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R. E. Engel

Rutgers University

"What" happens to turf is often unknown. "Why" it happens is more of a mystery. All of us hope research and experience will change the situation. Research is usually quicker and cheaper than waiting for experience to teach the answers. As we know, too much trial and error on the job is dangerous. You may recall the story of a golf course superintendent who was asked if he had tried one of the current season's new products. His answer was, "No, my course is already in too poor condition." Study of research results cost little, and down-to-earth use of new ideas will help grow better turf as well as avoid past mistakes.

What is research? There is nothing mysterious about it. The purpose of research is to answer questions that have not been answered before. The technique is to prove a point beyond a reasonable doubt.

I trust this simplification has not misled you. Finding the fact through formal research requires imagination (ingenuity and hard work). Also, knowledge of basic science is frequently necessary. Even with the tools of specialized training, many frustrations greet the formal research worker. We have reached a time

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when it is necessary to keep a close eye on technical turfgrass developments. Things we consider impossible may become possible. Forty years ago only a fool would have shot at the moon. Whether we like it or not, times have changed for turf maintenance and they will change more and more. It is unsafe to fall too far behind on new techniques as it seems our society cannot stand anyone who is contented.

#### Pre-emergence Control of Crabgrass

As with most other institutions, pre-emergence crabgrass control studies have consumed a considerable amount of our research time over recent years. We started our first tests in 1955 and my comments on this subject could fill a small book. A summary of our current views may be of interest to your work:

We classify dacthal and zytron the most useful to date. These are recommended only for established Kentucky bluegrass turf. Also, we consider these or any of the other chemicals too risky for the bentgrass lawn or fairway.

Chlordane and calcium arsenate are utilized in various ways, but we cannot place them as high for general use. Calcium arsenate gives long-term control but its action and safety varies greatly with soil conditions. More comments on chlordane follow.

Bandane at 45 and 60 pounds per acre has given good control. Thirty pounds per acre has appeared too light for best performance. Also, we would like to know more about its safety.

Newer products are being tested and more will come. Among the current group, Stauffer R-4461 and Hercules H-9573 have shown crabgrass control. These and others merit more study. Anyone concerned with pre-emergence must look at new products.

Our greatest concern for the pre-emergence technique is safety to the turfgrasses. I have observed or seen reports of injury for virtually all chemicals to date. Two types of injury are of concern: first, danger to the established turfgrasses; and second, danger to seedings made at a later date. Injury to established grass is very subtle. For example, we used chlordane for the 1962 season. A similar result was observed for tests made in 1960 and 1961. The injury appears to be associated with drought. While some damage occurred on most plots, it was far more severe on chlordane treated plots than the check or those treated with other chemicals.

We have observed a few very significant increases in clover content with dacthal and zytron. Any material that thins the turf cover should be of concern. Such experiences as I have just listed warns us that we must make long careful study of pre-emergence chemicals if we hope to minimize turfgrass injury.

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### Goosegrass Control

Work at New Brunswick in 1957 and 1958, which was USGA supported, showed chlordane had appreciable promise for goosegrass control. This project was not continued, but Bob Dunning and some golf course superintendents have reported worthwhile field results. For the past three seasons we have conducted limited work with current pre-emergence crabgrass herbicides. In 1960, standard rates of chlordane, dacthal and zytron applied on April 28 gave inadequate goosegrass control. In fact, the latter two were so effective on crabgrass that goosegrass was worse in these treatments. In 1961, bandane, chlordane, dipropalin, trifluralin at standard rates and double rates of dacthal and zytron failed to give a high degree of crabgrass control. In fact, all showed slight or severe damage to the annual bluegrass turf. It was of interest to observe the double rate of dacthal and zytron treatments showed appreciable bare ground at late as early November. This might be explained by the chemical residue acting on seed of annual bluegrass and the seeded turfgrasses. Several chemicals used in 1962, showed appreciable goosegrass control. However, most appeared to give turfgrass injury on the basis of appearance and clover ratings. Diphenatril at 60 to 120 pounds per acre appeared most promising. Laboratory studies have shown that light is a great aid to germination of goosegrass. This result plus observation has convinced us that good turf cover is important for minimizing goosegrass.

### Thatch Control

A thatch control study has been conducted for a period of seven years with aid from the USGA. The results after six years of treatments are summarized briefly as follows:

1. Cultivations tend to destroy or prevent thatch. We have not data on how this happens, but it is logical that the cutting of the thatch, the mixing of thatch with soil, and the removal of some material through cultivation should bring a degree of relief from thatch problems.
2. Lime appears to discourage thatch accumulation. The explanation for this might be that residues can become too acid for good decay activity.
3. Topdressing appears to encourage decay.
4. It appears that an increase in surface accumulation occurs with use of wetting agent. Whether this result outweighs the help this material can give in some situations where water penetration is poor has not been determined.
5. High nitrogen gave an increase in surface ac-

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cumulation. Again, it is difficult to say if this factor offsets the tendency for turf to wet more readily when it is growing with good nitrogen supply.

6. Topdressing was most effective in improving quality.

#### **Annual Bluegrass Control**

Some have proposed pre-emergence herbicides for annual bluegrass control. Certainly, we have too many unknowns to attempt this on any basis other than experimental. Most appear too unsafe for the grass and it seems this is a technique that needs much formal research.

You may recall that light, repeated applications of sodium arsenite have been considered useful when annual bluegrass and clover were excessive. We tested a series of chemicals some years ago with the hope of destroying the seed crop of annual bluegrass. A chemical that might prevent or kill the flowers might succeed. We found a chemical, maleic hydrazide, but it was too severe on bentgrass. During this work we discovered that endothal could selectively attack annual bluegrass in bentgrass turf. This was reported some years ago. This chemical does not have a large safety margin for bentgrass, but it differs greatly from the pre-emergence type of chemical in that it is a shortlived contact type herbicide. This is a desirable factor in that lingering effects should not occur to any appreciable extent.

We never pushed anyone to use the endothal treatment because we felt the situation was somewhat complex. Our work showed that two to three treatments of endothal in early spring at a rate of  $\frac{1}{2}$  pound per acre eliminated a majority of the annual bluegrass without significant harm to the bentgrass. We found that treatment after early May or after warmer weather arrived was unsafe. Other factors were: (1) annual bluegrass control is unlikely to be complete (possibly this would be undesirable), and (2) 30 to 50% bentgrass is required throughout the turf or appearance will be intolerable until more bentgrass becomes established.

Endothal, as used in our tests, gave good kill of clover. There is increasing interest in this point for growers of our area as we become more concerned about safety of the 2,4,5-T and 2,4,5-TP types to bentgrass. It is no secret that the phenoxy compounds such as 2,4,5-T and 2,4,5-TP have given considerable injury to bentgrass. This is an unfortunate realization to face when we know the great effectiveness of these herbicides.

With financial support of the USGA, we developed a study of the effects of 2,4,5-TP on turfgrasses (this work was primarily on bentgrass). The work to date

has shown this chemical produces severe interference with normal food reserves of the grass plant. As one would expect from this results, severe hindrance of good rooting can occur and this has been shown repeatedly in our tests to date.

Also, it was of interest to find the effects of 2,4,5-TP appear less severe when the grass is growing with cooler temperatures and optimum moisture. Normally, we prefer to say little about a study until it is complete, but we feel the dangers are serious enough that men in our area should do some thinking.

With regard to the use of 2,4,5-TP, we recognize its ability to kill troublesome turf weeds such as clover and chickweed. However, we have warned our turf growers in New Jersey against indiscriminate use of this chemical.

We suggest they use the lowest effective rate. A rate of  $\frac{1}{2}$  pound per acre is much safer than rates of  $\frac{3}{4}$  to 1 pound per acre. While we are not sure of the safest season for treatment, we would suggest avoidance of late spring and warm weather treatment if at all possible.

#### **Growth Control**

Chemicals for controlling growth of turfgrasses is fascinating and the subject seems to persist in thought and in some research programs. Some years back we took a look at maleic hydrazide. With a few new one on the scene, we decided to observe some of these this past season. We did not find adequate promise in any of the materials. Also, it may be of interest to you that all chemicals tested seemed to interfere with best growth of the grass before the test was completed.

The effects of soil moisture level on turfgrass quality and growth rate were studied recently by one of our graduate students. Merion bluegrass was permitted to remove varying amounts of water from the soil before water was added again. Re-watering when only about one-third of the available water was removed seemed to give the most vertical growth and it gave a measurable increase in shoots per unit area. However, delaying water until two-thirds of the water was removed gave the best color, quality rating, and the greatest weight to reach individual shoot. Delaying watering until seven-eighths of the moisture was used, produced only slightly inferior turf than the higher water ranges. Delaying water until all but one-twenty-fifth of the available water remained gave an open and inferior turf. In other words, this work showed maintenance of the water level in the lower range of available moisture did not harm quality, provided the wilting stage or near-wilting stage was avoided.

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