Control of Crabgrass and Other Turf Weeds with Chemicals

By Fred V. Grau

While the weed problem on golf courses is as old as the game itself, with the advent of the finer turf grasses and the increasing demand for finer playing surfaces the problem has become one of major importance. The cost of weeding constitutes one of the chief items in maintenance expense. Many methods and devices have been designed to simplify the problem, and some of these have been more or less successful.

The toxic action of certain chemicals on plants has long been known. As early as 1840 Liebig, in Germany, recognized that, as regards the growth of plants, substances fell into three groups—nutritive, indifferent, and toxic. Five years later certain generalities concerning the effect of arsenic compounds on plant growth were formulated. By 1895 the sulphates of iron and copper were being used in large quantities for selectively controlling mustard in the grain fields of North Dakota. Since that time there has been an enormous expansion of this phase of weed control in the United States and many other countries. The general use of chemicals for agricultural purposes has been largely prevented by their cost in relation to the margin of profit. On golf courses, however, where cost alone is not the all-important item and where fine, uniform, weed-free turf is the desired result, it appears entirely feasible that some method such as this may be employed.

In putting greens, species of crabgrass (Digitaria) are considered to occasion the most trouble. Fairways also are often severely damaged by the invasion of crabgrass, even though during the hot summer months it provides a good though somewhat coarse turf.

Crabgrass is strictly a summer annual. It appears rather late in the growing season, makes a rapid growth, and matures within about three months. After maturing seeds, or at the first touch of cool weather, it quickly becomes brown, and the patches of its dead and dying plants render turf unsightly, patchy, and uneven.

Due to its extensive shallow network of fine rootlets, crabgrass is able to compete successfully with turf grasses for moisture in the surface soil at a time when natural moisture is least available. Its moisture-loving nature is, however, evidenced by its profuse growth around the putting greens where the natural rainfall is supplemented by artificial watering. A single plant may produce as many as 200,000 seeds, which are known to be able to survive in the soil for many years. Actual counts under ordinary conditions show that as many as 400 plants may exist within an area of a single square foot in fairway turf in a low state of fertility. It produces seeds in abundance when clipped so close that the turf grasses are injured. Seeds are readily distributed through the agencies of wind, water, topdressing, stolons, and mowers. Turf grass seeds and seed mixtures ordinarily are seldom responsible for introducing crabgrass seed as an impurity. Soil once infested with a crop of seed will continue to produce crabgrass over many years even though no further seed production is permitted.

By effecting a control for crabgrass one more of the problems of the greenkeeper would be solved. Cultural methods, though in a degree effective in its control, have not been attended with great success. While hand-weeding, in conjunction with precautionary

measures, is at present the only practicable method for keeping putting greens clear of crabgrass, these measures are admittedly out of the question for fairways and approaches, from the standpoint of cost and labor.

The need for weed-free putting greens has come more and more into the attention of the golfing public as putting surfaces have become more refined and improved. That the putting greens should receive the lion's share of attention is only natural. Although they comprise only about 3 per cent of the entire playing area of a golf course, upon them is dependent practically one-half of the play.

The importance of, and methods for, preventing weeds and weed seeds from being introduced into putting greens through the agencies of topdressing, water, commercial seed, stolons, mowers, and other factors have been discussed in the Bulletin for August, 1930. In spite of the usual precautionary measures there still remains a potent and inevitable source of infestation—seeds carried by wind, equipment, and the clothes and shoes of players and workmen. It is evident that to guard against introduction from this source some provision must be made for preventing viable seed from being produced in the fairway and approach areas.

This draws attention to those areas which are the most frequently neglected but upon which more attention should be centered, since the weeds found in the putting greens are, as a rule, those which abound in the surrounding areas. Aside from menacing the putting greens with the large amount of seed produced, weedy turf in the approach and fairway areas usually presents a poor playing surface. By effecting a control in these places the value of the control becomes twofold—not only is the green thus protected from the invasion of weed seeds but the playing conditions are improved as well. The patchy appearance caused by weeds is not only unsightly but is indicative of some of the devastating effects of these weeds. They prevent the normal development of turf grasses by robbing them of light, plant food, and moisture, and by competing with them for space in the soil sufficient for the proper development of the root systems. Annual weeds, although not the only ones which compete with the turf grasses, appear to be the more devastating.

Recognizing the need for an effective and cheap method of controlling weeds in turf, and in particular crabgrass, a series of experiments was conducted in 1932 for determining which of the more common chemical weedkillers appeared to be of the greatest promise. The experiments were begun in January of that year at the University of Maryland, College Park, Md., and in the following May were augmented by more extensive tests at the Arlington turf garden, near Washington, D. C. The experiments were conducted principally on lawn and fairway turf, primarily for the control of crabgrass, although observations were also made on other turf weeds present in the treated areas. With a few exceptions there has been no attempt in these experiments to effect chemical methods of control for weeds of the putting greens. It has been felt that it is more important, at least at the present time, to devise control methods for those weeds of the fairway and approach areas which serve as an ever-present source of infestation for the greens. In particular the object of the experiments was to find an effective weedkilling chemical which would show a high degree of selectivity,—that is to say, one which, while driving out the weeds, would not prove to be injurious to the

grass, or at least only temporarily injurious. The experiments of the past season have indicated that this may be possible at a relatively low cost with a minimum outlay of labor and equipment and, which is more important, with but very little damage to the turf grasses.

Among those chemicals which have been used most frequently and have been widely tested for their practicability as weedkillers for turf and for agricultural purposes are common salt, kerosene, oils, gasolene, sulphuric acid, iron sulphate, copper sulphate, sodium arsenite, and sodium chlorate. In addition, some chemicals which are widely used on golf courses primarily as insecticides, fungicides, and fertilizers have, under certain conditions, been observed to have secondary effects in suppressing certain weeds. Among these may be mentioned sulphate of ammonia, arsenate of lead, corrosive sublimate, and other well-known materials. Only a few of the many chemicals tested have met the stringent requirements of a satisfactory turf-weed eradicant; namely, that it be safe, cheap, easily handled, selective in its action, effective in relatively small amounts, and cause no permanent injurious effects on either the soil or the desired vegetation. Of these, the factor of selectivity is the most important, as has already been pointed out. One of the most promising chemicals has the property of forming a dangerous explosive when mixed with finely-divided organic matter; another is extremely poisonous. These characteristics have been carefully considered, but the general use on golf courses of such highly-poisonous materials as arsenate of lead and corrosive sublimate indicates that, with proper warning as to the dangerous character of the materials, they may be used with comparative safety and freedom from undesirable effects.

In our experiments during 1932 considerable variations have been observed in the results obtained. This has been due to the complexity of the factors involved, which include the chemical used, temperature, rainfall, season, age and species of plants, and soil factors such as reaction, type, and moisture. While the observations of a single season are not sufficient evidence on which to base recommendations, certain definite effects have been noted. Some chemicals have shown a distinct promise for general use on golf courses for controlling certain weeds; others which have been reported in this capacity elsewhere have shown little or no promise, under the conditions of these experiments. Further, it has been shown that the application of practically any strong chemical to turf may, under certain conditions, be expected to cause a certain amount of injury. This also has been noted many times with the use of some fertilizers, fungicides, and insecticides. While this may be considered undesirable, it is no more objectionable than the digging of a weed. Digging disturbs the soil, turns up fresh weed seeds, and provides a favorable place where weed seeds may lodge and germinate. In these experiments the treatments which have been most effective on crabgrass have caused only temporary discoloration and, during the past season, have resulted in no lasting injury to either the grass or to the soil.

In presenting the following résumé of our progress during the past season with the more common weedkilling chemicals it must be borne in mind that a single season's work on a problem of this kind can be considered only preliminary and that therefore no recommen-

dations can be offered at this time as to effective rates, methods, and times of application of any one of the chemicals mentioned. It is hoped, however, that a continuation and extension of the experiments will sufficiently clarify the attendant influencing factors so that definite recommendations may be made at a later date.

Sodium chlorate.—This has been successfully used on thistles, morning glory, and many other farm weeds over a wide area since 1925. More recently it has been used in the control of some of the more common turf weeds, including speedwell and ground ivy, in Ohio. It was included in these experiments despite its characteristic of forming highly inflammable and explosive mixtures when combined with finely-divided organic matter.

In our experiments, sodium chlorate has shown a great deal of promise for controlling crabgrass as well as certain other turf weeds. In some plots the control has been as high as 99 per cent. One of the most outstanding features in connection with this control on poor, weedy turf has been that the turf grasses, principally Kentucky bluegrass, have increased from a stand of about 40 per cent to a stand of 80 to 85 per cent from the date of treatment to December. The initial injury and discoloration has been slight and recovery has been rapid. Practically no crabgrass seed has been produced in these plots. Soil tests have shown that the treatments have had practically no effect on either the nutritive elements within the soil or on the soil reaction.

Additional tests have shown that sodium chlorate is promising for the control of milk purslane, which often becomes a nuisance in fine turf. Definite control has been observed for this weed in widely-separated locations. Chickweeds likewise have been observed to be controlled with this chemical.

At present prices the cost of sodium chlorate, at rates apparently effective on crabgrass, would amount to something less than $10 an acre.

Ammonium thiocyanate.—In the United States this was first tested for its weed-control value in Minnesota, where it has been recommended for the control of certain annual and perennial weeds troublesome principally in agricultural land. These previously-reported results commended its inclusion in our 1932 tests. Its non-poisonous, incombustible character appeared to be particularly desirable from the standpoint of safety.

In our experiments ammonium thiocyanate has shown considerable promise for controlling crabgrass. In some plots the control has been practically as complete as observed for sodium chlorate. In most cases the improvement of the turf, following a rather severe discoloration, has been marked, due mainly to the large amount of nitrogen contained in the chemical. This nitrogen is released in readily-available form upon decomposition in the soil. Rates effective on crabgrass have not been sufficiently heavy to control plantain, dandelion, and other perennial weeds and the stimulation of their growth, along with that of the grass, has likewise been marked.

At present prices the cost of ammonium thiocyanate, on the basis of crabgrass control, would correspond favorably with that of sodium chlorate.

Arsenic pentoxide.—The successful use of arsenic pentoxide in New Zealand for controlling many weeds in putting turf has suggested its inclusion in the present experiments. While it is extremely

poisonous, as are all arsenicals, and toxic in relatively small quantities, its use should be no more hazardous than the use of arsenate of lead or corrosive sublimate.

In these experiments arsenic pentoxide has not shown promise of successfully controlling crabgrass and its presence in the soil has not proved injurious to either the grass or the soil in the concentrations at which it was used. A high percentage of control has been observed for plantain, white clover, chickweeds, ground ivy, knotweed, and pennywort. Control for the last-named weed has been observed both on putting greens and on lawns.

Present observations indicate that the use of arsenic pentoxide on weeds for which it has been observed to be effective, in spite of a higher cost of unit weight, would entail even a lower cost than either sodium chlorate or ammonium thiocyanate.

Sodium arsenite.—The extensive use of sodium arsenite for the control of weeds in Hawaii, as well as its use for controlling chickweeds as reported in the Bulletin as early as July, 1921, suggested its further trial in these experiments on crabgrass. It has not shown much promise in this direction, but results on other weeds have compared favorably with those obtained with arsenic pentoxide. Effects on the soil, on vegetation in general, and other characteristics are likewise similar.

Sodium arsenate.—This has been used to a limited extent for killing weeds. Its reported successful use in the South for controlling Dichondra suggested its inclusion in these tests. While, like all arsenicals, it is extremely poisonous, it is not as highly toxic, pound for pound, as either of the arsenicals previously mentioned. Larger quantities of it may be used with less danger of seriously damaging the turf grasses. Sodium arsenate, under the conditions of the experiments, has not controlled crabgrass, but, on the basis of equal quantities of water-soluble arsenic, it has given results on other turf weeds comparable with the pentoxide and the arsenite.

Lead arsenate.—This has been in general use on golf courses for insecticidal purposes for a number of years. Many instances have been given where, as a secondary effect, it has entirely controlled chickweed and, in some cases, crabgrass. In our experiments it has not controlled crabgrass, but under some conditions it may have value for controlling chickweeds. The control, however, has not been definite under all conditions. If used primarily for weedkilling purposes, the cost would become prohibitive.

Iron sulphate.—The early and extensive use of iron sulphate for controlling dandelions and other weeds in lawns has, to many, become a familiar story. Some instances have been reported where its use at a certain stage of growth controlled crabgrass for several seasons. Our experiments have indicated that this chemical does not control crabgrass but, on the contrary, has been observed to have a slightly stimulating effect on it. The seed production in the treated plots has been unusually heavy.

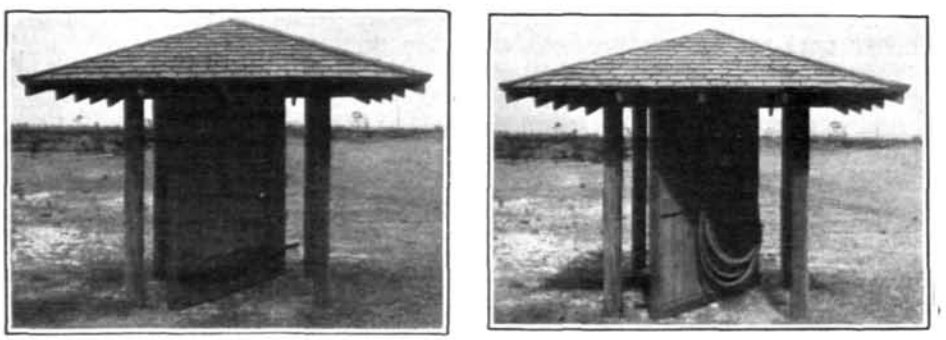
Sulphate of ammonia and iron sulphate mixed with soil.—The use of a mixture of sulphate of ammonia, iron sulphate, and soil as a topdressing material, first successful in South Africa, has given excellent results in suppressing many weeds on lawns and golf courses in the British Isles and, with certain modifications under some conditions, in Canada. It was hoped that it might be successfully applied to the control of crabgrass in this country even though

crabgrass has not been included in the lists of weeds reported controlled elsewhere by this mixture. Under the conditions of the experiments, however, by its monthly use during one season crabgrass has not been controlled, but on the contrary its growth and seed production have been greatly stimulated.

Sulphate of ammonia and iron sulphate mixed with sand.—This mixture differs from the one immediately preceding in that it has been prepared by fusing the mixture, followed by pulverizing. In the Bulletin for December, 1927, its preparation is described, as well as its reported successful use on certain weeds of Bermuda turf in South Africa. Certain preliminary tests on Bermuda turf in Florida have likewise indicated its value as a turf-weed eradicant. The 1932 experiments, while not sufficiently extensive, have indicated that it has little or no value for controlling crabgrass in the latitude of Washington, D. C.

A Convenient Storm Shelter

Shelters to protect golfers from sudden showers are much-needed accommodations on many golf courses, particularly in regions where heavy downpours of short duration are apt to occur at any time. There are many interesting structures built on golf courses to provide protection for this type of storm. One of the objections to many of these shelters is that they must be large in order to furnish protection from storms coming from different directions. An interesting shelter has been built on the Boca Raton course at Boca Raton,



Storm shelter equipped with revolving shield

Fla., by O. Sproule Baker, as shown in the accompanying illustration. This simple shelter consists of four permanent upright posts supporting a small roof. The main feature of the shelter is a large board shield revolving about a central axis, set on a concrete base, and fastened above to the rafters. During showers the shield may be swung around so that the seat will be on the lee side. On the opposite side from the seat has been fastened half of a metal wash-tub over which hose is looped. This shelter therefore provides a place where hose which is used in that vicinity may be neatly put away while not in use.