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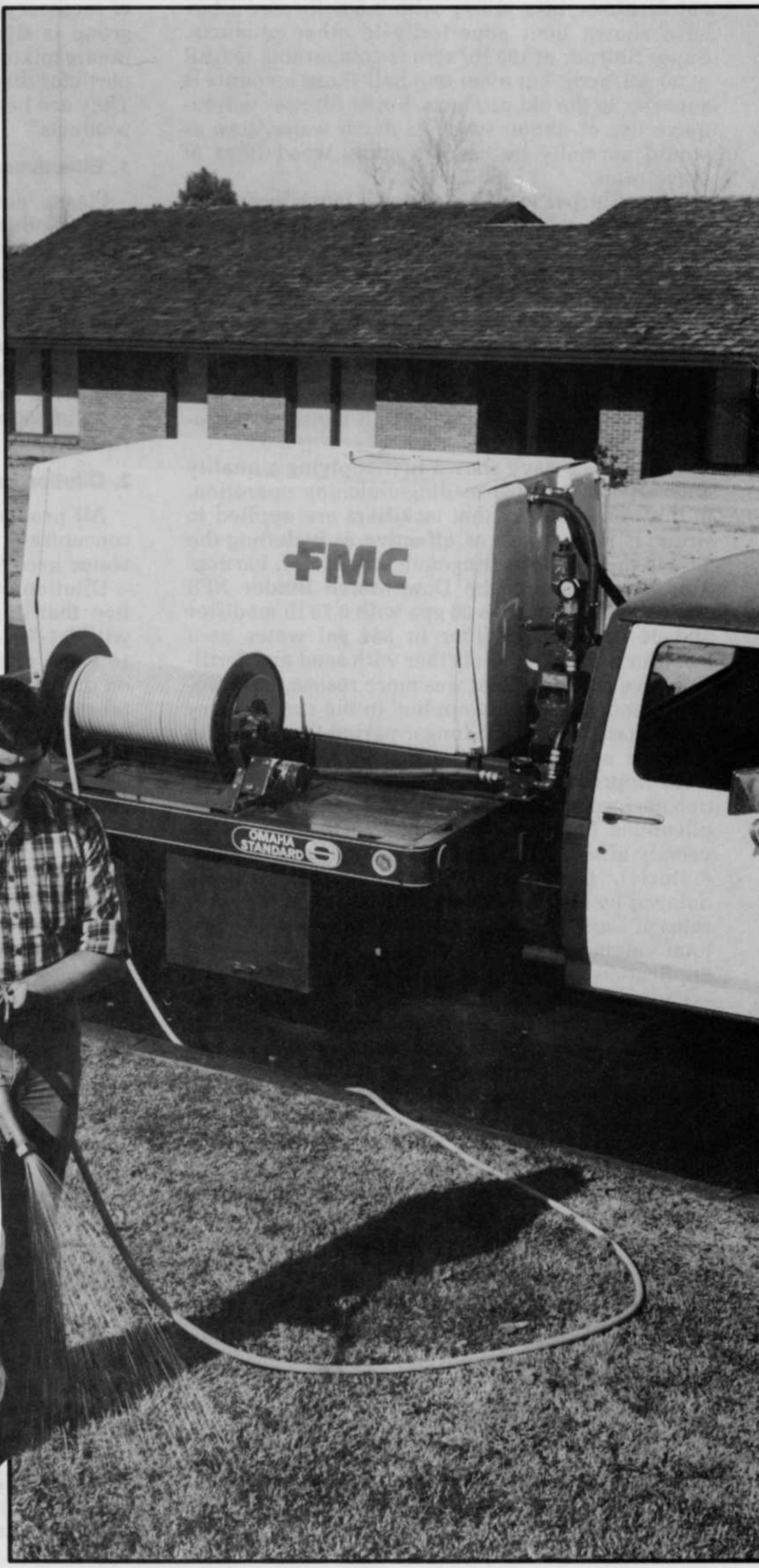

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Mulches *from page 20*

Applications of Super Slurper or Dow SBR without fertilizer in a slurry with 1,500 lb/acre fiber have shown their superiority to other products. Super Slurper at 100 lb/acre is comparable to SBR at 30 gal/acre, but even one-half these amounts is superior to the old products. Super Slurper will require use of aboutt twice as much water/acre as would normally be used to apply wood fiber at these rates.

Super Slurper in a fiber slurry is much less effective when used with fertilizer. SBR, in contrast, is made only slightly less effective by fertilizer. Previously tested was another SBR product which was seriously affected by fertilizer in that rubber balls were formed when fertilizer was added.

These two products are quite different in the form they take. SBR cures to a crust or film, whereas Super Slurper does not cure, but forms a viscous water-absorbing surface if moisture is present.

Recent tests have shown that applying a quality glue after the hydro-seeding-mulching operation, in the same manner that tackifiers are applied to straw, is many times as effective as including the glue in the hydro-seeding-mulching slurry. Particularly effective was the Dow Mulch Binder XFS 4163-L. Rates as low as 20 gpa with 0.75 lb modifier and 86 lb of wood fiber in 344 gal water as a tackifier over 1,500 lb of fiber with seed and fertilizer gave a surface that was more resistant to rainfall impact than 60 gpa applied in the single slurry or resistant for a much longer period than 20 gal in a single application. Similarly PVA applications were improved by a split application. Super Slurper performance was similar in single or split applications. Plant emergence or growth were not adversely affected by splitting the application of any material. Germination may be reduced and delayed by use of fertilizer with SBR. Using higher rates of seed will compensate for this loss. The low total volume of SBR required will call for careful application.

There is a hazard to the seed in using highly effective mulches or additives. These products or combinations may retain enough moisture to allow germination when the moisture in the soil is too low to permit establishment. Simply covering the seed with soil may be more effective in that the seedbed will remain dry until enough moisture is available for both germination and growth. Where enough moisture for growth is present or can be provided, Super Slurper might help keep the soil surface moist during the germination period.

Soil Binders

Plastic emulsions have been used for about a decade to bind surface soil particles for protection from wind and water erosion. Their use has been limited, however, by relatively high cost and by numerous reports of ineffectiveness and negative effects on plant establishment (Sheldon and Bradshaw 1977). Among the emulsions used are polyvinyl acetate homopolymers or vinyl acrylic copolymers, generally called PVA. Commercial versions are Aerospray 70, Crust 500, Curasol AK, Enviro, MGS, Stickum, Terra Krete, and Soil Bond. Soil Seal, similar in effectiveness, is a copolymer of methacrylates and acrylates. Another chemical group is styrene butadiene (SBR). All are an intimate mixture of high-molecular-weight polymeric particles dispersed in a continuous aqueous phase. They are basic ingredients in paint, glue, and other products.

1. Effectiveness and rate

Plastic emulsions give better initial protection than do other commonly used erosion-control practices. The optimum rate determined by the California Department of Transportation is 1,000 lb/acre of dry solids (about 200 gpa) for the polyvinyl acetates (750-1,100 lb/acre on various soils). Most emulsions are about 9 lb/gal and 55% solids. Recent tests compared PVA with an experimental SBR from Amsco Division, Union Oil Company at rates of 500 and 1,000 lb/acre solids. SBR at 500 lb. was similar in effectiveness to PVA at 1,000 lb.

2. Dilution rate

All products tested to date are sold as a liquid concentrate to mix with water. The amount of water used is critical.

Dilutions of 5:1 to 10:1 PVA are far more effective than higher dilutions. Comparison of water, with 5:1-7:1 optimum, 8:1 and 9:1 satisfactory, and 10:1 less effective. All of the tests were conducted on dry sand. Emulsions were applied to a horizontal surface of 13 x 19 inches and allowed to cure at about 60°F for at least two days. The surface was then inclined at 1:1 (steeper than the natural angle of repose sand). The surface was then exposed to artificial rainfall at 6 inches/hr. 3-mm drops, or 6 inches/hr composed of 2 inches/hr, 2-mm drops, plus 4 inches/hr as a mist. Some treatments survived over 120 inches of the latter type of rainfall.

The optimum dilution rate could be expected to be different with other products, on other soil materials, and with other soil-temperature and moisture conditions. Optimum dilution is far less critical for SBR. Tested were 6:1, 12:1, 24:1, and 36:1 at 500 lb/acre solids. The lower these dilution rates, all equally effective, were superior to the 36:1 dilution.

The poor performances of commercial applications can often be traced to the use of too much water. When the emulsion is applied as a component of hydroseeding, a frequent practice, the water required to carry the wood fiber and other components is often greater than the desired PVA dilution. Hydroseeding machines will normally pump 3-5% fiber by weight. If the contract called for 1,500 lb fiber and 200 gpa PVA the dilution rate would be 30:1 at 3% and 18:1 at 5%. (Both the liquid and solid effect of the PVA as well as the possibility of an easier pumping effect of PVA are ignored in these calculations as a safety factor to avoid a plugged hydroseeder full of expensive components.) This means that the PVA must be applied separately—after the first application (containing the fiber, seed, and fertilizer). A material which is less restrictive as to dilution rates would then be advantageous by allowing a single rather than split application. However, the benefits discussed

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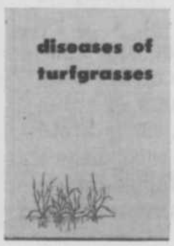

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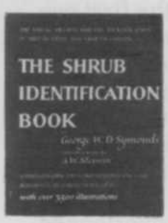

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Mulches *from page 22*

earlier of split applications allowing reduced chemical rates should easily make up for the cost of a second application.

3. Curing of emulsion film

A primary limitation of emulsions is the restriction placed on curing. The minimum curing temperatures generally recommended are 55° F for PVA and 40° F for SBR. Also required are proper drying conditions. Fog will prolong by many days the curing time of either emulsion, and rain before the emulsion is properly cured may prove the crust to be ineffective. A logical use of the materials would be when the construction project halted for the winter. Unfortunately, however, weather conditions which halt construction are the same as those which slow the curing of emulsions.

4. Effect on plants

Plastic emulsions are not generally toxic to plants even if sprayed directly on them. They commonly reduce establishment, however, and delay emergence of grass seedlings. Grass seedlings may have a tip burn. These problems are apparently the effect of fertilizer used with the emulsion and seed, rather than the emulsion itself, and are particularly a problem on sandy soils, and not on clay soils. Fertilizing separately, after seeds have germinated, has avoided the problem of fertilizer burn.

The most practical way so far of offsetting reduced seedling numbers has been to increase the seeding rate. Doubling the rate of Blando brome from 50 lb to 100 lb/acre has generally compensated for plant losses due to fertilizer, and sometimes resulted in an increase in numbers, ground cover, and pounds of grass growth. Wood fiber is an essential part of an emulsion treatment, particularly if seeds are used. PVA emulsions will not stick seed or fertilizer to a soil slope. Unless a fiber is added the seed and fertilizer will wash off readily. Do not apply fiber and seed after the emulsion, for they will wash off.

5. Other considerations

Freezing temperatures destroy all uncured emulsions. Biological activity also may limit the storage life of emulsions. Crusts formed by emulsions may shed most of the rainfall. Therefore they may limit plant establishment and growth in low rainfall areas and soils of low water-holding capacity. Crusts are not self-healing. The treated area must be protected from vehicles and animals, and breaks should be repaired. Crusts will not survive frost heaving. The emulsion could be used very effectively with transplanted shrubs. A soil-active herbicide could be used with them to provide a weed-free erosion control program.

SOIL AND ROCK MULCHES

Soil and rock mulches are often overlooked as the most practical solution to plant establishment and soil protection problems. The microsites created by rough seedbeds or rock provide seed coverage, separation of seed and fertilizer, and a mulch effect.

The importance of microsites to the establishment of plants was illustrated by Evans and Young (1972). In their Nevada study, seedling emergence and the growth of downy brome, medusahead, and tumblemustard were favored by seed burial, pitting of the soil surface, and soil movement. Air temperatures were continuously measured at the soil surface and 3 cm. above, and soil moisture from the surface to 1 cm. deep, and at 3 cm. Results showed that depressed sites retain moisture longer at the surface and have more favorable atmospheric moisture and temperature regimes than the flat soil surface. Conditions are also created for more adequate soil coverage of the seeds, which in turn further modified their environment.

A practical approach on steep slopes, such as highway cuts, is the use of benches, serrations, or simply rough grading. The rough effect can often be achieved by simply eliminating the final grading operation. Special pitting equipment is available for nearly-level sites. "Track walking" (walking a tractor on a slope to create cleat marks) is widespread and very effective.

Mulches of crushed stone or gravel one inch deep provided more effective erosion control than 4,000 lb/acre of straw, and heavier rates of stone were even more effective (Meyer et al., 1972). Field observations in Nevada and California also show a ground-cover of gravel to be effective for reducing wind and water erosion and encouraging invasion by indigenous plant species.

RELATIVE EFFECTIVENESS AND ECONOMICS

Mulching practices vary considerably in cost and effectiveness. Sometimes the characteristics of the site to be stabilized determine the only practical treatment. Usually, however, there are alternative methods which should be considered.

Seed coverage and mulch should be the first consideration. Seed germination and plant establishment will be improved more by seed coverage than by any other treatment. Mulch treatments increase in effectiveness with both the amount of mulch per acre and the length of the fiber. While it is possible to apply excessive amounts of mulch, economic considerations usually prevent it. The importance of fiber length, however, should not be overlooked. Increasing the fiber length (as from wood cellulose fiber to straw) may greatly increase the effectiveness of erosion control and germination (Kill et al., 1971; Perry et al., 1975). This relatively large increase in effectiveness can be achieved at little or no increase in cost. Even increasing the length of wood-cellulose fiber from a recycled paper product to virgin wood fiber improves results with little effect on cost. Table on page 19 (adapted from Kay, 1976) compares relative effectiveness and costs as observed on roadside erosion-control projects in California. Ranges of cost figures are based on conversations with contractors and review of California Department of Transportation contract bids (all bids, not just low bids) for the 1973-1975 period. Labor costs are at union scale.

The most expensive practice is not necessarily the most effective. For example, straw plus a tackifier is more effective for both erosion control and plant establishment than many of the more expensive treatments. A rough seedbed or covering the seed may be the cheapest and most effective treatment for establishing vegetation. **WTT**

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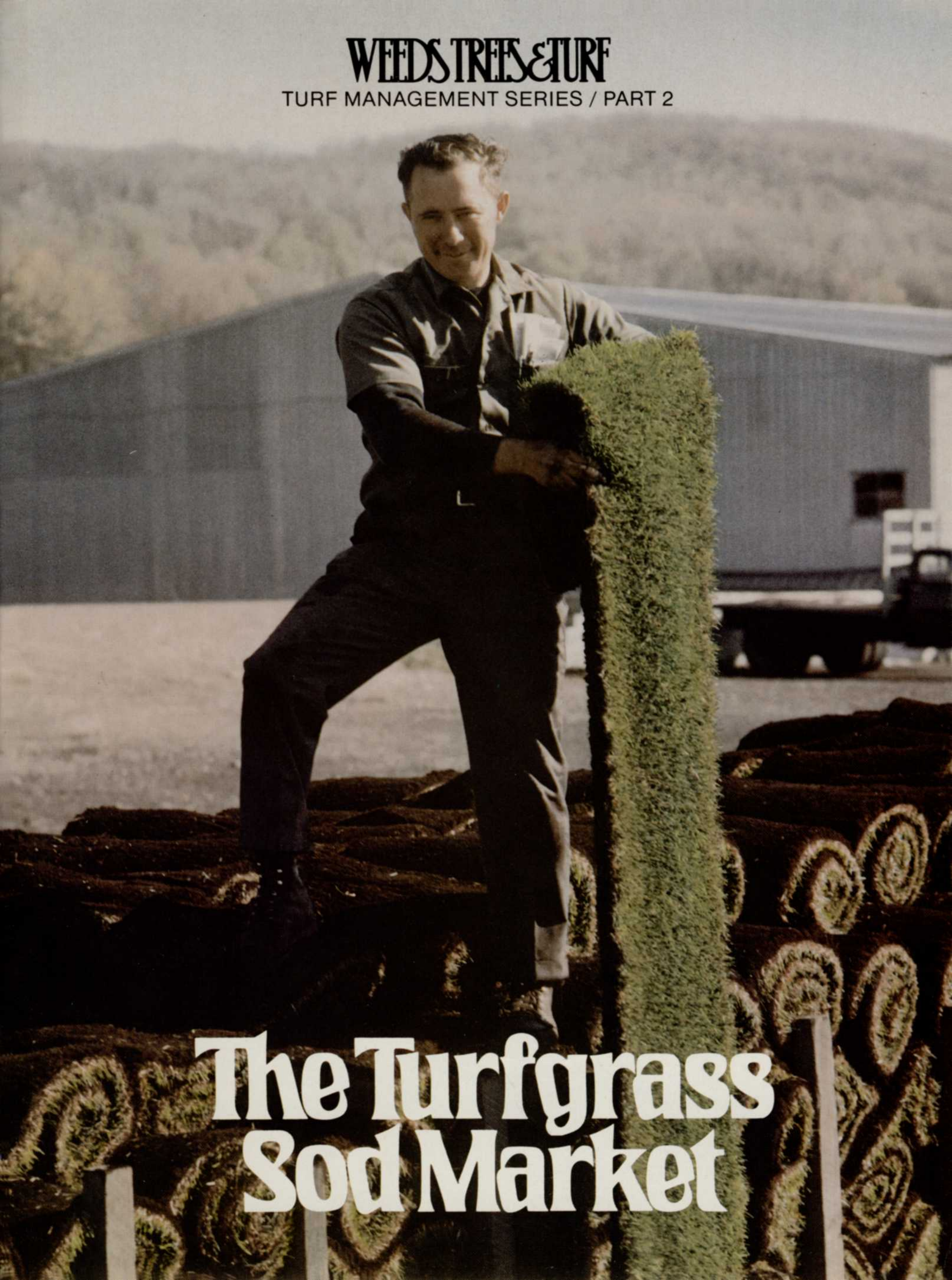
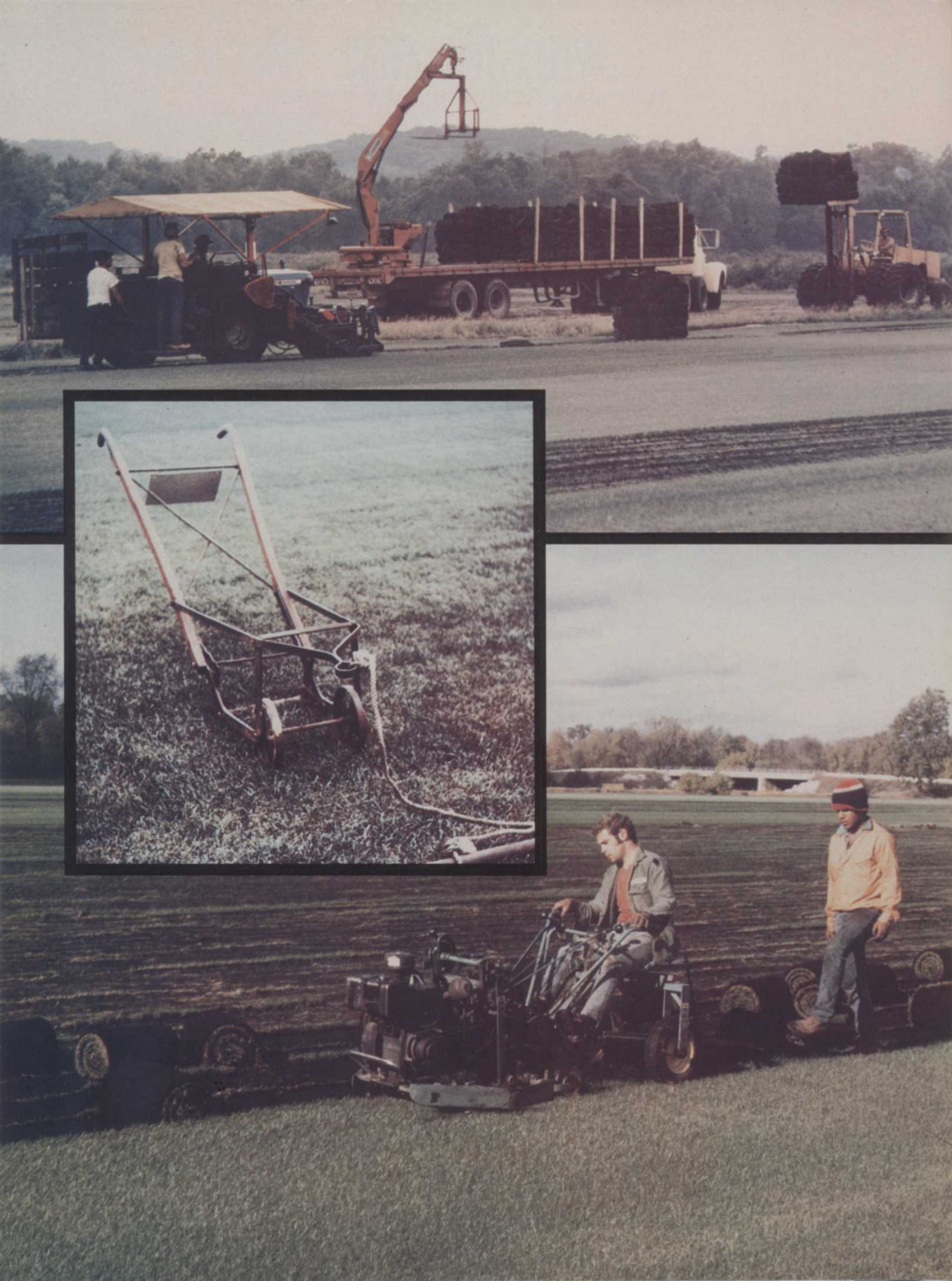


The Turfgrass Sod Market



The Turfgrass Sod Market

THE FORMATIVE YEARS

The cultivated sod industry, like the seed industry, began as a mechanism to transplant natural stands of common bluegrass from their rural location to the urban environment. Tied closely to the construction industry, both industries grew as man left the farm to take part in the American industrial revolution.

The original sod producer was really a landscape contractor who would pay farmers in the neighborhood of $100 per acre to cut and remove the pasture sod from their fields. If a job called for instant grass, the contractor would go looking for the fields and the men required. Equipment was primitive and the work required many men to accomplish.

By the 20's, a few cities could support a firm devoted mainly to obtaining and delivering sod to contractors. Unfortunately, few of these companies still exist today. The Depression delayed the progress of the sod industry during the early 30's. By the end of the 30's the market had begun to recover. The concept of planting fields specifically for sod use had taken hold, although pasture sod production still takes place today, mainly for specific jobs requiring native grasses or very low quality sod.

According to Ben Warren of Warren Turf Nurseries in Palos Park, IL, the sod business was one of few healthy and promising businesses in the late 30's when he started. Warren had worked for his uncle as a landscape contractor for nearly ten years and wanted to step out on his own. He surveyed various markets for potential and noticed that two sod companies in the Chicago area were doing very well. In 1938, Warren founded his business, and has since led the way for other sod growers in the U.S., at least in cool season turfgrass sod production.

Ben Warren

Organizer of both Midwest Sod Growers Association and the American Sod Producers Association. Warren is a pioneer in improved turfgrasses for sod and owner of sod nurseries in five states totalling 4,500 acres.

Warren later used vegetative production techniques for much of his bluegrass sod. Vegetative production's history parallels cool season sod production. Early production of bentgrass and bermudagrass stolons dates back to the 20's. Large nurseries of bermudagrass began in Florida at that time and that state developed the first certification program for vegetative parent material, not sod. Southern Turf Nurseries in Tifton, Georgia and Cal Turf in Ventura, California were leaders in mechanization and development of vegetative sod production. See sidebar for more information.

The transition from pasture sod to cultivated sod is still taking place in Europe. A small amount of pasture sod is still used in the U.S. Eastern sod specialists have four categories for sod. The first is cultivated sod which is produced from seed or stolons, carefully managed for weed control, harvested and sold as high quality turf. The second is semi-cultivated sod which is obtained from pastures seeded for the purpose of sod harvesting. Improved pasture sod is third. This sod comes from natural stands which are fertilized and harvested. Finally, there is unimproved pasture sod. The only management of this sod is mowing prior to harvesting.

The quality improved with each type of sod. The sod producer gained control over his product through improved turfgrasses, mechanization, chemicals, irrigation, and advances in the science of management.

In the mid-40's, Ryan developed the sod cutter. This engine powered oscillating knife enabled sod producers to harvest faster and improved the consistency of their product. Considerable labor was still required to roll and load the sod. In 1954, Ryan added a devise to cut the sod into sections and in the 60's an implement to roll the sod as it was cut. Despite this early progress, ways to cut manpower did not develop until the mid 60's.

Merion Kentucky bluegrass made a tremendous impact on the sod industry as it did on the seed industry. Pasture sod harvested and planted one fall on a job site, would be nearly all crabgrass the next fall. Disease just wiped out the common bluegrass during the summer, Fred Grau, former turf specialist at Pennsylvania State University and director of the USDA Green Section, said. Merion provided the disease resistance to withstand summer stress, quick establishment in sod fields, and a more attractive sodded lawn.

Slow release fertilizers were first developed in the late 40's. The ability to reduce burn potential, supply a steady stream of nutrients to the sod, and speed up grass growth gave sod producers new control over their product. Combined with the release of Merion in 1950, the sod cutter, slow-release fertilizer gave new substance to the business of growing sod. Many of the large sod producers today got started in the 50's. However, they started with comparatively small acreages and took advantage of Merion and eventual equipment improvement to break the 1,000 acre mark. Those who did not respond to improved turfgrass are not around to tell about it.

Those who did take advantage of Merion, like William Ruthven of Canada, were able to ship hundreds of miles into markets where Merion was not available. He shipped sod as far away as Chicago and Washington, D.C. Canada still figures well in sod today with the largest single farm in North America, Gem Sod Farms in Edmonton, Alberta, and Brouwer, the largest supplier of sod harvesters and also a large sod grower in Keswick, Ontario. Today, transportation costs and inspections make export of Canadian sod less attractive on a competitive basis with U.S. sod.

During the late 40's and early 50's, sod producers gained the assistance of selective herbicides and irrigation in producing a good crop in a reasonable period of time, usually 12 to 18 months.

Wiley Miner
Leader of sod industry in New Jersey and developer of one of the first effective sod harvesters.

After Merion was introduced, it was often grown as a monstand. The blend and mixture of turfgrass varieties did not come until the late 60's.

The 60's showed the sod industry as a viable and creative group. The sod grower began the decade as an independent using his ingenuity to solve equipment and marketing problems. He ended the decade organized, with improved equipment, and responsive to changes in turfgrass technology.

Many sod growers tried to solve the material handling problems of sod. They include: Wiley Miner of Princeton Turf Nursery of Hightstown, NJ, and Woodrow Wilson of Eastside Nursery of Canal Winchester, OH, who developed the Princeton harvester; Gerry Brouwer of Keswick, Ontario, Canada who developed the Brouwer harvester; John Nunes of Nunes Manufacturing of Patterson, CA who developed the Nunes harvestor; Martin Beck Sr. of Beck Turf Nurseries in Auburn, AL, who developed Beck's Big Roll harvester; and others who put time, energy and money into solving the equipment problem, such as Ben Warren; William Daymon of Michigan with his sod roller; Ray Jensen of Southern Turf Nurseries of Tifton, GA, with his zoysia plugger and stolonizer; and Toby Grether of Cal Turf Nurseries in California with his fork lift and net layer. In fact, today out of the five major makers of sod cutting and harvesting equipment, four are sod producers as well as equipment manufacturers.

From the standpoint of sod organizations, the Midwest Sod Growers Association was the earliest in the mid-50's. Consisting of sod producers from Illinois, Wisconsin, Michigan and Indiana, the Illinois group organized to correct through lobbying highway sod standards in 1957. The group was fighting specifications for 3-inch thick sod for highways. They knew that thinner sod actually took root more quickly than thick sod.

Common bluegrass pasture sod *near Washington D.C. in the 40's. Photo courtesy F.V. Grau.*

They also knew the weight problem of thick sod and the likelihood of sliding down embankments. They won their case and continued to serve as a force in sod production until the formation of the American Sod Producers Association.

Another early organization was the New Jersey Cultivated Sod Growers Association, formed in 1964 with the leadership of Wiley Miner and Dr. Henry Indyk of Rutgers. This group supported the development of a sod certification program for New Jersey. The mid-60's were very exciting years for New Jersey sod growers with the creation of an organization, the development of certification and the first demonstrations of a sod harvester prototype designed by Miner at the New Jersey summer field days in 1966.

During the 60's a group of five sod producers and a number of turf specialists began meeting at the Golf Course Superintendents Association of America Show. They included Ben Warren, Tobey Grether, Wiley Miner, Gene Johanningsmeir of Michigan, and Jim Ousley of Florida. Meeting with them were turf specialists Dr. Henry Indyk of Rutgers, Dr. William Daniel of Purdue, Don Juchartz of Michigan State University, and Dr. Elwyn Deal of the University of Maryland. Finally in 1967, at the GCSAA Show in Washington, D.C., Warren made the motion to create a national association and Miner seconded it. The industry finally had its own voice. Growing slowly at first, the organization has had three executive directors in its history. First was George Hammond of Paint Valley Bluegrass in Columbus, OH; second was Indyk from 1969 to 1973; and third Bob Garey from 1973. In 1973 American Sod Producers Association began holding a winter meeting as well as a summer field day. Today, ASPA has nearly half of the sod producers of the U.S. as members and supports research at various universities across the country.

Those states that have sod certification started it in the 60's. New Jersey established the first certification program which was followed by Maryland and Virginia. Basically, certification consists of inspection of fields prior to planting, approval of the seed blend or mixture, and periodic inspections during pro-

Early vacuum *at Warren's Turf Nursery in 1956. (left) Sod cut at 1/2 and 1 inch (below). Loading truck from field showing manpower requirements of sod cutting below). Photos by F. V. Grau.*