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HOW TO USE YOUR SOIL TEST KIT

Results of another *Weeds Trees and Turf* field research project.

SOIL TESTING is a useful technique that can be used by contract applicators in much the same way a doctor takes a patient's temperature. Interpretation of the results of a soil test will indicate various things, such as how an operator can make his weed control, turf, and soil sterilization jobs more effective.

Soil tests are of two basic types. The first is an acidity-alkalinity test (pH). Reaction of soils with chemicals or chemically treated papers determines the concentration of positively charged hydrogen ions (H+) or negatively charged hydroxyl ions (OH−). A high concentration of hydrogen ions means the soil is acid; concentrations of hydroxyl ions means the soil is alkaline.

In addition to chemicals and treated papers, pH values may be determined by use of an instrument which measures electrical resistance between two electrodes and interprets it into pH readings.

Second type is a soil analysis test which indicates, by mixing soils with certain chemical solutions, just what chemical elements are present in the soil.

Results of either or both of these tests can be important when one is to determine how to improve "ailing" turf.

Balance Changes Affect Growth

How does pH enter into turf problems? Soil is a physical-chemical relationship of organic material, water, air, and inorganic minerals. Each of these contributes to the growth of green plants. Optimum growth occurs when all these materials are in balance. When changes occur, caused by such things as excessive rainfall or watering and consequent leaching, and over-harvesting (mowing and removing clippings), soil conditions may become unbalanced and need correction.

Applicators can make a soil reaction test to see if it is acid (sour, low pH) or alkaline (sweet, high pH) and by considering the reaction, along with the physical condition of the unhealthy turf, make a fairly accurate recommendation for corrective measures.

Acid-alkaline reactions in a pH test run a scale from 0 to 14. Seven is neutral; acids and alkalies counteract or balance each other. Below 7 is the acid range; above 7 is the alkaline range.

Consider a homeowner in Pennsylvania whose lawn is beginning to brown out in spots in spite of sufficient water. He calls a contract applicator to find out what is wrong. It could be grubs, chinch bugs, fungus disease, or drying (already disproved). The turf specialist makes a soil reaction test with chemical solutions. Soil chemicals cause the test solution to change color. Comparing the resulting color with a color chart in the kit, the operator judges the pH to be 5.

A reaction of 5, then, shows that the soil is acid. The turf manager examines the grass roots and finds that they are shallow and very weak. Considering that the homeowner watered his lawn every day, the

applicator concludes, after making a soil analysis, that the soil is deficient in calcium and magnesium because the excessive water has leached these water-soluble alkaline minerals out of the soil. This left an abundance of nonsoluble acid materials in the soil. In this instance, annual bluegrass had invaded the weakened turf. The operator suggests 100 pounds of ground limestone be applied for every 1,000 square feet of lawn, which should raise the soil reaction to 6 and supply some of the needed minerals. He also advises the homeowner to water the lawn thoroughly only once a week to promote deep and strong root growth of the desired lawngrasses.

If the soil reaction in the previously mentioned test had been favorable, between 6 and 7, the turf manager could then have looked for other causes, such as grubs and chinch bugs.

To illustrate the usefulness of a pH test in the alkaline scale, we can move to the sandy porous soils of the Southwest. Here water-soluble alkaline materials, instead of draining off, are pulled to the surface by capillary action through very porous soil. Water evaporates, leaving the alkaline minerals as a residue. If grasses grown on these soils begin to indicate weakening by a sickly light-green coloration (chlorosis), and a soil reaction of about 8 is observed, an operator should readily guess that the alkaline materials have combined with iron trace elements in the soil and made iron unavailable to the plants. Iron, an essential part of the chlorophyll molecule which makes plants green, becomes less water soluble in "sweet" soils. To lower the pH reaction one can water heavily to leach the mineral residues, or apply an acid-forming fertilizer, such as urea, to lower the pH. Again, a pH soil reaction test showed part of the cause of trouble. These examples are just two of many ways soil reaction can help.

Soil Analysis More Exacting

Soil analysis is a more exacting procedure. Samples of soil are taken and reacted with chemicals. Reactions are indicated on a color scale which tells the operator whether an element is present or not and how much is needed to correct deficiencies. Soil analysis tests and pH reaction tests generally go together and complement each other. In the case of the alkaline soil mentioned above, a soil analysis would have shown that iron was in the soil. But a pH test showed that the soil was alkaline. Researchers have discovered that iron has low water solubility in alkaline soils and plants are unable to remove it from the soil. Therefore, the tester made the correct recommendation, that of lowering the pH to make more iron soluble.

There are many soil analysis tests for almost all of the major plant nutrients.

Though physical composition of soil can be seen and touched, chemical contents (mineral elements, acids, alkalies) must be discovered by chemical means. Testing outfits, as this article shows, are useful to anyone who sprays, plants, or maintains soil. Scientific tests eliminate guesswork; formerly unknown variables are taken into account when soils are treated. First-run success is more certain.

pH Hint to Sterilant Efficacy

For those applicators who offer soil sterilization, a soil reaction test may indicate how long a certain sterilant will be effective under soil environmental conditions. If one wants to apply a water-soluble soil sterilant and finds that the soil is highly acid, he may want to reconsider his formulation or form of application. An acid soil is one which has had the alkaline materials leached out. This indicates that there is a lot of rainfall or water coming from some source. A water-soluble soil sterilant would be leached away as quickly as the alkaline soil components, and the weed control period would not last as long as anticipated. A less water-soluble formulation may be the key to longer control.

A highly alkaline soil is known to be very porous. When working with alkaline soils, one should consider a water-soluble emulsion which would break out of solution soon after application so that it would not be carried too deeply by its own water through the porous soil.

Once a corrective material has been applied to turf, the soil reaction may change. This change may have an effect on chemicals, insecticides, herbicides, or fungicides applied later. Thus soil testing leads one to the subject of incompatibilities.

Chemical Incompatibility Adversely Affects Results

When an operator is treating a phosphorous-deficient lawn for annual bluegrass *(Poa annua)*, he will replenish phosphorus by applying a fertilizer high in this element. Then he will treat the annual bluegrass weeds with a suitable herbicide. A good chemical for annual bluegrass control is calcium arsenate. But in this case, calcium arsenate should not be applied, because researchers have found that a high amount of available phosphates will deactivate calcium arsenate weed control treatments; they are incompatible. A different herbicide should be used.

Unfortunately, little is known about this kind of incompatibility, since research on this problem has been scant. Many operators whose control treatments have failed may have been victims of this kind of incompatibility.

Incompatibilities of tank mixtures are better known. Nonmiscible chemicals are subject to the same pH rules which apply to soils. Chemicals which are decomposed or changed by acids or alkalies should not be mixed

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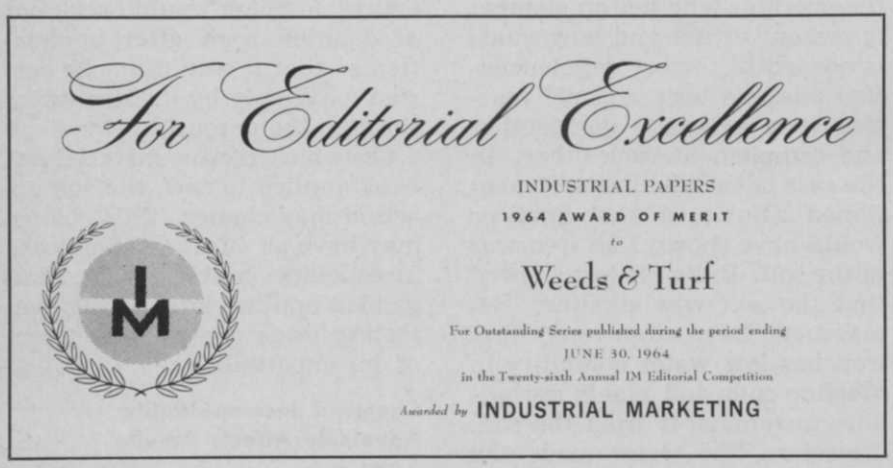

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with other chemicals which are essentially acid or alkali in content. Elaborations of noncompatible mixtures can be found in texts* dealing exclusively with chemistry and chemical descriptions of pesticides.

Soil reaction kits and soil analysis kits, available from several manufacturers, should be a part of the diagnostic materials used by the knowledgeable, progressive contract applicator. These kits are not cure-alls, just as pesticides and cultural practices are not cure-alls in themselves. But, professional use of these handy aids will help operators cite trouble, and recommend corrective measures readily when faulty soil conditions are the cause of turf problems.

* Shepard, Harold H., The Chemistry and Action of Insecticides, McGraw-Hill Book Co., Inc., New York, N.Y., 1961, p. 481. Entoma, 14th edition, E. H. Fisher, ed., Entomological Society of America, Madison, Wisconsin, 1961-1962.

St. Louis May Have Weed Law

A proposal for a weed control ordinance was recently taken under advisement by the St. Louis County Council after Counselor Norman C. Parker revealed there was no measure in the law books for the control of weeds in vacant lots, and unincorporated areas of the county.

Parker further said weed cutting can be enforced by prosecuting property owners only after the health department has determined that the weed area is a breeding ground for mosquitoes and is a health nuisance.

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An illustrated 4-page leaflet describing the life history and habits of the elm leaf beetle, means of natural control, and control with insecticides, is now available.

Titled "The Elm Leaf Beetle" (Catalog No. A 1.35:184/4), copies may be obtained by writing the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. Price of the item is 5 cents, payable in coin, money order, or check. Stamps are not acceptable.

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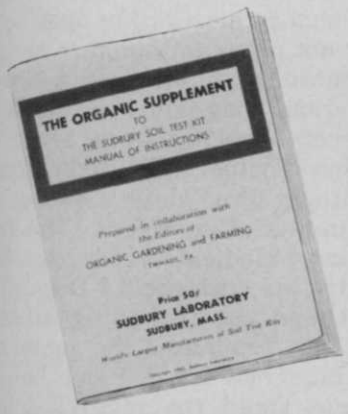

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Turfgrass Portraits VII:

Bahiagrass

By DR. ROBERT W. SCHERY

Director, The Lawn Institute

Marysville, Ohio

This is the seventh in a series of nine articles on the basic traits and maintenance procedures for common turfgrasses. Next month author Schery discusses centipedegrass.

BAHIAGRASS, *Paspalum notatum,* is even now in transformation from pasture grass to a valued ornamental. It offers the Deep South, where bahia is basic to most lawn seed blends, an alternative to the traditional hand planting of live starts. The hosts of modern homesteaders there owe mainly to bahia their chance for an inexpensively established lawn, easily maintained. Of course no one claims that bahiagrass, at least as represented by the current varieties, is an outstandingly beautiful lawngrass — it can't touch the fine-textured zoysias and bermudas, for example. But for those who are content with "average" attractiveness, bahia has much to offer for the Atlantic and Gulf coastal plains.

Paspalum notatum is native to tropical America, and reportedly was introduced to Texas from Cuba during the Civil War. More recently other bahias have been brought to the United States from South America for pastures. Varietal designations smack of the pampas—"Argentine," "Paraguay,"—while "bahia" itself suggests origin from the state of that name in Brazil. "Pensacola" bahia was found on a vacant lot in Pensacola, Florida. "Wilmington" comes from naturalized swards near Wilmington, North Carolina. And these are assuredly only beginnings in the development of better bahiagrasses for lawns.

Bahiagrass has among its relatives several "black sheep." Notorious is *Paspalum dilatatum,* the pestiferous dallisgrass, a scourge worse than crabgrass in the South. Nor are "bullgrass" Paspalums, of coarse texture and intemperate habits, much better than weeds. Some disfigure lawns north nearly to Chicago. Common bahia is itself so coarse as to better remain in the pasture than the lawn. Varieties used for lawns are at present primarily the finer leaved "Pensacola," "Paraguay," and "Argentine." Seed of selections chosen especially for turf just isn't available yet, not even "Wilmington." Maybe research will lick the difficulties in seed production, and newer products of the breeders art will eventually grace southern lawns.

This uncertain stage is no cause for wonder when one remembers that production of bahia seed is relatively new. Chan Baker tells us that some of the first seed harvested in Florida was only in 1940, with a bluegrass stripping machine procured in Maryville, Missouri. More recently, combining of the seed, with artificial drying, has permitted more extensive production of field bahias (including ill-defined Pensacolas), from the Carolinas through Georgia and into Florida. Baker reports that he now has acreage in Florida certified as true Pensacola. "Paraguay" bahia does not seed well in the humid Southeast, and is largely produced in Texas.

Adaptation and Preferences

Bahiagrass is a real southerner, at its best along the mild coastal plain (though fairly tolerant of cold, persisting only erratically into Tennessee). As would be expected, its season of most luxuriant growth is summer, so that spring plantings have best chance for thorough filling. Seed sown in autumn can overwinter in the soil, a favorable omen for "all-season" seed blends. Even warm weather sowings may prove more attractive from inclusion of the unaggressive northern bents, fine fescues, and bluegrasses, which give temporary color until the typically slower bahia has sprouted fully.

One of bahia's outstanding virtues is immense tolerance. It can stand comparative neglect and little fertility, yet prosper on better soils under higher fertility. Its versatility—and deep vigorous roots — make it one of the best southern grasses for sandy soils that dry quickly and hold nutrients poorly. It withstands drought quite well, yet holds up in moist locations. It is carefree about soil, growing well in both acid and alkaline environments.

What to Watch Out For

Unlike st. augustine, bahiagrass is relatively unpalatable to the ubiquitous chinch bugs. Nor are other insects of more than average bother, controllable with the usual pesticides. Billbugs are reported on bahia, but not so serious a pest as with thatching zoysia. Nematodes have not been severe. So far bahiagrass has not been greatly afflicted with disease, although it does catch dollar spot and brown patch, controllable with broad-spectrum fungicides. A disease of the seedheads, ergot, sometimes toxic to cattle, is of no consequence in the lawn. So all in all, bahiagrass is a relatively self-sufficient, easy-to-care-for species.

Bahia forms a rather open sod, one not prone to thatch so easily as most lawngrasses. But weed invasion may thus be easier. Higher mowing — at least 2 inches—helps bahia fight competition; very close mowing is an invitation to weeds. The familiar broadleaf weeds can be controlled with the 2,4-D family of chemicals, including silvex for the "toughies," the same as on bluegrass lawns. But bahia cannot stand the methyl arsenates (crabgrass killers). Preemergence crabgrass preventers

can be used, though with essentially year-round weed sprouting in the Deep South, preemergence techniques are not so effective as farther north. Simazine and atrazine, used effectively with newly sprigged st. augustine, zoysia, and centipede, should not be employed with bahia.

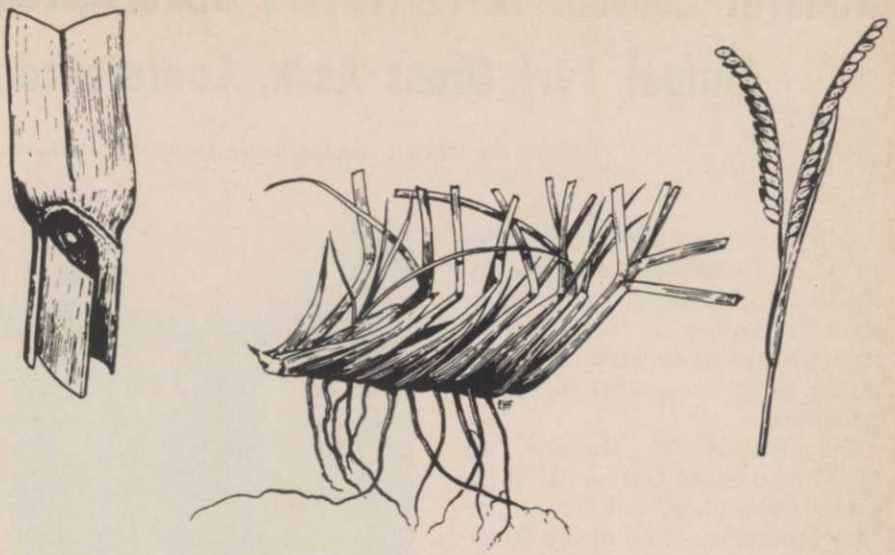
Mowing is typically with a rotary mower to better control the wiry seedheads, especially troublesome in spring, perhaps the chief disadvantage of bahiagrass. For those experimentally minded, a maleic hydrazide spray just ahead of seeding season is said to prevent seedhead formation, reduce need for weekly mowing. Bahia foliage is fairly "stringy," and a dull mower does fray the leaf tips. But compared to the dense tough-to-mow zoysia, mowing bahia is a breeze (permitting use of the less costly mowers).

While bahia persists under low fertility, as with any turfgrass it looks more attractive if fed adequately. The University of Florida suggests a complete fertilizer in March and at least nitrogen-potassium in September, with perhaps an organic feeding or two in summer for the better-tended bahia lawns. Feedings should be at least 1 lb. N/M. Seedhead formation can be reduced by omitting or delaying early spring fertilization.

Bahiagrass is quite tolerant of shade. Indeed, experimentation at Tifton, Georgia, showed bahia shade-tolerance to exceed even that of st. augustine. So it can be planted in tree-studded lawns where bermuda cannot.

Growth and Propagation

Like most southern grasses, bahia spreads by horizontal stems (stolons when aboveground, rhizomes when creeping beneath the surface). Thus it *can* be propagated the same as is st. augustine or zoysia, by plugs or sprigs. But much simpler is the planting by seed. This is the familiar way for newcomers accustomed to seeding the finer lawngrasses such as the Kentucky bluegrasses, fine fescues, and bentgrasses in the North.



Diagrammatic drawing of bahiagrass

Unfortunately, the seed of bahiagrass is more temperamental than is that of bluegrass or fescue. Without special treatment, only a limited percent will sprout quickly, because of a waxy coat that delays moisture penetration. Thus for dense, quick stands, some authorities suggest seeding rates as high as 10 lbs./M. On the other hand, 2 or 3 lbs. will make a pretty good turf in time. Some seedsmen improve germination by cracking the seed coat, which others decry as reducing viability (through injury, or by allowing entree of disease). As inexpensive as seed is to plant, relatively heavy seeding rates would seem feasible, with occasional bolster seedings thereafter to keep bahia turf thick. Southern seed blends may include zoysia, bermuda or centipede, too; and "wintergrasses" such as Kentucky bluegrass, fine fescues, and Highland bentgrass. Such a combination is amenable to seeding at any time of the year.

Varieties

The varieties usually available were cited in the opening paragraphs. Other selections are under test. Although experience is scantier with bahia than with many lawngrasses, the summarizations below reflect opinion of several experts across the South, especially in Florida where the bahiagrasses are perhaps more used than elsewhere.

Argentine—a "softer" variety with hairy leaves, more easily mowed, but somewhat coarse. Often liked for lawns in southern Florida. Subject to ergot disease.

Common—even coarser than Argentine, not desirable for lawns. May winterkill below 20°.

P. nicorae—species on test at University of Florida, no details.

Paraguay (Texas)—much like the more widely used Pensacola, but leaves hairy and with a consequent duller sheen. Slow sprouting. Many seedheads.

Paraguayan 22 (Tifton)—differs from the Texas Paraguay, coarser and more like Argentine.

Pensacola—best germinating, work-horse variety, hardy, fine-leaved (for bahia), glossy, reasonably resistant to cold (to 5°) and pests, maintaining winter color better than most varieties.

Seaside Paspalum (P. vaginatum)—quite fine textured, but must be vegetatively propagated since it scarcely sets seed.

Tifhi—a Tifton hybrid of Pensacola, said to be denser and leafier than Pensacola.

Wilmington—similar to Pensacola, fine textured, dark green, with fewer seedheads. One of most cold-tolerant varieties. Promising, but unfortunately, does not set seed adequately, so seldom available.

Mineral Content in Fertilizers Underscored at Oklahoma's Annual Turf Grass Assn. Conference Nov. 4-6 in Stillwater

By LEE STEVENS, Associate Editor, Oklahoma State University, Stillwater

A hypothesis formulated in the middle of the 18th century by Justis Von Liebig, a German scientist known as the father of agricultural chemistry, is still a guide for a successful turfgrass program.

Dr. Wayne W. Huffine, an Oklahoma State University turfgrass researcher, talking at the 19th annual meeting of the Oklahoma Turf Grass Association held on the campus of OSU, November 4-6, told the group that Von Liebig's hypothesis that "the crops on a field diminish or increase in exact proportion to the diminution or increase of the mineral substances conveyed to it in manures" still holds true. Theme of the conference was "Fertilization of Turfgrass".

In putting Von Liebig's hypothesis in more direct terms, Huffine explained that nitrogen alone is not enough for optimum plant growth. "Even though nitrogen is the key element in turf production, all of the essential elements must be present in sufficient amounts to meet the needs of the grass to grow good turf," he said.

Inspection of experimental turf plots is standard procedure at most of the turf conferences now offered throughout the country. During the Oklahoma Turf Grass Association meeting, Dr. Wayne W. Huffine (left) explained the Oklahoma plots to (left to right) Dr. G. C. Horn, University of Florida, Gainesville; Dr. Coleman Ward, Mississippi State University, State College, Miss.; and Dr. N. D. Morgan, American Potash Institute, Shreveport, La. All those pictured were on the program.

Elements for Plant Growth

The turfgrass researcher reported that 15 elements are known to be essential for plant growth—carbon, hydrogen, oxygen, phosphorus, potassium, magnesium, nitrogen, sulphur, iron, calcium, molybdenum, manganese, boron, copper, and zinc.

Nitrogen is responsible for color and vegetative growth and constant liberal supplies are essential for good leaf and satisfactory root development. Phosphorus is a necessary part of all living tissue and is particularly important in stimulating quick development of a good root system in a newly seeded grass. Potassium is needed to help produce energy and plant structural materials by aiding in production and movement of starches and cellulose.

In a report of progress in turf management research a number of studies were discussed by Dr. Huffine. Of timely interest was the report that the herbicides dicamba and silvex were found to be equally effective in the complete control of henbit and chickweed at rates as low as ½ pound of active ingredient per acre when applied in early January; however, they were only 30 to 90 percent as effective when applied in early March. Crabgrass was completely controlled with the preemergence herbicides Bandane, Betasan, Dacthal, Pre-San, TOK-2, and Zytron.

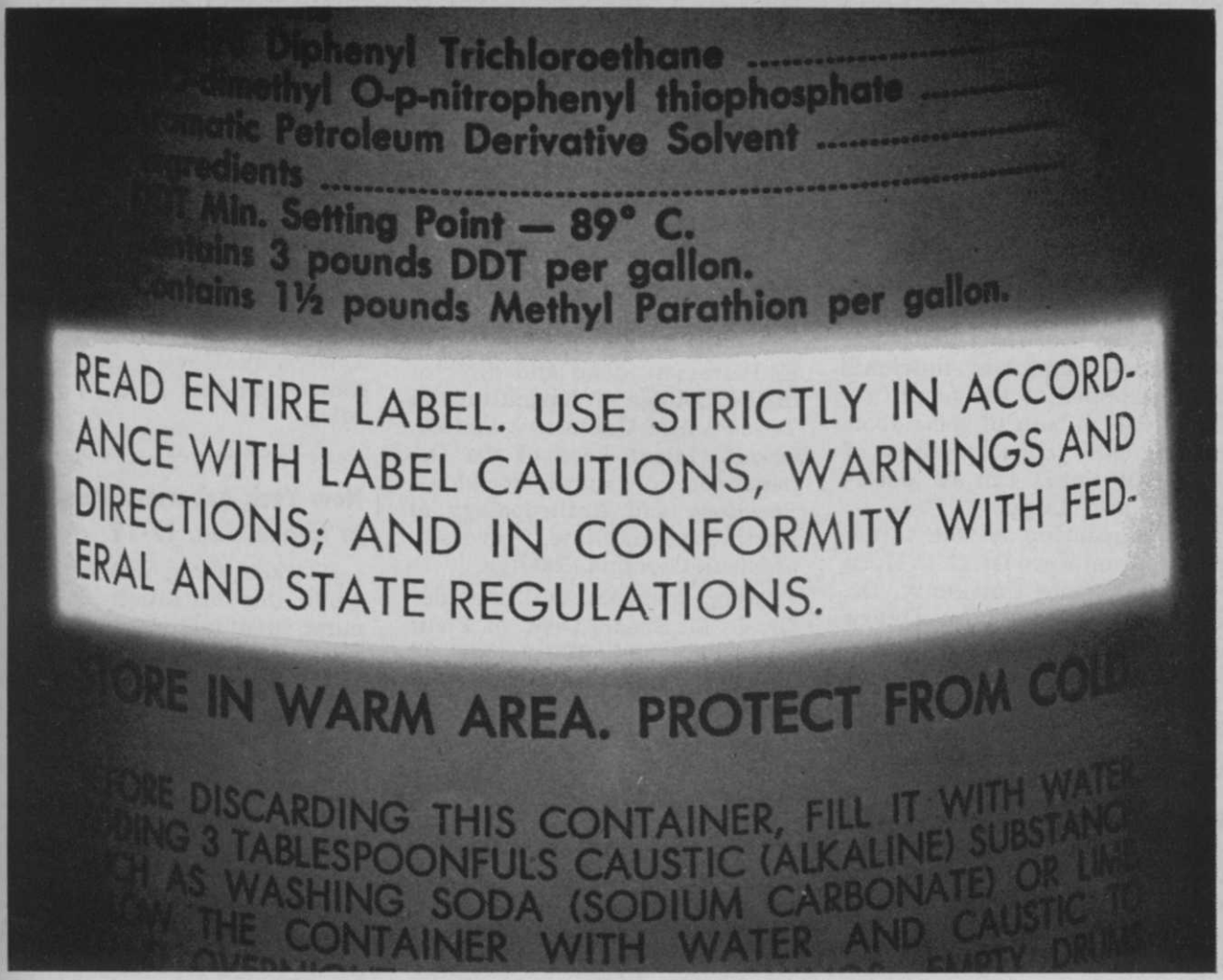
The optimum height to mow several turfgrasses as determined by the largest quantity of chlorophyll in the grass per unit area was found to be ½ inch for Sunturf, Tifgreen, Tifway and African bermudagrasses, and 1 inch for Meyer zoysiagrass. In a study of the salt tolerance of several turf-type bermudagrasses, Sunturf was found to be slightly more tolerant to high levels of sodium chloride than Tifgreen; however, both varieties were found to make satisfactory growth on soils of rather high salt content.

Dithane M-45 for Algae

Eradication of algae was obtained with Dithane M-45 at six ounces per 1,000 square feet on newly planted turf plots being established at OSU, consisting of Tifgreen (Tifton 328) bermudagrass, and Seaside Creeping bentgrass.

Dithane M-45 was applied on greens where algae had developed at the Hillcrest Country Club, Bartlesville, and the Quail Creek Country Club, Oklahoma City. Good control was obtained in both cases.

Leland Tripp, Extension agronomist of OSU recommends fertilizer applications on turfgrass be made on the basis of a soil test. "This gives the plant



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the nutrients that it needs at a minimum cost," he said.

Another tool that can be used in turfgrass maintenance and discussed at the meeting is tissue testing. This test discussed by Dr. N. D. Morgan of the American Potash Institute provides an analysis of tissue content of the plant and is easily done with a kit provided for this purpose.

The tissue test supplements the soil test which gives the nutrient level of the soil while the tissue test shows the plant nutrients being supplied to the plant.

"By use of both of these tools a very close approximation of the plant needs can be determined," said Tripp.

Also appearing on the three-day program were Dr. G. C. Horn of Florida State University, Dr. Vic Sheldon of John Deere Chemical Company, Charles Wilson of Milorganite, and Dr. J. Q. Lynd, Dr. Lester Reed, Dr. Harry Young and Dr. R. V. Sturgeon, all of OSU.

Herbicide Sales Above '63

Sales of herbicides and other plant growth regulators are placed at about 23% of the total potential market, an increase of some 4% from 1963. This figure is indicated in a news release from the National Agricultural Chemical Association, Washington, D. C.

Extreme wet weather in a number of major crop areas of the Middle and Far West was a large factor in creating the increase. Sales of fungicides also show a slight gain of 1% over 1963, to some 15% of the market.

As in previous years, the use of herbicides, including desiccants, defoliants and other plant growth regulators, continues to show a steady increase.

Kans. Treemen Meet Jan. 21-22

A full program presenting the newest information pertaining to tree care and maintenance has been readied for delegates to the Kansas State Shade Tree Conference set for Jan. 21-22 at Manhattan, Kansas.

The conference will meet at Umberger Hall, Kansas State University.

Southern Weed Conference Meets in Dallas, Jan. 19-21

Teaching, research, extension, and industry authorities plan to participate in the Southern Weed Conference program at the Hotel Adolphus in Dallas, Texas, Jan. 19-21. Officials expect almost 900 persons to attend the conference this year.

Taking part in the general session on "Weed Control in the Changing South," will be: Dr. R. E. Patterson, dean and director of the College of Agriculture at Texas A & M University, and Dr. Selz C. Mayo, head of the Departments of Rural Sociology, Sociology and Anthropology at North Carolina State, University of North Carolina, Raleigh.

Other speakers will include: Dr. G. M. Shear, Dept. of Plant Pathology and Physiology at Virginia Polytechnic Institute; Tom E. Corley, Dept. of Agricultural Engineering at Auburn University; Turney J. Hernandez, E. I. du Pont de Nemours & Co.; and Southern Weed Conference President R. E. Frans, Dept. of Agronomy, University of Arkansas.

More than 150 papers are scheduled for presentation, covering eight aspects of weed control. Chairmen and major program subjects are:

Weed Control in Agronomic Crops Including Turf and Pastures. Chairman: Paul W. Santelmann, Dept. of Agronomy, Oklahoma State University, Stillwater.

Weed Control in Horticultural Crops. Chairman: Raymond B. Taylorson, Crops Research Division, USDA, Tifton, Ga.

The Control of Weeds and Woody Plants in Forests and Rangelands. Chairman: Orel G. Otwell, Chipman Chemical Co., Pasadena, Texas.

The Control of Weeds and Woody Plants on Utility, Railroad, and Highway Rights-of-Way and in Industrial Sites. Chairman: F. E. Gonzales, E. I. du Pont de Nemours & Co., Atlanta, Ga.

Aquatic Weeds and Special Weed Problems. Chairman: Lyle W. Weldon, Crops Research Division, USDA, Fort Lauderdale, Fla.

Ecological, Physiological, and Edaphic Aspects of Weed Control. Chairman: Howard L. Morton, Crops Research Division, USDA and Texas A & M University, College Station, Texas.

Extension, Teaching, Regulatory and Public Health Aspects of Weed Control. Chairman: Jon W. Hooks, Elanco Products Co., Columbia, S. C.

Developments from Industry. Chairman: Hoyt A. Nation, The Dow Chemical Co., Wayside, Miss.

New York Arborists Meet In Ithaca, Jan. 17-19

A trade show which will include demonstration of equipment is a feature of the New York Arborists Association winter meeting, scheduled for Jan. 17-19, at the Statler Hotel in Ithaca, N. Y.

A meeting of directors is set for Sunday afternoon, Jan. 17. A general meeting for the membership will follow later in the evening. The association's annual banquet will conclude Monday's program which will begin with the annual business meeting. The banquet is slated for late afternoon.

Three workshops, each undertaking a specific phase of the arborist industry, will be held during the final day of the meeting. Panel discussions on general topics are also on the program.

Arborists Meet in Florida

Important discussions bearing on business, new techniques in the tree service industry, and many other topics of interest will be brought into focus when delegates to the National Arborist Association Winter Meeting assemble Feb. 14-16 in Florida.

Site for the annual event is Guy Lombardo's Port-O-Call Inn, on Tiera Verde Island, near Clearwater, Fla.

Information may be obtained from Dr. Paul E. Tilford, Executive Secretary, National Arborist Assn., Box 426, Wooster, Ohio.