Correspondence pertaining to Green Section matters should be addressed to:
USGA Green Section, Room 307, South Building, Plant Industry Station, Beltsville, Md.

CRABGRASS CONTROL

By M. H. Ferguson and C. G. Wilson

Agronomist in Charge of Research and Extension Agronomist, Respectively, USGA Green Section

Crabgrass was the most serious problem in turf in 1950. It was the most nearly universal weed problem. It received more attention from research workers than did any other single phase of turf investigation.

Before 2,4-D came into use, crabgrass was one of the minor turf weed problems. It received very little attention outside of the crabgrass belt. Now research is being aimed at crabgrass control in such borderline states as Rhode Island, Michigan, and Georgia.

It is doubtful if crabgrass in turf is more detrimental than it was 10 years ago. The control of some of the more serious turf pests (Japanese beetles, dandelions, and plantain) has removed some of the major obstacles in the way of good turf maintenance. Since the large stones have been removed from our shoes, this small one has become extremely annoying.

Crabgrass has many attributes which allow it to withstand many of the attempts to control it. It tolerates close mowing. It grows most actively during the hot summer months when the vigor of most cool-season grasses is at its lowest point. It produces seeds in abundance, and apparently they can maintain their viability for many years in the soil. It is related so closely to turf grasses that there is little selectivity in chemical effects.

The volume of research effort being expended on crabgrass control is not altogether in vain. Several chemical control materials are now being marketed and are being used with varying degrees of success. Management practices are being geared to offer the greatest opposition to crabgrass invasion. More attention is being given to improved summer-growing (warm-season) grasses which are able to compete successfully with crabgrass. A few mechanical measures have been devised for lessening the severity of crabgrass infestation. With so many different angles of attack being investigated, it seems likely that effective crabgrass control measures will be developed in the near future.

Research workers are obliged to deter-

mine (1) which are the most effective chemicals, (2) which management practices are most important and effective, (3) whether or not the use of summer-growing grasses is feasible, and (4) the usefulness of mechanical devices under various conditions for crabgrass control.

Chemical Control

Phenyl Mercuric Acetate Materials

The PMA materials have been marketed in both liquid and dry forms and in various strengths. The user of any of these products should be guided by the rates recommended by the manufacturers. Various conditions may be encountered in practice, however, that necessitate variations in the rate of application.

In general, it has been found that the PMA products are most effective when applied to crabgrass in the seedling stage. Several applications usually are needed because crabgrass continues to germinate over a period of several weeks.

Liquid PMA products are considered to be the safest crabgrass control materials for use on putting greens. They have been used successfully by greenkeepers in a number of locations. Where disease is a problem, the mercury materials have an added fungicidal value.

It has been reported that PMA has an inhibiting effect upon the germination of grass seed sown in the fall following its use. This apparent disadvantage may be a blessing in some instances where it is desirable to inhibit the germination of *Poa annua*. Root growth of turf grasses has been inhibited in some cases.

There have been some reports of skin irritation from the handling of PMA. The lack of acceptance by the public of poisonous materials such as mercury and arsenic compounds may be important in determining their ultimate usefulness. The use of PMA for crabgrass control on large areas may be restricted by its cost. The material is relatively high in price and several applications (3 to 6) usually are needed for effective control. Some of the dry formulations of PMA which have been advertised widely have been very costly and relatively ineffective at the rates recommended by the manufacturers.

Potassium Cyanate

Potassium cyanate (KOCN) is marketed in the dry form and in some cases a wetting agent is included in the formulation. The rate of application most commonly used is 8 pounds to the acre, with a wetting agent. One hundred gallons of water to the acre are regarded as standard.

Studies in 1950 have been concerned with rates, gallonage, the effects of wetting agents, and the time of application. Results have been somewhat variable. A thorough wetting of the foliage appears

COMING EVENTS

Feb. 26-Mar. 1: Pennsylvania Turf Conference, State College, Pa. H. B. Musser.
Mar. 5-8: Midwest Turf Conference, Purdue University, West Lafayette, Ind. W. H. Daniel.
Mar. 6-7: Fourth Cornell Turf Conference, Cornell University, Ithaca, N. Y. John F. Cornman.
Mar. 8-9: Massachusetts Turf Conference, Amherst, Mass. L. S. Dickinson.
Mar. 7-9: Minnesota Greenkeepers Ass'n. Turf Conference, Minneapolis. Gilbert C. Foster.
Mar. 12-14: Iowa Turf Conference, Ames, Iowa. H. L. Lantz.
Mar. 14-16: Canadian Turf Conference, Ontario Agricultural College, Guelph. C. E. Robinson.
Mar. 21-22: Northwest Turf Conference, Pullman, Wash. E. G. Schafer.
April 16-17: Montana-Wyoming Turf Conference, Butte, Mont. R. Manfred Peterson.
Apr. 26-27: Northern California Turf Conference, University of California, Berkeley, Cal. J. J. McElroy.
Apr. 30-May 1: Southern California Turf Conference, University of California, Los Angeles, Cal. V. T. Stoutemyer.
May 10-11: Southeastern Turf Conference, Tifton, Gr., Glenn W. Burton.
Aug. 20-24: American Society of Agronomy Annual Meetings, Pennsylvania State College, State College, Pa. L. G. Monthey, Madison, Wis.
Oct. 24-26: Central Plains Turf Foundation Turf Conference, Manhattan, Kans. L. E. Lambert.

to be necessary for good control. KOCN materials appear to be most effective when used in the middle and late portions of the crabgrass season.

The safety factor is one of the important attributes of potassium cyanate. It is considered relatively non-poisonous and is therefore much more acceptable to the homeowner than are materials of a poisonous nature.

There are indications that potassium cyanate is an excellent material for controlling chickweed during the winter months. The same rates that are effective against crabgrass appear to be right for chickweed control.

Some observations indicate that KOCN may not be as selective in the case of crabgrass-infested Bermudagrass turf as are some of the other chemicals. However, results of tests at Tifton, Georgia, do not confirm these observations.

Potassium cyanate may be considered to be the most promising crabgrass control material in use at the present time. It disappears quickly in the soil and, upon its breakdown, it actually has a stimulating effect on the turf.

Arsenicals

Arsenical compounds, particularly sodium arsenite, are among the oldest of the herbicidal materials. Their poisonous nature and their limited selectivity have prevented them from attaining widespread usage.

Some recent studies have indicated that rates of one pound to the acre, with a wetting agent, may be useful in keeping crabgrass in check. At this rate several applications would be required for complete control. Clover suffers severely under this type of treatment.

On Bermudagrass turf, the arsenicals are among the best crabgrass control materials. Bermudagrass can withstand rather heavy rates of arsenic compounds with only slight damage. Except in the case of Bermudagrass, it seems that some newer developments may take the place of the arsenic materials for crabgrass control.

Miscellaneous

Sodium chlorate is one of the materials studied in the early stages of the development of herbicides. Sodium chlorate showed considerable promise as an herbicide, but it has never reached large-scale usage in turf because of the fire hazard associated with it. This drawback is extremely unfortunate because sodium chlorate appears to be a specific for crabgrass control.

Sodium fluosilicate*, an insecticide, has demonstrated some promise at the University of Tennessee as a possible crabgrass control material. Studies with this material on crabgrass are quite limited but they deserve more attention.

The Michigan Agricultural Experiment Station has reported the successful use of two petroleum fractions in the control of crabgrass. Results of tests with these materials have not been outstanding in other locations.

Variability of results seems to characterize all the studies conducted with chemical crabgrass control products. One must realize that humidity, temperature, soil moisture, age of crabgrass, species of permanent grasses comprising the turf, mowing height, fertility conditions, and many other factors may influence the action of an herbicide even though the rate, gallonage, spray pressure, etc., may be controlled exactly. Surely chemicals will be an aid in effecting the control of crabgrass, but it seems unlikely that chemical aids ever will afford complete control except when coupled with improved grasses and good management practices.

Mechanical Control

Because crabgrass is endowed with a prostrate habit of growth, it will thrive under the closest mowing. It forms seedheads in spite of the fact that it may be growing in turf that is mowed at one-half inch.

James Morrison, of the Hershey Country Club, Hershey, Pa., has devised a

* Sodium fluoride as an Herbicide. Reprint, Journal of American Society of Agronomy. Volume 33, No. 4, April 1941. S. Marcovitch, Tennessee Agricultural Experiment Station, Knoxville, Tenn.

"vertical mower" to cut off the prostrate stolons of crabgrass. Such an operation plays havoc with a sprawling, vigorous crabgrass plant. A description of Mr. Morrison's machine appeared in the Winter, 1949, issue of the USGA JOURNAL.

Flexible combs which may be attached to fairway mowing units are now available on the market. These combs pick up the seed heads of the crabgrass plant so that they can be cut off. Some golf courses have found that the use of this attachment has been effective in giving good crabgrass control. This device is described on page 185 of USGA's new book TURF MANAGEMENT (McGraw-Hill — $6).

Better Grasses

A large part of the turf research effort of the last 20 years has been expended in attempts to develop improved grasses which are better adapted for turf use. One weakness of chemical control in inferior turf is that when the crabgrass is destroyed, you still have weak, inferior turf which still can't resist the crabgrass. Merion bluegrass (B-27), zoysiagrasses, the tall fescues, improved creeping bents, improved Bermudagrass, and some of the newer selections of red fescues promise to do an outstanding job for competing with crabgrass. The summer-growing grasses are beginning to be used in the more northerly parts of their range. Where cool-season grasses are being grown in combination with warm-season grasses, crabgrass will not be too great a problem.

A discussion of the merits of some of the newer grasses will be found elsewhere in this issue of the JOURNAL.

Good Management Practices

Proper use of herbicides, use of mechanical crabgrass control methods, and use of better grasses are parts of good management. There are still other management practices which may have a great influence upon the ability of the turf to resist crabgrass invasion.

Insect damage is responsible for many crabgrass infestations. Whenever turf is damaged to the extent that enough space is left for a crabgrass plant to grow, the crabgrass is almost certain to take advantage of the opening. *Good insect control is good preventive weed control.*

Fertilizer should be applied in sufficient quantities and at the proper times so the maximal vigor and density of turf can be maintained throughout the crabgrass season. A weak, sparse turf invites crabgrass.

The timely aeration and cultivation of the soil under a turf cover, coordinated with favorable soil moisture, with periods of maximal root growth, and with fertilizer application, can do a great deal to strengthen the grass plants and to resist damage to the turf which opens the way for crabgrass invasion.

The Green Section has maintained an unwavering policy on mowing heights. The turf on greens, tees, fairways and other sports areas *must* be mowed at a height in keeping with the use of the area. On these turf areas, then, any discussion of height of cut for crabgrass control is purely academic. However, it is an accepted fact that common bluegrass and red fescue will do a better job of resisting crabgrass if mowed not shorter than 1½ inches. Therefore, on large lawn and park areas and where use permits, higher mowing heights may help some types of turf to resist crabgrass.

Summary

The full range of crabgrass control methods will be used principally by professional turf superintendents who have many growth factors of turf under their control and who have efficient mechanized equipment. They have the facilities to apply chemicals at the correct rate and at exactly the right time. Mechanical control is simply a matter of putting available machines and attachments to work. Golf courses always have been the first to use improved grasses (because they were responsible for their development).

Homeowners are greatly limited in their ability to use modern chemicals intelligently. They do not attend turf conferences and turf field days to learn

the fine points of turf management. The great majority will depend wholly upon better turf from better grasses for their crabgrass control program. They will buy seed from their dealers and they will sow it on their lawns (much of it out of season), and then hope! A few will use a chemical control, but much of it will be used improperly because they do not know best how to use it. Almost none will use mechanical methods because that involves labor, and the homeowner wants to relax on his lawn. Most of them will cut their lawn closely because that is the way they want it. We will encourage this practice because our improved turf grasses for golf thrive under close mowing for any other use, too.

On golf courses, athletic fields, and many other turf areas, we have learned that periodic soil cultivation provides many benefits to the turf. The net result is stronger turf and, therefore, less crabgrass. This will become standard practice on all turf areas as we learn more about it.

We believe that crabgrass control in turf will become a simpler procedure as we gain knowledge and understanding and as commercial turf interests develop a better basis for disseminating accurate, authentic information. Crabgrass is losing its place as the No. 1 national turf pest where all known methods of control, the introduction of better grasses, and good turf management are practiced.

FACTORS IN CONTROLLING CRABGRASS WITH POTASSIUM CYANATE

This was regarded as one of the outstanding papers presented at the 1951 Northeastern Weed Control Conference in New York, January 3-5. The authors were requested to condense the original paper especially for the USGA JOURNAL. We are pleased to present the condensed material here.

By R. H. BEATTY AND B. H. DAVIS
HORTICULTURISTS, AMERICAN CHEMICAL PAINT COMPANY

Potassium cyanate was reported as an outstanding chemical for the selective control of crabgrass in turf by R. E. Engel and D. E. Wolf, of the New Jersey Agricultural Experiment Station in 1948. Further work was reported in 1949. During the summer of 1950 experiments were run to investigate possible causes and remedies for irregular results occasionally observed in field work. Factors investigated include temperature of the solution, degree of concentration, number of applications, rate and type of wetting agent, spray particle size, and possible activators.

Temperature of the Solution

The first tests were made May 25 when crabgrass kill had been rather slow, apparently because of cool weather. Crabgrass plants were in the two-leaf stage. Weedone Crabgrass Killer was applied at the rates of 8 and 16 pounds of potassium cyanate per acre in 180° and in 60° water. The best kill resulted from applying 16 pounds in hot water as the fine spray produced by Monarch nozzle F-97-S No. 20.0. A coarser spray of 16 pounds in hot water was next in effectiveness. The 8-pound treatments followed the same trend. Poorest results were from coarse sprays of cold solution, indicating a possible advantage to using hot water at this time of year and to using a fine spray.

Number of Applications

Cumulative application tests were begun June 23. Applications of 8 pounds of potassium cyanate per acre repeated four times at 3-day intervals produced 100% control which persisted throughout the season. Three similar applications gave nearly as good control, with slight reinfestation. Two treatments were more than twice as good as a single treatment.

Minimum Concentration

In an attempt to obtain satisfactory crabgrass control with a minimum of discoloration to the permanent grasses, Weedone Crabgrass Killer was applied at rates of 4, 6 and 8 pounds of potassium