

TIMELY TURF TOPICS

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UNITED STATES GOLF ASSOCIATION GREEN SECTION

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CONTROL OF SOUTHERN TURF WEEDS: Several reports have already been received from Georgia and Florida that various weeds which present some of the most critical turf problems in those states have been controlled with 2,4-D without any injury to turf grasses. Mr. Frank Rogers of the Ponte Vedra Country Club in Florida, for instance, referring to several of the soluble formulations which were sent to him by the Green Section for test purposes says: "They have given great results and have had no effect on either the centipede grass or the Bermuda grass." Among his worst weeds is the species of pennywort (Hydrocotyle bonariensis). Another species of pennywort was perfectly controlled at the Hollywood Country Club in Florida. This was Hydrocotyle umbellata, which occurred along with Dichondra repens. Applications made by Mr. Schmeisser of that club early in March to turf which consisted of 90% Dichondra and pennywort resulted in complete eradication within 2 weeks of both species, with no injury to the Bermuda grass and very little injury to the St. Augustine grass in spite of the facts that the tests were made on putting greens and in some cases at twice the recommended rate. The weeds were completely eradicated as a result of single applications at the recommended rate, namely, 5 gallons of a 0.1% solution to 1,000 square feet. These clubs are concerned now over just one thing and that is the acquisition of an adequate amount of material to eradicate these weed pests from all their greens.

Word has also been received from Mr. T. M. Baumgardner of Sea Island, Ga., that in large-scale fairway tests various 2,4-D formulations applied in April and May of this year have effectively eradicated Lippia, pigweed, dandelion and several other broad-leaved weeds. Concerning the effect on the grasses he writes: "There was no serious burning of the Bermuda and carpet grass and in fact, as near as we could determine, there seemed to be a stimulation noted by the darker green color of the Bermuda grass 2 or 3 weeks after application. None of the grass-like weeds were affected. These included crabgrass, watergrass, sand bur and one of the broad-leaved grassy weeds which we could not identify." In his tests the tops of the Dichondra were killed but by the end of July were reappearing in spotted locations. On the putting greens and lawns in which small-scale tests were made centipede grass and St. Augustine grass were also present and these did not suffer any apparent injury. Concerning the weeds on which the tests were made he states: "We are satisfied that Lippia, dandelion, pigweed and a few other broad-leaved weeds prevalent in our turf can be practically eliminated with one application. We also believe that Dichondra and pennywort can be controlled sufficiently so that the permanent grasses will have an opportunity to cover over and successfully compete with these weeds. There is also the possibility that Dichondra and pennywort can be entirely eliminated on golf greens and other fine turf areas by repeated applications of 2,4-D." It should be noticed that Mr. Baumgardner accomplished these results with an application of approximately 1½ pounds of 2,4-D in 96 gallons of water to the acre.

Another 2,4-D sensitive-weed which, although not a turf weed, may be a serious problem on waterways on southern golf courses is the water hyacinth. Tests were made by the Green Section this past winter on plants growing in pails in an 80°F. greenhouse at Beltsville. The waxy leaves were sprayed with a 0.1% solution of 2,4-D in Carbowax and within 5 days the plants were curled in such a manner that the leaf blades were completely submerged. Within 2 weeks the plants were dead and were well on the way to complete decomposition. What effect the 2,4-D might have on fish or, for that matter, on the water, is not known. The fact has been demonstrated that the water hyacinth plants are very sensitive to the 2,4-D-Carbowax spray.

RESPONSE OF GRASSES TO 2,4-D: Since the first tests with 2,4-D on turf weeds were made in August of last year it has been tried in many formulations at various concentrations on numerous turf grasses commonly used on fairways and tees as well as on putting greens.

Applications made last fall in cooperation with Dr. Mitchell and Dr. Marth of the Hormone Project of the Department of Agriculture did not exceed the use of 10 gallons to 1000 square feet of a 0.1% solution. Applied at that rate there was no injury either to established Kentucky bluegrass or to very young seedlings of the same grass. Tests this spring and early summer in cooperation with the National Capital Parks, however, have been made at rates up to and including 10 gallons to 1,000 square feet of a 0.25% solution in order to attempt to control weeds such as sheep sorrel and Oxalis, which did not seem to be readily controlled by the rates used last fall. Kentucky bluegrass and Bermuda grass have been uninjured by such applications made both in spring and during the hot weather of early June. Chewings fescue withstood, without any apparent injury, treatments up to 5 gallons to 1,000 square feet of a 0.25% solution made in March immediately after the grass had initiated spring growth. Ryegrass treated at the same time tolerated applications up to and including this rate. Expressed in terms of the rate which is at present recommended for clover and weed control in turf in spring and fall, namely, 5 gallons of a 0.1% solution to 1,000 square feet, this means that Kentucky bluegrass and Bermuda grass have tolerated at least 5 times the recommended rate and fescue and ryegrass $2\frac{1}{2}$ times the recommended rate. More recently Zoysia matrella turf was treated at rates up to and including 10 gallons to 1,000 square feet of a 0.15% solution, or the equivalent of 3 times the recommended rate without any apparent injury, although after 4 weeks, growth was still retarded in proportion to the amount of 2,4-D applied.

Bent grasses, however, are not quite so tolerant to 2,4-D. In a few instances creeping bent has been present in patches on some of the fairway plots. In these cases it has shown slight temporary injury a week or so after treatment but recovered 1 or 2 weeks thereafter. Applications to creeping bent on putting greens resulted in a more drastic response on the part of bent. Within a week after treatment the small square-foot plots drenched with 0.1% and also with 0.05% solutions in late August of last year gave all appearance of having been killed. However, when removed from the putting green together with surrounding untreated turf and allowed to grow under a higher cut, recovery of the grass was complete within 4 weeks' time although the clover which had occupied 60% of the area never recovered. The most striking result, however, so far as the growth of that particular plot of bent is concerned appeared this spring when the plot which was treated with the 0.1% solution became green and initiated growth 10 days prior to the surrounding untreated area. I should add that to date (11 months later) the clover has not reappeared in the plot so treated. Although this was a small bit of turf this observation should be followed up because of its possible wide application if it is a response which can be depended upon.

A color response has also been observed both in field plots and in the greenhouse tests on the part of Kentucky bluegrass and Bermuda grass. Plots which have been treated with 2,4-D repeatedly have appeared better in color than the adjoining untreated turf. The color effect is comparable to that resulting from an application of sulfate of ammonia. Whether this improvement in color is due to the direct effect of the growth regulating substance on the grass or is due indirectly to an effect on the soil microflora, or to the removal of competition from the weeds has not yet been determined.

In addition to the observation of the improvement of color of the grass, greenhouse studies were made during the winter in cooperation with Dr. Marth of the clipping weights resulting from various rates of application to established bluegrass turf. These results are being checked and the experiments amplified by Dr. Marth and Dr. Mitchell on established turf, the results of which will be forthcoming at the close of the season.

In the experiments to date there has been no consistent apparent difference in the behavior of grasses other than bents to the 2,4-D in Carbowax and in the form of water-soluble salts. In the greenhouse, however, creeping bent maintained at putting green height apparently was less injured by applications of the ammonium and sodium salts than by the use of 2,4-D in Carbowax. A limited number of tests are being conducted on creeping bent under putting green conditions at present to get further indications in this direction but the experiments are too recent to justify any conclusions at present.

Attention should be drawn to the fact that all of the weedy grasses tried thus far are apparently as tolerant to the 2,4-D as are the turf grasses. These included mature crabgrass plants last fall, crabgrass seedlings this spring and early summer, Paspalum, and Muhlenbergia schreberi. Crabgrass seedlings and Paspalum have definitely survived applications to and including the use of 5 times the recommended rate of application. Rates higher than 5 gallons of the 0.1% solution have not been tried on Muhlenbergia schreberi but it has definitely survived applications at that rate of various formulations of 2,4-D. Canada bluegrass and Poa annua also have survived all rates tried thus far.

Attention should be drawn to the fact that claims have been made by some of the manufacturers of materials available commercially at present that crabgrass seedlings can be killed with 2,4-D. These claims have not been corroborated by any of the tests so far established. It would seem as though the only chance for the use of 2,4-D in the control of annual weedy grasses such as crabgrass and Poa annua might be an application at the time when the grasses are in flower or in green seed, which might result in killing of the seed so that the reinfestation the following season would be at a minimum.

COMPARISON OF 2,4-D FORMULATIONS: In cooperation with the National Capital Parks this spring and summer the Green Section has tested 16 different formulations and salts of 2,4-D which are either already available commercially or are being considered by various commercial chemical manufacturers. In general on such weeds as dandelion, plantain and members of the mustard family, all of these formulations have been approximately equally as effective when applied at rates sufficient to give 2/3-ounce of 2,4-D to every 1,000 square feet. None of them, however, has consistently equaled or surpassed 2,4-D in Carbowax for effectiveness under special conditions or against some of the more difficult weeds to control, such as clover. In connection with these tests the sodium, ammonium, potassium, and calcium salts of 2,4-D, all of which are directly soluble in water, have been tried. The potassium salt gave evidence in two triplicated series of working more rapidly than either of the other three salts. The end results on the wider-leaved weeds mentioned above, however, have been equally as satisfactory. It should be stated that no spreader was used in the preparation of the solutions of the salts since the eradication was essentially perfect without the use of a spreader. In greenhouse tests last winter the salts tested were apparently less injurious to bent growing in flats maintained at putting green height than was the 2,4-D-Carbowax applied at the same rate.

REGIONAL TESTS WITH 2,4-D: Since January of this year the Green Section has assumed the leadership in a nation-wide series of tests to determine the value of 2,4-D for the control of weeds in various types of turf under widely differing climatic and soil conditions. Ten-ounce jars of 2,4-D in Carbowax, adequate for the preparation of 10 gallons of a 0.1% solution, as well as comparable quantities of various dry formulations which are being manufactured experimentally this year by numerous leading chemical firms have been sent into 23 states in addition to the many tests which have been made in the District of Columbia. Officials on golf courses, parks, cemeteries, as well as in the Army and the Navy, in addition to staff members of various experiment stations, have been recipients of such test lots of 2,4-D from the Green Section. In all cases detailed letters of suggestions for tests have accompanied the material.

Reports which have come in to date, some of which are mentioned in other sections of this issue, have given evidence of a real corroboration of results which were obtained on turf weeds in the Washington area last fall and throughout this season. These tests have been under way in Connecticut and Rhode Island, in New England; North Carolina, Georgia, Florida and Louisiana, in the South; most of the Middle Atlantic states; many of the Mid-western states, including Ohio, Illinois, Indiana, Missouri, Kansas, Iowa and also Wisconsin and Minnesota; and in addition also in Idaho, Colorado, Oklahoma and Texas. If adequate reports are submitted at the end of the season by the cooperators concerned, the Green Section should be able to produce from these tests a very satisfactory picture of what can be expected in the way of turf weed control with 2,4-D in its various proposed formulations under many different environmental and soil conditions and on widely differing weeds and grasses.

REPEATED APPLICATIONS OF 2,4-D MAY BE ADVISABLE: 2,4-D applied to turf at the recommended rate does not significantly affect the weed seeds in the soil. Therefore when weeds are removed it would generally be advisable to think in terms of a second application the following season in order to kill those weeds which have become established from germinating seeds as well as to kill any individuals which were missed in the first application. In some instances it may be necessary to apply the 2,4-D a second time within 3 or 4 weeks following the first application. This is likely to be true when mat weeds such as chickweed are to be eradicated. Because of the dense mat it is frequently impossible to get an adequate coverage with one application and therefore it is necessary to repeat the treatment. Also on creeping bent putting greens it may be possible to remove weeds with relatively little injury to the bent by repeatedly applying the material at concentrations one-half or less of that recommended elsewhere in this issue for use on fairways and lawns.

HERBICIDAL EFFECTS OF COMBINATIONS OF GROWTH-REGULATING SUBSTANCES: The Green Section recognized early in the work that if 2,4-D was so effective in its selective killing of certain weeds in turf it might be possible to find other hormones which might be combined with 2,4-D for better selectivity or a more efficient kill of certain other weeds. This season, therefore, as a start in this direction the Green Section has tried in its cooperative tests with the National Capital Parks phenylacetic acid, naphthoxyacetic acid, and naphthaleneacetic acid alone and in combination with the 2,4-D. In all instances when applied alone there was practically no herbicidal effect evident. However, when applied in combination with the 2,4-D, 500 parts per million of phenylacetic acid, for instance, combined with 500 parts per million of 2,4-D, the plots were completely free of dandelion and plantain, which are the predominant weeds in the area on which the tests were made. Particularly fine results were obtained with the combination of phenylacetic acid and 2,4-D, with no significant injury to the clover. If this lack of injury to the clover characterizes fall applications of certain of these combinations of growth regulating compounds, the fact may have real significance to the home owner and the farmer who may want to kill their weeds without injuring permanently the clover on their lawns and pastures respectively.

HAND-OPERATED HIGH PRESSURE SPRAYERS CONVENIENT FOR SPOT TREATING: In connection with the experimental work on 2,4-D the Green Section has become acquainted with a small automatic all-purpose sprayer which seems ideally suited for spot treating with sprays. The sprayers are unlike any other the Green Section has ever seen so far as simplicity of operation is concerned. The small 1-quart tanks are built of steel with riveted and soldered seams and are tested by the manufacturers to 300 pounds pressure. Air pressure is readily applied to the tank from a compressed air line or a hand tire pump. A pressure of 65 to 70 pounds is easily developed with a few strokes of a hand tire pump. For spot treating, or for experimental plots in which quantities of liquid not exceeding a quart are frequently used it is an ideal sprayer. It is sold under the trade name "Sure Shot Sprayer" and is manufactured by the Milwaukee Sprayer Manufacturing Company, Inc., Milwaukee, Wisconsin.

BRITISH INVESTIGATORS CALL 2,4-D CHLOROXONE: Scientists in Great Britain also have been working with growth regulating substances as selective weed killers in recent years. Nation-wide tests have been made by the Imperial Chemical Industries Ltd. and the Ministry of Agriculture, of chloroxone, which is the name by which they refer to 2,4-dichlorophenoxyacetic acid, and a related compound, methoxone, both of which have been found to be very effective in the removal of weeds from corn and other cereal crops. They state that they have found methoxone to be a promising selective herbicide and are this year conducting an extensive program of tests with it, the tests having been designed to obtain information on a wide range of weeds under a variety of conditions. The Green Section has not yet been able to acquire any of this material for testing purposes on turf weeds in this country.

BAMBOO POLES: Clubs have been reporting difficulties with their bamboo poles. The American poles, so they report, are not so durable as were the imported ones and are very easily broken. These reports have led the Green Section to discuss the question with the U. S. Department of Agriculture's authority on bamboo culture, Dr. R. A. Young. Apparently other users of bamboo poles besides the greenkeepers have been having the same difficulty for Dr. Young has already cautioned the growers of bamboo in this country concerning the criticism which their poles are receiving and urged them to rectify the situation. The reason in most cases for the lack of durability of bamboo poles is that they are cut before their third year and it is not until the third year that the wood becomes completely hardened.

Bamboo plants, according to Dr. Young, attain their full diameter of the culm or stem when only a few inches high and make their entire growth in height within 6 weeks. Therefore unless the culms are marked in some durable fashion early in their first season it is practically impossible to distinguish between 1, 2, and 3-year old culms, although the wood in the culms in the first two years is comparatively soft, the individual cells being thin walled and filled with sap. It is not until the third year that the cell walls of the woody tissue become thickened and the culms thereby reach their maximum strength and durability.

Perhaps if, when ordering bamboo poles, a request is made for guaranteed 3-year old culms sufficient pressure can be brought to bear on the growers so that they will recognize the importance of marking their culms and marketing only those which are at least three years old.

GROW YOUR OWN STOLONS: The establishment of a stolon nursery should perhaps be the first move in anticipation of the rehabilitation of your greens following victory in Asia. This will not only insure availability of stolons of superior strains of bent at a time when they are needed most but will be decidedly an economic move. The Green Section has increased its stock of C 1, C 7, C 15, C 17, C 19, C 28 and C 36 so that stolons will be available to any member clubs which are interested in establishing a stolon nursery this fall. One square foot of stolons should plant a row of 100 feet and each 100-foot row under good maintenance should produce sufficient stolons within a year to plant an average green. Late summer or early fall is an ideal time in which to start a stolon nursery. Directions for the establishment and maintenance of such nurseries was given in **TIMELY TURF TOPICS** for August, 1944.

Just as a stolon nursery is a sound economic move, so the establishment of a sod nursery is good insurance. Every course should have a sod nursery composed of the same grass used on the putting greens and maintained under putting green conditions. Such a sod nursery makes possible the replacement of bad scars on a green simply by the removal of the affected sod and the insertion of an identically shaped piece of turf from the sod nursery. Both types of nursery are indispensable in an efficient economic management of a golf course, particularly where putting greens are composed of bents.

ZOYSIA FOR WEAR-RESISTANT TURF: Active interest is steadily mounting in the tough wear-resistant turf which is produced by the two species of Zoysia, -- Zoysia japonica (Korean lawn grass) and Zoysia matrella (Manila grass). The first of these two species, having been found growing natively in Manchuria, is, as would be expected, sufficiently cold-resistant to survive the winters in parts of Michigan and Wisconsin. Its leaves, however, are so coarse that for golf course purposes it has not aroused the interest as has the second species, Zoysia matrella, even though this latter species is much less resistant to low temperatures.

Neither of the Zoysia species is native to the United States. Seed of Zoysia matrella was first sent in from Manila on August 8, 1911, by C. V. Piper of the Bureau of Plant Industry of the Department of Agriculture and experimental plantings were made at once at his recommendation in Florida. By 1912 his early notes on this first experimental planting stated that the grass showed unusual promise along the Gulf Coast and Atlantic Coast in Florida. By 1923 sufficient evidence had been accumulated by the Department of Agriculture to justify the following statement in the book by Drs. Piper and Oakley entitled, "Turf for Golf Courses": "Manila grass is native to the Philippines and other places in the Malayan region. In Manila it makes a very fine and beautiful turf seen

the Luneta. In experimental trials along the Gulf Coast of the United States this grass has formed very beautiful plots of fine leaved turf, which remains green all winter. The texture of the turf would make it ideal for greens and there is hope this grass may be exactly what is desired for Gulf Coast and Florida courses." By 1933 the Department of Agriculture had sent vegetative stock to 9 of our southern and southwestern state experiment stations.

Since then the Green Section has continued its interest and faith in the potentialities of Zoysia matrella although little popular interest was aroused before the late 30's. Its toughness together with its drought resistance, its fine texture and its ability to grow under very low cut, all have indicated its very strong potentialities as a tee grass in climates in which it is winter hardy. Its wide scale use on the tees in Louisville, Ky., which tees received wide publicity last year in "Time" and other magazines, arose as a result of a shipment of a square foot of stolons by the Green Section to Mr. C. O. Bohne of that city in the spring of 1938. By the fall of 1939 he wrote that they anticipated having sufficient vegetative stock to plant 160,000 square feet in Zoysia matrella the following spring, from which stock of Zoysia matrella many of the tees in Louisville have since been sodded.

Zoysia matrella produces a dense sod composed of tough stolons on the surface of the soil and innumerable tough roots below the surface, with the result that neither weeds nor divots are serious problems in established Zoysia sod. Its summer color is a rich green. It never produces a great deal of erect growth, not growing more than approximately 6 inches in height if left uncut throughout the entire season. It has been demonstrated to tolerate a putting green height of cut as far north as Milford, Conn. In the South it is acclaimed as perhaps the best shade grass available and its growing season is, if anything, a little longer than that of Bermuda grass. In the vicinity of the District of Columbia it has over-wintered very satisfactorily, although it becomes dormant much earlier in the fall than does the bluegrass and fescue and becomes green much later in the spring. Last fall the Green Section's Zoysia plots remained green until the third week in October, at which time a heavy frost caused most of the strains to go dormant immediately. Normally the Zoysia matrella does not become green before the latter part of April or early in May. The turf, however, remains wear-resistant even though straw colored instead of green. In addition to its short growing season there are two other disadvantages connected with the use of Zoysia matrella. One is that it does not readily produce seed in this country and we are not certain how easily turf could be obtained from seed if it were available. The other is the slowness with which turf is established from vegetative plantings.

It is usually stated that one must allow two years for the establishment of a solid turf from vegetative plantings. The Green Section, however, in 1944, using one 4-inch pot of Zoysia for each 16 square feet of turf, was successful in establishing a very satisfactory sod from many of its strains of Zoysia matrella within a period of 3½ months. This was accomplished by sprigging the Zoysia rather than planting it in 2-inch squares, as is frequently advised, and by adequately feeding and watering the new plantings. Although when once established, the Zoysia is a very drought-resistant grass, it is obvious that in order to initiate and accelerate good stolon development it is wise to use water as consistently as when planting the bents or any other grasses vegetatively. In planning a nursery, therefore, it should be so located that water facilities are conveniently at hand.

For use on tees it will be necessary, because of the slow growth of the Zoysia to establish sod nurseries of it and subsequently sod the tees with the well established turf. In this way the grass is readily established on the tees and should be able at once to resist weed invasions as well as the wear and tear of the game.

The Green Section has selected and increased numerous strains of both species of Zoysia. Some of these are being increased in nursery rows this year in order that at least small amounts may be available to member clubs which are interested in experimenting with the potentialities of Zoysia under their conditions. It is to be hoped that, through breeding, the cold resistance of Zoysia japonica can be combined with the fine texture of Zoysia matrella. With this idea in mind, the Green Section has furnished vegetative material of both species to the Indiana and the New Jersey Agricultural Experiment Stations, at both of which institutions there are well trained men interested in the breeding of superior strains of turf grasses particularly for use on tees and fairways.