from wear and compaction injury may also be used to help turf persist in heavily trafficked areas.

Paver complexes (i.e. concrete, brick, and plastic materials) have been designed as physical support systems for turf growing in areas such as parking lots, firelanes, and golf car paths, where traffic stress may be a problem. Paver complexes are designed to allow the turfgrass plant to grow in void areas while the crown or growing point of the plant are protected from traffic injury by placement below the paver surface or by waffle-like protrusions on the paver surface.

One of these turfgrass-paver complexes was tested at the University of Nebraska Turfgrass Research Facility located at Mead, Nebraska. The paver complex was tested to determine its influence on turfgrass establishment, quality, wear tolerance, and recuperative potential. Information of this nature is needed to help turf managers better understand the advantages and disadvantages of using such a system in heavily trafficked areas.

Six turfgrass species were included in this study: (1) Manhattan perennial ryegrass, (2) Merion Kentucky bluegrass, (3) Kentucky 31 tall fescue, (4) Dawson creeping red fescue, (5) Highlight chewings fescue, and (6) Fairway crested wheat-grass. These species were selected because they were commonly used in Nebraska and they covered a range of wear tolerant and intolerant species. The grasses were established in two areas, one with the paver system and an adjacent area planted in soil (Sharpsburg silty-clay loam). Once the turfs were established, they were mowed weekly at 3.0 inches; watered to prevent drought stress; and fertilized with three pounds of nitrogen (45-0-0) per 1,-000 sq. ft. per growing season.

Some of the relative effects of the grass-paver complex on establishment, winter survival, and turf quality are indicated in Table 1. The grass paver complex adversely affected turf quality for Manhattan and Merion but enhanced the quality rating for Fairway crested wheatgrass. The reduced turf quality rating for Merion was primarily due to its slow establishment rate in the paver complex compared to that in the non-paver area. Merion and Fairway established more slowly in the paver complex than the soil area; while Manhattan, Kentucky 31, Dawson and Highlight established equally as well in either area.

Winter survival of susceptible grasses was adversely affected by the grass paver complex during the seedling year. The six species were establsihed in September, 1976. During the following winter, snow cover was lacking and temperatures were ex-

Turf pavers ready for topsoil and seeding in cart path.

Turf Pavers *from page 57*

tremely low. As a result, Manhattan perennial ryegrass and Kentucky 31 tall fescue were injured by direct low temperature injury in both the paver and non-paver areas, but injury was greatest in the grass-paver complex. Turf managers should be aware of this as a potential problem. Selecting cold tolerant species and cultivars and avoiding late fall plantings should help minimize potential problems from low temperature and desiccation injury.

Wear treatments were applied, using an 18-horsepower Cushman truckster. Each turf was subjected to 600 trips with the truckster over a four hour period. Subsequent wear injury and recuperative rates were evaluated (Table 2). Wear injury from the 600 trips was quite severe, particularly on grasses such as chewings fescue and crested wheatgrass which are wear intolerant species. The grass-paver complex improved turfgrass wear tolerance and recuperative potential for all the turfgrasses except for Merion Kentucky bluegrass. The paver system was most beneficial in helping grasses that were very susceptible to wear injury (i.e. Fairway crested wheatgrass, chewings fescue, and creeping red fescue), but it was even beneficial to those that were fairly wear tolerant. Loss in turfgrass quality (density and uniformity) associated with the paver complex was offset by its improvement in turfgrass wear tolerance and recuperative rate.

Turfgrass-paver complexes can play a beneficial role in maintaining turfgrasses that are exposed to intense traffic, particularly in areas like overflow parking, driveways, cartpaths, walkways, and firelanes. Placement of paver systems, regardless of type or construction, is extremely important. The paver must be situated so that the crown of the turfgrass plant is protected from injury. If the paver system is improperly placed, its purpose is defeated and no improvement in wear tolerance or recuperative rate will be obtained.

Turfgrass-paver complexes are not without management difficulties. Thatch accumulation and its removal could be a problem. Turf managers should select turfgrasses that have a minimum thatching tendency and use cultural practices that reduce thatch accumulation. Snow removal on paver complexes with surface protrusions can be a problem; however, float devices for the snowplow blade minimize the problem. Oil and gas spills can be a problem in parking areas, and repair of damaged areas may be necessary. Increased soil temperatures were thought to be a problem in paver complexes. However, in this study no differences were noted in soil temperatures beneath turfs growing in the paver and non-paver areas. Mowing was not a problem in either area and turfs used similar amounts of water. **WTT**

Table 1. Relative effects of paver complex on establishment, winter survival and turf quality.[1]

Turfgrass Species	Rate of Establishment	Percent Ground Cover	Winter Survival	Turf Quality
Manhattan perennial ryegrass	0	0	-	-
Merion Kentucky bluegrass	-	-	0	-
Kentucky 31 tall fescue	0	0	-	0
Dawson creeping red fescue	0	0	0	0
Highlight chewings fescue	0	0	0	0
Fairway crested wheatgrass	-	-	0	+

[1]Ratings based on + = better than, - = poorer than, and 0 = no different than turfs in the non-paved area.

Table 2. Relative effects of paver complex on wear tolerance and recuperative rate.[1]

Turfgrass Species	Wear Tolerance	Recuperative Rate
Manhattan perennial ryegrass	+	0
Merion Kentucky bluegrass	0	+
Kentucky 31 tall fescue	+	+
Dawson creeping red fescue	+	++
Highlight chewings fescue	++	++
Fairway crested wheatgrass	++	++

[1]Ratings based on + = better than, - = poorer than, and 0 = no different than turfs in the non-paved area.

WHITE OAK RESISTANCE TO WILT COMPARED TO RED OAK COLOR, SPEED

By Douglass Chapman, Horticulturist, Dow Gardens, Midland, MI.

Oak *(Quercus)*, a sun-loving tree, is the most important hardwood timber genera in the United States. It should be one of the most important shade tree groups in production today. When considering optimal growing, oak species are adapted to conditions varying from droughty upland sites to flood plains. Quercus species are variably tolerant to urban stress, air pollutants (ozone and sulfur dioxide), salt (chlorides), and disease. I would like to discuss the oak in two accepted groups — red and white oak.

The red oak group includes Scarlet Oak *(Quercus coccinea)*, Northern Red Oak *(Quercus rubra)*, Black Oak *(Quercus velutina)*, Pin Oak *(Quercus palustris)*, and English Oak *(Quercus rubur)*. In general, this group grows more rapidly with a shorter life span while showing acute susceptibility to oak wilt when compared to the white oak group.

Scarlet Oak *(Q. coccinea)* is a rapid growing (2-3 feet per year) upland tree species. It grows well in moist, well-drained soil. *Q. coccinea* has an upright, oval habit of growth, reaching 60-75 feet in the landscape. The foliage is a glossy green throughout the summer with an effective soft red yet variable fall color. It transplants easily as it exhibits little or no tap root. When considering advantages, Scarlet Oak is the most rapid growing oak and shows moderate tolerance to ozone and highway salts. *Q. coccinea* is effective as a street tree as well as a specimen in golf courses and institutional grounds. Its disadvantages include a relatively short lifespan (70-80 years), extreme susceptibility to oak wilt, and high maintenance requiring pruning every 3-4 years.

Red Oak *(Q. Rubra)* is a good street, park, golf course, industrial, and home landscape specimen tree. Its foliage is shiny green throughout the summer, becoming bright red in the fall. This rounded tree ultimately reaches 60-70 feet in height, with some individuals in the wild reaching over 110 feet in height. Red Oak transplants readily into moist, yet well-drained soil. *Q. rubra* is tolerant of urban conditions, e.g., salt, ozone, and sulfur dioxide. The main disadvantage of Red Oak is its extreme susceptibility to oak wilt, which should limit the use of it in areas where this disease is active. Further, when using this tree in the landscape, it should be limited to less than 5% of the street trees in any one locale, thus avoiding catastrophic problems similar to those of American Elm.

Black Oak *(Q. Velutina)* is second only to White Oak in a broad native range which is essentially from the Great Plains - East, excluding small parts of Texas and Florida. It has a broad oval crown, reaching 50-60 feet in height. *Q. velutina's* dark green leaf of summer makes it a valuable specimen. It grows rapidly in well-drained, upland sites, while transplanting with relative ease up to 2 inches in diameter. It is shade intolerant; therefore, is a good specimen tree in full sun. It can be used in institutional grounds, parks, or in golf courses. Black Oak is often found associated with Scarlet Oak and hybridizes readily. It exhibits many of the same environmental tolerances as Scarlet and Red Oak. It should become a more valuable tree in the trade.

Pin Oak *(Q. palustris)* displays a pyramidal habit of growth, reaching 60-70 feet in height. This tree, with a strong central leader and horizontal branches (rarely over 20 feet in length) has great eye appeal for individual home landscapes. This is a relatively short-lived tree, when considering oaks rarely live over 80 to 90 years. Pin Oak thrives in very poorly-drained, acid soils. It has been used as a street tree but is almost always a disappointment. Pin Oak may have a place as a native tree in golf courses, parks, and industrial grounds, but should not be used in the home landscape or as a street tree. Its disadvantages include extreme susceptibility to oak wilt, moderate susceptibility to ozone and salt spray and iron chlorosis (deficiency) on disturbed sites, which include almost every landscape. Dr. Smith at Ohio State University has reported iron citrate implants overcoming the problem of iron chlorosis but considering the high maintenance requirements, disease susceptibility, and urban environment intolerance, this ornamental should be very low on one's recommended list of trees.

English Oak *(Q. robur)* is a pyramidal tree when young, reaching 70 to 80 feet at maturity with a rounded crown. The foliage is a rich dark green throughout the summer with little or no fall color. This oak transplants readily into well-drained fertile soil. It is a good specimen tree for parks, institutional grounds, golf courses, in the home landscape, and as a street tree. It is tolerant of urban conditions, especially air pollution, salt, and anthracnose. *Q. robur* is less susceptible to oak wilt than Scarlet Oak, but more susceptible than White Oak. This is a relatively low maintenance tree, but it grown on marginal sites (heavy soil), borers can become a problem (reported by Michigan State University). Although there are many native trees which thrive under the varying conditions, English Oak fills an interesting niche intermediate between red and white oaks.

The white oak group includes White Oak *uercus alba)*, Swamp White Oak *(Quercus bicolor)*, and Bur Oak *(Quercus macrocarpa)*. This group is long-lived (White Oak being reported 750 years old), fairly resistant to oak wilt, and adapts to a wide range of sites. Generally, the lobes on the leaves are obtuse or oval for the entire white oak group.

White Oak *(Q. alba)* is native to an extensive geographic range in all areas east of the Great Plains. This plant is valuable for its lumber as well as an exciting landscape specimen. The habit is pyramidal when young, becoming an 80-foot oval at maturity. The leaves are a bluish-green throughout the summer and change to rich red to brown in fall. White Oak transplants easily when young (under 1½ inches in diameter) into fertile, well-drained