Soil Modification Report

Dr. Joseph M. Duich, Associate Professor of Agronomy at Pennsylvania State University University Park, reported preliminary results of tests with 81 soil mixtures studied under putting green management.

Water infiltration rate was considered the most reliable index of what was occurring in the plot, Duich said, but he cautioned that desirable rates cannot be standardized but must depend on grasses, climate, irrigation system, and other local factors. In Penn State plots, heavy compaction was applied to various combinations of sand, peat, and soil, with a substantial reduction of infiltration rates. The definite trend toward decreasing infiltration over a four-year test period spotlights the need for long-range research, Duich commented.

Coarse sand (5-Q) proved best in easing compaction, with a rapid increase in effectiveness as sand content was increased from 40% to 80%. However, infiltration in these plots also decreased greatly over the test period. Fine sand increased infiltration the least but showed a less drastic decrease. Concrete sand proved intermediate. With sand-modified plots (as with calcined clay and slags also tested), Duich concluded that "the effectiveness of sand type over a period of years is primarily determined by size and range of particle sizes and the gap between silt and the most predominant sand size."

Growing Grasses in Shade

Estimating that about 20% of the turfgrass area in the U.S. comes under the influence of shade, Dr. James B. Beard, Assistant Professor in Crop Science at Michigan State University, East Lansing, cited several shade factors that alter grass growth and cause management problems.

Shade will be the greatest problem where there is a dense stand of trees, forming a thick canopy able to screen out as much as 95% of radiation. This causes reduced light intensity, altered light quality, moderation of temperature extremes, restricted wind movement, increased relative humidity, increased intensity and duration of dews, decreased carbon dioxide in the air, and tree root competition for water and nutrients.

Trees respond to these conditions with reduced root and shoot growth, and reduced rhizome or stolon growth. In general, root growth decreases more rapidly than topgrowth, lowering the ratio between the two. Turf density is reduced and a more upright growing habit is noticeable. At Michigan State, test plots were established under a dense sugar maple canopy to study the effect of shade on different grasses.

Beard's conclusion: grass responses are primarily to diseases rather than to such factors as moisture, etc. While shade-planted Merion and common Kentucky bluegrasses never recovered from disease attacks, Pennlawn red fescue grew stronger and was the only individual grass to increase in density over a three-year period, though a mixture of 33% each of Pennlawn, common Kentucky, and roughstalk bluegrass showed highest density at the end of the test period. Mixed stands moderated the severity of disease attack on any species.

Beard offered these suggestions for growing grass successfully in shade: use adapted grass species, such as Pennlawn, St. Augustine, and improved Bermudas; raise mowing height; avoid excessive nitrogen; use deep but infrequent irrigation; and avoid excessive traffic. Managing trees will also help: prune limbs up to 8 to 10 ft.; thin limbs in crown area; remove surplus shrubs and brush; pick up fallen leaves immediately; and avoid surface tree feedings under dense shade.

Of Crabgrass and Insects

"Of course crabgrass is here to stay," Dr. Ralph Engel, Professor of Turf Management, Rutgers University, New Brunswick, N. J., told turfmen. But even so, it's not the problem it was 20 years ago. Giving much of the credit to preemergence herbicides, the Rutgers expert advised turf managers not to be frightened from their use by an unsuccessful experience.

Choose the correct chemical. On the basis of his research experience, Engel singled out DCPA, DMPA, and siduron. Apply most preemergents in dry form for best results, and apply at the right time of year. Respect the tolerances of a given grass, and use extreme care to get an even application at the correct rate.

John C. Schread, Entomologist

New officers of the Golf Course Superintendents Association of America. From left to right: Walter Boysen, superintendent, Sequoyah Country Club, Oakland, Calif., president; Director Robert Mitchell of Sunset Country Club, St. Louis, Mo.; James Brandt, vice president, from Danville, Illinois Country Club; Keith Nisbet, director, from Westview Golf Club, Aurora, Ontario, Canada; and Herman Johnson, director, from Quail Creek Golf and Country Club, Oklahoma City, Okla.

WHIZARDS

Small International® fleet handles all the

Palma Ceia Country Club observed its 50th anniversary at Tampa, Florida, last year. Its annual tournaments include the Florida Seniors and the Gasparilla Festival. Members are challenged by huge, ominous traps and by more than 500 trees—a dozen varieties ranging from banana and mock orange to holly and weeping willow. All fairways are underground irrigated and kept clipped to one-half inch. Superintendent Kelly Kee says, "My members insist on seeing that ball from tee to green." Palma Ceia is one of the most demanding, high-maintenance mowing jobs of any club in the country. That makes Mr. Kee an International man. All International.

OLD FAITHFUL This is one of two 5-year-old IH tractors which have carried the mowing load for five years—gang mowing fairways and flail mowing the rough. Mr. Kee says, "We haven't had a total of 3 days down time since we got them."

EXACT FIT Mr. Kee says this new 2424 Lo-Boy® is sized just right for his operation, and foresees a time soon when two of them with the 3414 will handle all his maintenance. The IH fleet is expected to do all construction, too. This year, for instance, four greens will be torn out, reshaped and rebuilt in a major modernization program.

year round maintenance at demanding Palma Ceia Country Club

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INTERNATIONAL HARVESTER COMPANY

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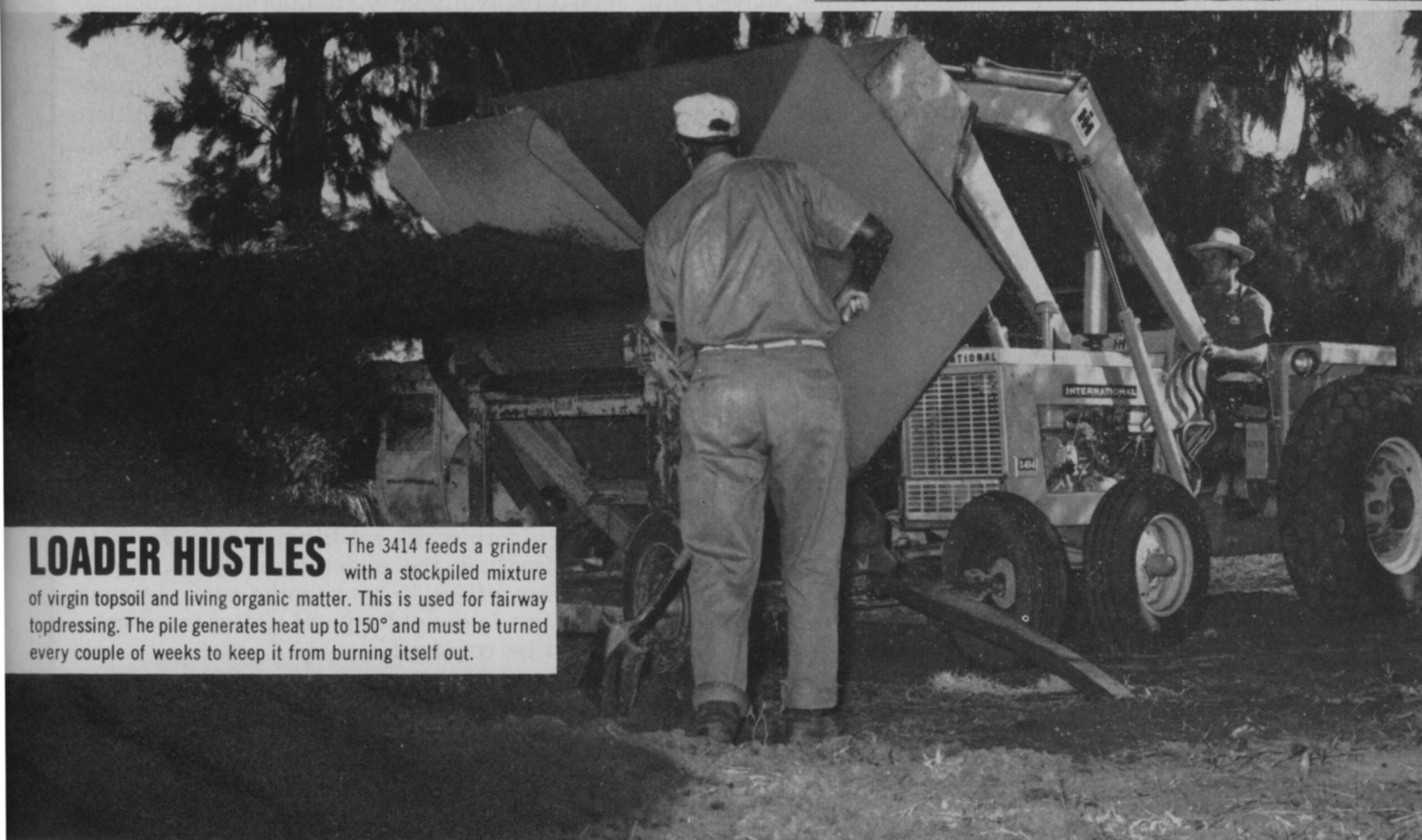
Mr. Kee has been in turf work for 43 years, supervises 15 men year-round at Palma Ceia. Of his 3414 loader tractor he says:

"We bought that one on competitive demonstration—looked at others just to make sure we weren't wrong sticking with International. And we weren't. The 3414 was tops. We use it for everything. It handles topsoil, pulls the aerator, gang mows, and serves as a scraper on our maintenance roads. We use it with a disc for rebuilding tees, pull out posts and stumps with a chain, and even carry sand a bucket at a time from a central pile to our bunkers. That way we avoid the compaction of a truck."



LOADER HUSTLES The 3414 feeds a grinder with a stockpiled mixture of virgin topsoil and living organic matter. This is used for fairway topdressing. The pile generates heat up to 150° and must be turned every couple of weeks to keep it from burning itself out.

at the Connecticut Agricultural Experiment Station, New Haven, cited the frit fly, clover weevil, and European chafer as newer insect problems for turf managers to contend with. Frit fly damage is already a fact; clover weevil damage has been noted on golf courses in New York; and the European chafer is posing a problem similar to other white grubs, such as that of the Japanese beetle.

Schread pointed to these controls: DDT seems to be lessening in its control of the frit fly, but lead arsenate has given satisfactory results; in two locations, dieldrin and Diazinon have controlled the clover weevil; and chlordane and dieldrin are now in common use against chafers.

Noting changes in insecticide recommendations because of pest resistances, Schread used frit flies and DDT as an example. Another is the chlordane-chinch bug relationship, which is often unsatisfactory nowdays from the turfman's standpoint. Diazinon, ethion, Sevin, Trithion, and Baygon have killed chinch bugs and are in wide use in place of chlordane, Schread stated.

GCSAA's '67 election produced the following officers for the coming year: president, Walter R. Boysen, Oakland, Calif.; vice president, James W. Brandt, Danville, Ill.; rechosen secretary-treasurer was John J. Spodnik, LeRoy, Ohio. Plans are already underway for 1968's "Greatest Show on Turf," due to convene in San Francisco, Calif.

(For a detailed report of sod producer activities, held in conjunction with this year's turf meeting, turn to *WTT's* Sod Industry Section, page 26).

VPI Turf Course Described

A new leaflet, describing opportunities in turf ecology and Virginia Polytechnic Institute's four-year Turf Option in the Department of Agronomy, has just been made available by the school. To obtain a copy or more information about the study program, contact Dr. H. L. Dunton, Head, Department of Agronomy, Virginia Polytechnic Institute, Blacksburg, Va. 24061.

Fertilizing Helps Turf Crowd Out Weeds

(from page 14)

improved turf vigor, not all of nitrogen's value going to benefit crabgrass.

Seedbed nitrogen was more help in combating crabgrass in Merion than was maintenance nitrogen. However, only when maintenance levels were low was seedbed nitrogen of value in suppressing crabgrass in Kentucky bluegrass-red fescue turf. It is apparent that grasses and grass mixtures vary so greatly in their response to fertilization that changes in the competitive nature of the grasses affect weed infestations.

Maintenance Nitrogen Combats Dandelions

Relations of seedbed and maintenance nitrogen treatments to dandelion infestation was also studied in this field experiment (see Table 6).

Maintenance nitrogen had a pronounced effect on numbers of dandelion plants found in Merion bluegrass turf. Plots having high seedbed nitrogen produced fewer dandelions than those with low seedbed nitrogen except where Merion was maintained under high levels. In this case, there was no significant difference, and the value of maintenance nitrogen was so pronounced that it masked any effect of seedbed application. In general, maintenance nitrogen did more to reduce dandelion infestation than did seedbed treatments.

Thus, the perennial weed, dandelion, competes with turfgrasses differently from the annual weed, crabgrass. Getting new turf off to a fast start with plenty of nitrogen helps more to slow down and keep out crabgrass than dandelions. On the other hand, continued fertilization as a regular maintenance practice proves a greater asset in keeping dandelions out than in preventing crabgrass infestations.

Findings and Recommendations Summarized:

Crabgrass seedling vigor is influenced by watering and by competition from bluegrass. In turn, competitive nature of bluegrass varies with moisture availability, temperature changes, and fertilization practices. These weed-turfgrass growth relationships are important to predict the effectiveness of preemergence crabgrass killers. A crabgrass seedling that is growing well because of relatively moist soil or lack of competition from bluegrass will more likely escape the effects of a chemical weed killer than a slow-growing seedling.

With preemergence herbicides, fertilize turf well and so water it that a dense grass cover is produced prior to crabgrass germination. Adequate nitrogen in the seedbed of a newly established turf is good insurance against crabgrass. Use of extra nitrogen from ureaform sources has proved of value to get turf off to a faster start. In this way, bluegrass turf can help make a chemical crabgrass control treatment more effective.

Regular fertilization of established turf, particularly during late summer and early fall, will help cut down populations of dandelions and other weeds. Remember, the vigor of weed seedlings has an influence on how readily they are controlled by chemicals. The more vigorous the seedling, the harder it is to kill; the weaker the seedling, the easier it is to kill. Make chemical weed control most effective by keeping turf vigorous and competitive. Where this is done, frequent use of weed control chemicals should not be required.

Sodmen Move to Form National Group

Meeting in the Washington (D.C.) Hilton Hotel in conjunction with the 38th International Turfgrass Conference, sodmen from around the country took initial steps to form a national association of sod producers.

Action came at the Thursday, February 9, sod session, chaired by Dr. Henry Indyk, Rutgers University extension specialist. "In the absence of a formally organized national sod producer organization, a program committee with representation from the sod industry and educational institutions scheduled the Sod Producer Session to provide producers an opportunity to meet on a national basis to discuss developments as well as problems pertinent to the rapidly growing sod industry," Indyk told *WTT*.

Opening the discussion of a national group, Indyk announced that the Mid-America and New Jersey sod associations had formally voiced approval of a national organization, and that support had been received from other groups and producers.

With an eye toward a committee representing as wide an area as possible, these sodmen were chosen to study details for the proposed association: Wiley Miner, Princeton Turf Farms, Inc., Cranbury, N.J.; Ben Warren, Warren's Turf Nursery, Palos Park, Ill.; Tobias Grether, California Turf Nurseries, Camarillo, Calif.; James E. Ousley, Ousley Sod Co., Pompano Beach, Fla.; and Eugene D. Johanningsmeier. Hiram F. Godwin and Son, Inc., South Lyon, Mich. Named to the committee in an advisory capacity was George Hammond, Paint Valley Bluegrass, Columbus, Ohio.

This year's sod program came in two parts, a morning session for producers and an afternoon session arranged by the GCSAA program committee. Next year's program will be up to the committee formed at this meeting.

Maryland Researches Sod

Leading off educational talks on the producers' program, Dr. Elwyn Deal, turf specialist from the University of Maryland, College Park, cited the growing consumer demand for only highest quality sod. Noting that there has been almost no research to date on sod production as such, Dr. Deal suggested that the three greatest agronomic problems facing the industry were rhizome development, root development, and numbers of roots and rhizomes in sod grasses.

Dr. Arne Hovin (left), USDA turf researcher, makes a point during sod producers' discussions, as Dr. Henry Indyk, Rutgers extension specialist, looks on.

How important is rhizome development? Deal pointed to recent instances of Merion sod with good rhizome development, which nevertheless failed to hold together when cut. This is an important factor when it comes to reestablishing cut sod, but it remains to be seen how important it is to the physical handling of sod.

Grasses need a good network of roots. But, how deep do they need to be? Only in the upper ½ in. to 1 in. for harvesting, but deeper roots are needed to survive under sod field conditions.

How does population density of grasses tie in? As population density increases beyond a certain point, size of individual plants decreases and when these begin to compete with each other there will be fewer roots per plant. Management practices will largely determine density and development, Deal said. As examples, overfertilization with nitrogen and overirrigation will interfere with root development. Also, mowing too often, too closely, will hamper roots and rhizomes. A 2-in. cut at intervals of a week or more is preferable to a 1½-in. cut at twice weekly intervals.

Important for producers is the manner in which sod holds together and the techniques that will produce a well-knit product. Extensive tests are underway at the University of Maryland in an effort to find out just how these factors relate.

Consider Roots and Tops

"Any long-term benefit to grasses can be achieved only if maintenance practices favor both roots and tops," Dr. R. E. Schmidt, Assistant Professor of Agronomy from Virginia Polytechnic Institute, Blacksburg, told sodmen. Leaf and root development can not be divorced; they are closely related in good grass production.

Mowing practices, moisture availability, light intensity, soil pH, temperature, and nutrition are major factors in grass production. Emphasizing nutrition, Schmidt said that as long as there is sufficient K_2O and P_2O_5 present, grasses will develop adequate roots *if* nitrogen fertilization practices do not interfere.

Nitrogen application must be carefully managed. This element

is needed for root growth, but too much will favor tops at the expense of roots. There is a big difference between adding nitrogen where none is present and overapplying nitrogen where it is already present at low levels.

Turning to other management factors, such as thatch formation and watering, Schmidt told growers they should be shooting for a 12- to 18-month production period for sod; with good management, thatch should not be too much of a problem in that time. When it comes to watering, the fine line between letting soil get bone dry and letting it dry out a bit should be observed. A bit of dryness is desirable for root growth, while higher mowing, less frequent mowing, and adequate phosphorus and potassium fertilization will help sod get through periods of drought with good recovery.

Drs. Elwyn Deal (left, from the University of Maryland) and R. E. Schmidt (right, from Virginia Polytechnic Institute) compare slides presented to sod gathering.

Wiley Miner, head of Princeton Turf Farms, spoke on industry mechanizations and sod specifications. At the a.m. producers' session, he was named to the national committee.

Sod producers Eugene Johanningsmeier (left) and Ben Warren (right) were both selected to serve on the committee investigating formation of a National Sod Producers' Association.

"Sprigging and Plugging" panelists (left to right), Tobias Grether, Wade Stith, and James E. Ousley, wait for session to get underway. Grether and Ousley are also committeemen for the proposed national sod group.

"Interim" Grass Varieties

The ideal new turfgrass for the bluegrass region should be resistant to the diseases (such as stripe smut, rust, powdery mildew, and fusarium) that are now attacking Merion, Dr. Arne Hovin, USDA, Beltsville, Md., told producers.

Ultimately, hybridization will be employed to combine disease-resistant grasses, Hovin said. For the present, some of the newer varieties show promise: Scott's Windsor; Chicago Shade, developed by Warren Nurseries; Park, which is well adapted to cooler areas of the bluegrass region; 0217, or Fylking bluegrass; and Delft, a prostrate-growing Dutch development.

Of warm-season grasses, Tifgreen "will be replaced by Tifdwarf," the first true dwarf Bermuda, Hovin predicted. Santa Ana, a West Coast development, was also cited as promising. Among zoysias, there has been no great improvement in billbug resistance, though Emerald is somewhat better than Meyer zoysia in this respect.

Also addressing the producers' gathering were Wiley Miner, president of Princeton Turf Farms, Cranbury, N.J., and Professor Wallace A. Mitcheltree, of Rutgers University.

Tracing the development of Princeton Turf Farms' new sod harvester, which is now available commercially, Miner predicted that producers will eventually have to employ mechanical harvesting techniques if they are to survive in the industry. This leads to another consideration, Miner noted: pro-

ducers will need a high quality of sod in order to handle it mechanically.

Begin Before the Beginning

"What is done before starting to grow sod can have a lot to do with what the end product will be," Dr. Deal told the afternoon sod session held jointly with golf superintendents.

Of prime importance in preparing for sod production are the selection of a suitable soil, adequate grading and leveling, adequate nutrition, and good planting practices. For sprig production, a light, sandy soil is satisfactory. But, for producing plugs or sod, a heavier soil is required. Fields should be graded until they are gently sloping. Most important, sunken patches, or water pockets, must be eliminated. Calling this a big cause of trouble for many farms, Dr. Deal recommended fallowing the field for several months before planting. This allows soil to settle so that trouble spots can be corrected, and also allows time for weed elimination.

In the early stage of grass establishment, lime and phosphorus are more critical needs than nitrogen and potash, which can best be added later. Lime and phosphorus should be thoroughly mixed throughout the top 3 or 4 in. of soil. When planting, seeding in two directions at right angles to each other is suggested. For final seedbed preparations or maintenance operations, tractor tires with cleats or lugs should not be used. This is another common cause of sod loss, Deal explained.

Why Vegetative Establishment?

Defining vegetative establishment as the use of mature plant tissues for establishing a plot of grass, Ben Warren, president of Warren's Turf Nursery, examined the advantages of this practice as it applies to both whole sod and use of plant parts, such as plugs, sprigs (stems), and stolons (stems chopped into fine pieces).

Chief characteristic of whole sod is the "immediacy" of establishment, according to Warren. A grass cover is immediately available to control erosion, or form a playing surface, or serve an aesthetic purpose. Only a short critical maintenance period of two to three weeks is required after establishment; then, normal maintenance is possible. Further advantages include purchase of a finished product, which can be examined for quality, and flexibility of installation—any time the ground can be worked.

Establishing plugs, sprigs, or stolons is often a matter of necessity when grass varieties do not reproduce from seed, or have a poor seed yield, or seed is difficult to germinate, or reproduction from seed is not consistent. Here again, establishment is marked by a shorter intense-care period and a somewhat more flexible planting schedule.

Growing, Buying, Selling Sod

Placing greatest emphasis on the importance of a *uniform* stand of sod, Dr. Indyk offered some suggestions for producing quality grasses. After selecting well-drained land with an abundant water supply and a minimum of hard-to-control weeds, and after adequate seedbed preparation, the grower must seed carefully. Late summer and early fall seedings usually perform best, often outstripping seedings made in the spring of the same year. Also, light to medium seeding rates are most desirable if grasses are to develop a good root and rhizome system.

After seeding, a constant and closely watched maintenance program will bring sod to maturity, at which time it should be thin-cut (¾ in. to 1 in. thick). Thick-cut sod complicates handling and reestablishment.

What factors should the sod purchaser consider? Wiley Miner enumerated these points: suitability of grass type to the intended area and purpose; source and maturity of sod; quality, including uniform density, texture, and color, and freedom from plant and insect pests; thinness of cut; short time lapse between lifting and installing; and such installation factors as sodbed preparation, laying, rolling, and watering sod, and main-

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Watch for more detailed Aerial prescriptions in the April issue.

GROUND FOLIAGE

CROPPED OR NON-CROPPED AREAS

1) 2 gal. T-D-B/100 gals. water. Apply to thoroughly wet foliage and stems to groundline when brush is in full leaf and actively growing.
2) 1⅓ gals. EMULSAMINE BRUSHKILLER/100 gals. water. Apply as in (1) above.

Watch for more detailed prescriptions for Ground Foliage Spraying in the June issue.

DORMANT SPRAYS

BRUSH DENSE **CANE BROADCAST**

1½ gals. DINOXOL/ 100 gals. fuel oil. Spray to thoroughly wet dormant canes and root collar zone. Spray exposed roots and suckers.

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4 gals. DINOXOL in 100 gals. fuel oil. Thoroughly wet base of clumps until solution puddles around root collar.

Watch for more detailed prescriptions of Dormant spray techniques in the September issue.

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taining the grass during its early, critical period.

"A sound, functional sod certification program can help bring a better quality sod to the market," J. L. Newcomer, University of Maryland professor, related. With the wide range in quality of sod being sold around the country, at least six states have cultivated sod certification programs underway, and the International Crop Improvement Association Grass Committee is working on General Certification Standards for Sod. Why certify? "Certification can help in marketing of quality sod of named varieties," Newcomer stated. The general public, and particularly architects and builders, want and need more information on suitable grasses and the assurance they are getting what has been requested.

Panel Views Sprigs and Plugs

"Rooting of stolons or sprigs is affected by the same three basic elements as seed: water, heat, and oxygen," Tobias Grether, president of California Turf Nurseries, told the joint meeting of golfmen and sodmen. Considering establishment characteristics of both bents and Bermudas, Grether outlined some basics for a good stand from stolon or sprig plantings.

Bents are easier to germinate and grow, though depth of planting is a critical factor. Intimate contact of stolons with soil must be established in the top ¼ to ⅜ in. of soil. Constant watering to nearly field capacity is then required. Temperature can range from a daily average of 38° to 90°, with the optimum growing temperature at 60° to 70°.

Planting Bermuda stolons is a more critical operation, and greater care must be taken to get intimate contact between soil and stolons, since material left on the surface will generally desiccate. Just as it is important to avoid planting Bermuda stolons in a dry soil, irrigation is required almost immediately after planting. Temperature average must be at least 50° with no frost to establish Bermudas and zoysias.

Describing sprigging and plugging as "the most popular methods of vegetative propagation of large turf areas in the Southeast," James E. Ousley, president of Ousley Sod Co., pointed out that bermudagrass, zoysiagrass, and creeping bent are generally sprigged, while St. augustinegrass and centipedegrass usually give better results from plugging.

Sprigging is most commonly used on large turf areas, and gives faster, more uniform coverage than plugging. It is less expensive but more susceptible to weather changes and requires greater initial irrigation. Plugging carries a higher planting cost but is desirable where only limited water is available.

Wade Stith, West Point Products Corp., West Point, Pa., emphasized temperature and moisture as determinants of how well harvested stolons will stand up. "Excessive moisture can cause disease and loss of grass and a poor stand, while dryness can cause death when stolons are planted," he related. Experiments with refrigeration of harvested grasses have shown that they can be kept in excellent condition for several weeks as long as the temperature is maintained at the proper level.

A short question and answer session followed up the "Sprigging and Plugging" forum, with much of the discussion aimed toward Ben Warren's contention that seeded Penncross bent will show considerable variability in color, texture and disease behavior when observed in space plantings.

Harder Publishes Price List

Harder Arborist Supply Company, New York distributors of a complete line of tree surgeon's tools and supplies, as well as of pesticides for arborist use, announces the availability of new price lists for both chemicals and equipment. Interested treemen can obtain a copy by writing the company at 63 Jerusalem Avenue, Hempstead, New York 11551.