PROCEEDINGS

46 TH
ANNUAL CONFERENCE
MID-ATLANTIC GOLF COURSE SUPERINTENDENT ASSOCIATION

January 6-7, 1975

BALTIMORE-HILTON INN
PIKESVILLE, MARYLAND

The proceedings of the 46th Annual Conference of the Mid-Atlantic Association of Golf Course Superintendents were published through the combined effort of the University of Maryland Cooperative Extension Service, the University of Maryland Department of Agronomy and the Mid-Atlantic Association of Golf Course Superintendents.

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PLANNING A DISEASE CONTROL PROGRAM

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In these days of climbing prices and static or declining budgets many golf courses are faced with reduced purchasing power. Cutbacks are occurring. From the superintendents view, can he provide the same level of maintenance on fewer dollars, or must standards also be reduced? The answer depends on his skill and the degree of cutback. For the present with most net reductions (inflationary reduction in buying power and static or reduced budgets) in the 0-20 percent range, I believe the same standards can be maintained without loss. Very few of us are so efficient that we cannot find better ways of doing things for less expenditures.

In an attempt to help you maximize efforts in at least one area, namely, disease controls, I have prepared a check list of ideas for you to consider in planning a 1975 program. The sequence of presentation represents a priority ranking from my view but my priorities may differ vastly from yours. If just one of these ideas is of some use then I won't feel my efforts have been wasted.

1. Disease control can't be separated from the total management picture. Every cultural practice in some way effects disease incidence and severity.

    a. Irrigation - overwatering in general makes disease more severe.

    Light syringing irrigation (except Fusarium blight) will usually make summer diseases more severe - example fairway dollar spot and brown patch.

    b. Fertilization - nitrogen manipulation is especially critical and can be both a plus or minus.

    c. Vigorous grass (not succulent soft grass) will recover more rapidly and sustain less damage.

2. There is no substitute for a complete basic knowledge of all turfgrass diseases.

    a. Diagnosis - know the problem, identify it.

    b. Prognosis - the future course of the disease, the outlook. Is it serious, or just curiosity? Will it get better or worse regardless of what you do or will your efforts change its course.

    c. Control - be able to choose among all possible available options, then select the best one for your situation and budget.

3. Establish priorities for maintenance for the various areas of a golf course. For example this would be my selection.

   a. Greens - 40 years ago this was the major golf course consideration, it still should be #1. With poor greens all else is wasted.

   b. Tees - This is the green companion; on short holes the in between is just walked over.

   c. Fairways - In a crisis during mid-summer a more or less brown droughty area can still serve as a fairway (the duffer gets a better roll). Sheep pastures originally provided fairways, at least yours won't have the sheep manure problem unless things really get tough.

   d. Roughs - Nobody has any right to be here anyway. What he encounters is his own fault.

   e. Don't forget the flowers and club house area. A few bright spots can make a dismal situation much brighter.

4. Work as closely as possible with the greens committee and/or club management. Be sure that your priorities and theirs are in agreement.

   a. When a cutback or change will have a noticeable effect, be sure they are appraised of this ahead of time. Try to get them to assume responsibility for the changes that come from financial constraints. You should not be the blame-taker for poor fairways on a reduced budget. Be sure the club does not save money by replacing you with your assistant or foreman.

5. Measure the cost effectiveness of all you do.
Evaluate each practice in light of what your dollars produce. Time is money but in some instances time is available and money for equipment and materials is not.

   a. Most golf courses on slow release fertilizers have excellent residual carry-over of plant nutrients in fairways from year to year. You can cut back here but perhaps not on greens.

   b. Does this fungicide application really result in a response? Is the response you get worth the expenditure?

   c. Maximize the benefit/cost ratio. Some expenditures are marginal; others represent a very wide benefit/cost difference. Seek the wide margins.

6. Where possible use cultural management practices to replace high cost fungicides.

   a. Frequent and light top dressing is one of the most effective disease control practices for greens and tees. Moist soil speeds clipping and thatch decay and provides bacterial action for suppressing fungal disease organism survival.

b. On bluegrass fairways with Helminthosporium leaf spot and crown rot problems a delay in N applications from March to June can save $40.00 to $50.00 per acre in fungicide material costs plus $3.00 to $9.00 per acre in application cost.

c. If fairway fungicides are not feasible in this year's budget then take a hard look at irrigation. Irrigation of the fairways in mid-summer makes fungicides imperative for controlling the wet, hot summer diseases.

7. Consider a partial curative program for disease control rather than complete preventive program.

a. This depends on your locality and past experience; treat only problem areas ahead of time.

b. Will you trade several thousand dollars worth of fungicide expenditures for a twice day examination of greens and tees? Fungicide insurance treatments are a poor substitute for careful examination.

8. Consider partial treatment of portions of the golf course as problems appear.

a. In many cases the real troublesome areas where diseases appear year after year may involve only a few greens, tees, or fairways. Treat these on a preventive basis, let the rest continue on a curative basis.

9. Measure effectiveness of treatments.

a. Very often we see what we wish to see. After an expensive treatment we very much desire good results. Often the results will not stand up in the cold light of objective evaluation. You cannot afford chemical practices based on good intentions and hope for results.

b. Leave check areas and untreated strips.

10. Apply chemicals in the best possible manner. Everything must be right.

a. Calibrated equipment.

b. Proper nozzles.

c. Precise dosages.

d. Good timing.

In summary, planning a disease control program with a shrinking budget will require the best of your ability. The rewards can be great. Money freed for other purposes can produce much more tangible results than unnecessary fungicide treatments.

A LOOK AT WARM-SEASON - COOL-SEASON COMBINATIONS

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Here in the transition zone from my point of view, there are four primary turf species. These are creeping bentgrass, Kentucky bluegrass, bermudagrass and zoysia. In a talk to this organization in June of 1974, I compared the advantages and disadvantages of these four species. As you are well aware, none of these are exactly perfect in this area for tees and fairways. Because of this many of you are trying perennial ryegrass overseedings into either bermudagrass or Kentucky bluegrass.

In the summer and fall of 1973, I initiated an experiment with eight combinations of warm and cool season perennials, and the four perennials by themselves. They were as follows:

1) 'Meyer' zoysia by itself
2) 'Meyer' zoysia and a blend of five Kentucky bluegrass varieties
3) 'Meyer' zoysia and 'Penncross' creeping bentgrass
4) 'Midwest' zoysia and the bluegrass blend
5) 'Midwest' zoysia and 'Penncross'
6) 'Tufcote' bermudagrass and the bluegrass blend
7) 'Tufcote' and 'Penncross'
8) 'Tifgreen' (328) bermudagrass and the bluegrass blend
9) 'Tufcote' by itself
10) 'Tifgreen' and 'Penncross'
11) 'Penncross' creeping bentgrass by itself
12) the blend of five Kentucky bluegrass varieties

The Kentucky bluegrass blend consisted of equal parts of the varieties Fylking, Merion, Pennstar, A-34 and Adelphi.

Two fertilizer treatments were initiated for these grass combinations in May 1974. A summer program was imposed over half of the experiment. This consisted of 4 lb of N/1000 square feet applied as ammonium nitrate in one pound applications during the summer. A fall to spring program of the same amount of ammonium nitrate was applied to the other half. The whole experiment received 2 lb of N as ureaformaldehyde in early September and two pounds of phosphorus and potash as a 0-20-20 soluble fertilizer. The experiment was mowed at 3/4 inches in the summer and 1 inch in spring and fall.

The bermuda and zoysia varieties were established first. Then heavily vertically mowed and seeded in September 1973 to the bluegrass blend and 'Penncross' to give the desired combinations of warm and cool season grasses.

The following report is the results from the establishment phase and the first summer of treatment. These results should thus be evaluated as only preliminary findings.

The bluegrass blend and zoysia varieties were slow starters and haven't looked as good as the bermudagrass varieties and 'Penncross'. It is expected

that the zoysia will prove to be more promising with time. The stand of both zoysia varieties was reduced by 'Penncross' overseeded into them but not by bluegrass. 'Meyer' zoysia and both zoysia-bluegrass combinations were slow to heal 4 inch cup-cutter scars left after removing samples from the plots. Zoysia combinations had low quality ratings during the summer. These same combinations rated much better than similar bermuda combinations in the fall after the first frost. The reason for this was the zoysia combinations retained more of the cool-season grasses through the summer than the bermuda plots. However, 'Meyer' plots were still very patchy. 'Meyer' does not appear to blend as well with the cool-season grasses as 'Midwest'. This was expected as 'Midwest' has long stolon internodes and was originally selected for the purpose of being used in blends.

I personally found 'Midwest' to be too coarse. The wide blades of this variety did not form a uniform turf with either the bluegrass or bentgrass.

The bluegrass blend became well established in the zoysia and bermuda plots by the summer of 1974. However, in the bare unprotected plots where it was supposed to form a pure stand of bluegrass, it did not produce a satisfactory stand by the time fertilization treatments were initiated. With less immediate competition from zoysia, the zoysia-bluegrass plots had more bluegrass in them at summer's end than the bermuda plots did. While bermuda competition reduced the percentage of bluegrass under both fertilizer programs in the bermuda-bluegrass plots, the bluegrass percentage in zoysia-bluegrass plots responded differently. There was a reduction in the percentage of bluegrass in the zoysia plots receiving summer N applications only. It should be noted that this occurred without a significant increase in the zoysia under this fertilization treatment. A reduction in bluegrass under this fertilization treatment also occurred in the pure bluegrass blend plots.

Bluegrass seed moved by wind and water established significant size bluegrass stands in the plots that were supposed to be pure 'Tufcote' and pure 'Meyer', but not in any plot overseeded to bentgrass. The 'Tufcote' quickly crowded out this bluegrass during the summer, but the bluegrass still maintained a significant level in the 'Meyer' plots that were receiving the winter N program.

The percentage of bentgrass was not significantly reduced by summer heat and competition as the bluegrass was. There was significantly less bentgrass under the summer fertilizing program in the Meyer-bentgrass and the 'Tifgreen'-bentgrass plots but not in the pure bentgrass plots.

During the overseeding with 'Penncross' there was considerable contamination of other plots. In May after the fall seeding, bentgrass had established significant size stands in the plots that were suppose to be pure 'Tufcote' and pure 'Meyer' but not in plots overseeded to bluegrass. 'Tufcote' competed well enough during the summer to reduce this contamination to an insignificant percentage. However, the 'Meyer' plots had significantly more bentgrass in them by the end of summer than the 'Tufcote'-bentgrass plots. This again emphasizes the slow rate of spread found with 'Meyer' zoysiagrass.

The 'Tifgreen'-bentgrass combination remained closest to a 50:50 mixture and appears to be the most promising mixture.

In review, I would like to say that in the transition zone combinations of warm and cool season grasses may offer a better all around turf than single species. However, more research and much time must pass before I am ready to recommend anything but a trial approach to this possible solution to your turf problems.

SOME OBSERVATIONS ON GROWTH RETARDANTS FOR TURF

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The studies we have conducted to evaluate growth retardants on fine turf enable one definite conclusion. None of the chemicals tested can be considered a panacea. This has been shown by other studies performed in various parts of the country. Although we have not evaluated all chemicals that are considered growth retardants, we have studied several that have the most potential for turf usage. Some may be good turf management tools if used properly.

How does one use growth regulators properly?

First of all, the presently available growth regulators should not be used on turf areas that are intended to maintain a first class condition. Retardants may give undesired results on greens, tees, and fairways. Slowing growth with chemicals reduces plant quality. The most effective regulators usually cause at least a temporary phytotoxic effect on the grass. General appearance may become unsatisfactory as the older leaves die and new leaves are slow to develop. Mowers are still the best grass growth regulators on these types of turf areas.

The most appropriate place to use retardants are on areas that can't be mowed efficiently and where a temporary off-color can be tolerated. For example, ditch banks, rough areas with shrubs or trees, or steep slopes on which a mower cannot be driven are areas where a growth retardant can satisfactorily be used.

Secondly, it appears to be wise to delay application of the chemical until after some spring growth has been made, possibly after the first mowing if some color is desired. If treated in early spring before new growth is evident the new leaves are retarded and subsequently fail to provide green turf color as the older leaves senesce and deteriorate. Since most roots of temperate grasses are formed in early spring, the application of a growth retardant will hinder root development. Application after the roots are formed seems to have a less detrimental effect.

Third, heavy dosages should be avoided. Increased application rates will not provide proportionally increased periods of reduced growth. Also heavy dosages may perform as sterilants rather than regulators.

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*Paper was presented by Dr. R. E. Schmidt

Fourth, applications must be uniform to obtain favorable results. The growth retardants although uniformly applied may not be uniformly effective. Each species in a turf mixture will react differently to the retardant. Even when the retardants are applied to monospecies turf, completely uniform results may not be obtained. Variations of soil, fertility, and microenvironments within the turf community will cause plants having the same genotype to respond differently.

Our research shows that the growth regulators we investigated will reduce topgrowth for about 6-8 weeks. After this period there is some topgrowth stimulation. This regrowth can be checked with a second application. It is best to permit some recovery before a second application is made in order to prevent complete deterioration of the plants.

Phytotoxicity effects are generally greater with summer applications of retardants than with spring treatments. It is possible that lower dosages in summer would offset these effects. The slower growing leaves showed more symptoms of disease, possibly because they remained in the sward for a longer period and therefore became less resistant to infection as they became older.

Heavy irrigation and fertility lessen the effectiveness of the regulators. On the other hand, plant growth hindered by lack of moisture or fertility will show little response from an application of a growth regulator.

Seedhead production was reduced with application of all the inhibitors we studied.

Delaying spring application of certain growth retardants for one month after underground development started gave an increase in Ky bluegrass roots and rhizomes over plants treated earlier. However, turf not receiving an application of the regulator produced significantly more roots and rhizomes than any of the treated grass.

The retardants that were most growth inhibitive also caused the turf to have the poorest appearance. However, the effect was temporary and grass from all plots recovered in four weeks after the initial application. This was also observed when a summer application (June) was made following a spring treatment (April).

Although we are not in a position to recommend any growth retardant based on the limited data we have obtained, we feel that three may have potential. Sustar, Maintain, and HLR-R07-6145 gave the most topgrowth control with the least phytotoxicity.

HLR-R07-6145 gave excellent control of chickweed and Veronica, a difficult weed to control. It also gave some reduction of Oxalis. Maintain provided excellent control of chickweed and Oxalis and partial control of Veronica. No other weeds were observed to be controlled by the other chemicals.

A greenhouse test in which one inch of irrigation was applied at different intervals after treatment showed that irrigation should not be applied for two hours after application of the regulators. This was especially true for the Sustar treatment.

Although growth retardants are not completely perfected for use on fine turf, if used within their limitations they can be effective in some turf areas. Retardants appear to be most effective on fine turf species that are of the dwarf or slow growing type.

NEMATODES IN TURFGRASS

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"Nematodes in turfgrass," permits a very broad coverage of the subject. However, I intend to describe what plant parasitic nematodes are, review briefly what injury they can cause to grass, relate some of my earlier work on nematodes and my present endeavors with one nematode, and also touch on chemical control.

Nematodes are found on land and in water from the Arctic to the Equator. The greater numbers, however, are most often found in the warmer regions. There are all types of nematodes: those associated with animals, others with plants, and still others feeding on decaying organic matter. Our interest is with those that parasitize cells of turfgrass roots and are pathogenic. Their size, length and width is measured in microns. A micron is about one twenty-five thousandths of an inch. Because of their size and the fact that they are translucent, a microscope is needed to observe them. It is not uncommon for turf managers to mistake the thread-like larvae of beetles for nematodes. Even the larger plant nematodes are not easily discernible with the naked eye. They vary in shape according to specie but most nematodes infesting turf are snake or worm-like. Their life cycle, in general, consists of an egg, four larval stages, and an adult. Plant nematodes are often divided into groups according to their method of parasitism. There are ectoparasites which complete their life cycle outside the host, feeding on the plant's surface or near surface cells. The other group is known as endoparasites which spend part or all of their life cycle feeding within the plant tissue.

Plant parasitic nematodes feed by injecting a needle-like structure, termed a stylet, into the living cell of the grass root. A digestive enzyme is then pumped by the nematode through the stylet into the cell. The cell contents are predigested and withdrawn through the stylet for ingestion. Enzyme secretions by some nematode species cause an alteration of the plant's cell growth which results in abnormalities of the root tissue.

Periodically published reports of parasitic nematodes associated with turfgrasses suggest plant injury by the organism. They fail to relate the true nature of the relationship or its pathogenicity. Such reports are often simply the result of a field survey. For instance, in 1954 I took samples from a large number of golf greens in Rhode Island and Massachusetts. These turfgrass samples were taken from areas that displayed symptoms of chlorosis and/or dieback. Many of the nematode species extracted from these turf samples were identified as parasitic. However, no experiments were initiated to determine if these suspected pathogens actually caused the chlorosis or dieback. Nematode pathogenicity on turfgrass is not always easily determined but considerable progress toward this end has been made in the last twenty years.

As mentioned above, nematodes feed on individual cells. Depending upon the species of nematode, its effect on the cell, the population of nematodes feeding, and the particular host, varying and multiple symptoms may occur.

There are known nematodes that feed on grass root cells without causing noticeable injury to cells, but that do bring about a reduction of either the plant's top growth, root growth or both. There are some nematodes that cause a shriveled shortened root system but not root lesions. Others cause variously shaped swellings of the root. Stunting of both plant roots and shoots, chlorosis of the leaves, as well as root galls, are caused by still other nematode species. It is also important to point out that nematodes can severely reduce turfgrass root systems without producing noticeable above-ground symptoms. However, symptoms may become evident when the plants are subjected to stress.

Nematodes have been shown to be vectors of viral diseases. They are in constant association with soil microorganisms including fungi and could very well be involved with fungus-caused diseases of turf. Root injuries incurred by nematodes could also provide areas of entrance by pathogenic fungi. As a matter of fact, observations of fungus diseases on turfgrass appearing to have been affected by nematodes have already been reported. Dr. Hall recently wrote to me of this possibility occurring in Maryland turf. My latest endeavor is one that follows along similar lines, that is, experimenting with a specie of Longidorus. Longidorus, a rather large nematode, has been known to transmit viral diseases.

Longidorus was found to be infesting poorly growing Poa annua on several New England golf courses. The infested turf was short rooted and could be peeled back like a carpet. Experimentation with nematodes requires a fairly constant source of inoculum. A review of literature indicated that the organism could be propagated on spearmint grown in sandy soil. However, a more intensive study of the literature showed that Longidorus is a very delicate nematode. To cultivate it the host plant must be watered with demineralized water and the water must be applied by subirrigation methods. In addition only certain types of fertilizer can be used to supplement the plant's nutrition. Application of the wrong form of fertilizer and water would result in the death of the organism. The point is, if such care is required to propagate Longidorus, one wonders how it survives in the field. To date the only result we have been able to obtain is that the nematode does cause a swelling of spearmint root tips. The nematode is pathogenic on spearmint. The tests, however, will continue for at least one more year.

Grass species, as well as cultivars, vary in susceptibility to nematode pathogenicity. Warm temperature is one factor that favors nematode activity and because of the temperature factor southern grown grasses are more often affected. There have been many publications reporting damage by many different species of nematodes on grasses grown in the Southeast. Still, many of the parasites belonging to the same genera have been found on turfgrasses grown in the North. In the early to mid-sixties a study of two of these nematodes and their effect on several turfgrass species was made.

The two nematodes studied are known as Tylenchorhynchus, the stunt nematode, and Pratylenchus, the lesion nematode. The former is an ectoparasite and the latter an endoparasite. These two nematodes were chosen for study because of their widespread occurance on turf and because both nematodes could be cultured axenically. Ryegrass, creeping red fescue and Kentucky bluegrass were selected as hosts.

The experiments consist essentially of replications of each of the three grass species, each grown singly in a nutrient agar in test tubes free of organisms. A certain number of each grass specie were individually inoculated with lesion nematodes and another group with the stunt nematode. Plants of each grass specie were also kept as controls. Semi-weekly thereafter two plants of each grass specie were removed from the tubes, the roots examined, and the nematodes then re-isolated and counted.

Shoot growth of the three grass species was not affected by either nematode. Many lesion nematodes and their eggs were located only in the cortex of both primary and lateral roots of ryegrass and fescue but the nematode was found only in the roots of two Kentucky bluegrass plants. Nematode lesions were never apparent on the roots of any of the inoculated grasses but the walls of the cortical cells were torn by movement of the parasite. The injured cells were not discolored nor was there any semblance of necrosis. The stellar tissue, phloem and xylem, appeared unaffected.

The stunt nematode, an ectoparasite, was never found within the roots of any of the grasses nor was its stylet puncture of the cells ever discernible.

A series of greenhouse experiments was made to determine the gross effects of the same two nematodes on the same three turfgrasses. Ten plants of each grass specie were planted in steam-sterilized soil placed in plastic pots. The requirements of the grass in each pot, pH, fertility, water, and mowing height, were maintained. Each pot of turfgrass was inoculated with either 5000 lesion or 5000 stunt nematodes and controls were maintained. Three and one-half months after inoculation the nematodes were extracted and counted. The top growth of the nematode-infested ryegrass and fescue appeared as healthy as the top growth of the control grasses. No lesion nematodes were removed from either the soil or roots of Kentucky bluegrass. The stunt nematode caused reduction of the root weight of creeping red fescue.

A second test was made similar to the first greenhouse trial, except that no fertilizer was added during the experiment and nematodes were recovered after two months.

Both nematodes parasitized the three grass species. Yet, the top growth of the three grass species infected with either nematode appeared healthy. The lesion nematode significantly reduced the root weight of ryegrass, however, the shoot weight of the ryegrass infested with the stunt nematode was increased. Results of these experiments indicated that both nematodes were pathogenic but the effects on the grasses were slight, particularly when the grass was growing well. Injury to the cortical cells of the grass by the lesion nematode could affect the uptake of nutrients and water, particularly in the field where these factors are likely to be limited.

Nematode control can be obtained in a number of ways but on established turf it can be seen that the application of chemicals is necessary. There are a number of nematocides on the market, some more effective against a particular specie than others. All are toxic to humans but several are extremely toxic. However, with the many variables occurring in the field it is not always possible to credit turf improvement to a reduction of nematodes resulting from an application of a nematocide.

We conducted nematocide tests in the past and again last spring. The earlier investigation involved the evaluation of seven nematocides compared to an application of fertilizer. To determine the effects of treatments, clipping and root weights were measured. The fertilizer and one nematocide increased clipping weights. Fertilizer improved turf color. All nematocides reduced the number of parasitic nematodes, two of them more effectively than the others. The fertilized plots contained the highest number of parasitic nematodes. Root weights were not affected by any nematocide treatment.

In last year's nematocide trial a single chemical was applied at three different rates. At all rates the chemical injured the turf, which recovered, all the treated turf plots appearing darker green in color and healthier than the controls. The point, however, is that there were very few, if any, parasitic nematodes in any of the test plots prior to chemical application. It is possible that in both nematocide trials, stimulation of grass growth may have been brought about by the effects of soil fertility and its interaction with the nematocides. Also, in the first test the nematocides reduced parasitic nematodes and at the same time increased nutrient availability, both of which could have stimulated plant growth. In addition, some nematocides are known to have either insecticidal or fungicidal activity and this insect or fungus control could account for turf improvement. When working with a biological entity, especially soil inhabitants, it can be very difficult to obtain clear-cut results.

To sum up -- There are many parasitic nematodes pathogenic on turfgrass and they appear to be most damaging to turfgrasses in the Southeast. Pathogenic nematodes cause root lesions, slough tissue, variously shaped swellings of the grass root, and other effects. Above ground symptoms most often are not discernible except possibly when population build-up and stress occur. Chlorosis and thinning are the usual top symptoms. Nematocides, some more specific for the control of a particular nematode than others and several more toxic, will reduce nematode population. Remember, they reduce numbers and repeated applications may be needed to keep populations low. Most important - if nematodes are suspected, before applying a control, check with a trained nematologist. Have him identify the parasites present and their numbers, then choose and apply the correct controls. Last, there is a need for increased and more thorough investigation of parasitic nematodes found associated with turfgrasses.

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EFFICIENCY AND SAFETY IN CONTROLLING WEEDS ON THE GOLF COURSE

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Chemical weed control has become a great tool in growing turf. It has brought more improvement in the last 25 years than any other phase of turfgrass management. Yet, careless use of this procedure is dangerous to turf; and, on occasions, herbicides have done more harm to the grass than we have realized.

Certain steps generally apply when we attempt turfgrass weed control hoping to obtain the best results with the greatest efficiency and safety. The first step is growing good turf. This reduces the necessity for frequent use of herbicides that may injure the grass. Secondly, choose the correct herbicide. This becomes more difficult as more and more herbicides and variations of their use occurs. If there is no clear answer as to which chemical should be applied, use the established chemicals that you have known and worked with before. There are times when you must try a new chemical for the first time. Check with other professional turfgrass managers on such occasions. This may be a good procedure even though you know the chemical. Third, know when to use a herbicide. One aspect of determining when to use a chemical is the relative benefits and risks involved. No herbicide makes the grass grow better. If the weed problem is worse than the injury risk, treatment is justifiable.

Application at the correct time of the year is an important concern in herbicide use. While dandelions can be treated too early with 2,4-D for good kill, it is just as important to apply this chemical in time to prevent a large crop of seedheads. In the case of preemerge herbicides, most of these perform best when they are applied 2 or 3 weeks in advance of crabgrass germination. Fourth, applying the correct rate is important. Too little gives poor control and too much can cause serious injury and waste money. The first step is determining the amount of chemical concentrate required per unit area for use in calibration of the spreader or sprayer. Recheck the calculations to assure no mistake has been made. The second step is to calibrate the spreader or sprayer. This may take considerable time if you are unfamiliar with equipment or it is working poorly. At the time of calibration, make sure the equipment has a uniform spreading pattern.

Attaining complete control of turf weeds, i.e., to the last weed, is efficient for many sites. This is especially true on small areas and with weeds such as crabgrass, dandelion, and goosegrass. Once the number of weeds is reduced to a few, hand removal or spot treatment on a regular basis may be easier and safer than allowing a few weeds to increase into a problem that requires use of a severe herbicide treatment at an early date.

Suggestions on Several Weeds and Herbicides

It is standard procedure to use 2,4-D for dandelion, buckhorn and broadleaf plantain. Yet, a special distinction should be made on golf turf where bentgrass and annual bluegrass are often the major grasses. With these species, use of 1/2 to 3/4 lb. active ingredient per acre (AI/A) of 2,4-D will give quite satisfactory control with less risk to the turf. This contrasts with the 1 to 1½ lb. AI/A rate which is appropriate on Kentucky bluegrass lawns and roughs. On occasions, use low volatile 2,4-D for greater safety to nearby plants. When clover, chickweed and/or knotweed are present in bentgrass-annual bluegrass fairways in the spring, use the lower rate of 1/2 lb AI/A 2,4-D with 1/8 to 1/4 lb AI/A of dicamba. Some may prefer to use the commercial mixes for these weeds on the golf course, but these herbicide preparations should be checked for the total of the related compounds of 2,4-D, Silvex and mecoprop. When these total 1 lb/A or more, the risk to the turf becomes similar to the use of a high rate of 2,4-D alone.

When clover, chickweed and/or knotweed occur, spring treatment, well in advance of hot weather, is recommended. Usually, this can be done as soon as the clover has good leaf growth. When these weeds occur with no dandelions, dicamba at 1/4 lb AI/A is adequate. Some may wish to use the phenoxys such as mecoprop and silvex. Again, with bentgrass-annual bluegrass turf, this raises concern over the large total of phenoxy material being applied. Silvex is always questionable on fine turf and rather than use mecoprop alone, it might be combined with dicamba.

Preemerge for control of crabgrass and goosegrass -- Control of crabgrass with the available preemerge herbicides is quite good but they are often less satisfactory on goosegrass. Yet, the turfgrower has no choice but to use these chemicals on many occasions. Careful and well-conceived use of these chemicals becomes important.

Control of annual bluegrass -- Before golf course superintendents in the cooler latitudes consider all-out attacks on annual bluegrass, they should consider their chances of growing this grass successfully. In some of our cooler climates, it should not be looked upon as a weed. If you consider annual bluegrass a weed, you must still rely heavily on management for control because we do not have herbicide panaceas. Of the chemicals available, tri-calcium arsenate has given the best control in spite of the fact that it is a risky chemical. Currently, the unavailability of this chemical does not leave us with any simple method of eliminating the annual bluegrass problem. A number of our preemerge herbicides are quite good at preventing annual bluegrass germination. But the need for longer residual activity from late summer through spring plus their inability to control the vegetative types of annual bluegrass do not make them a good prospect for control of this weed.

Endothal showed some selectivity on annual bluegrass in bentgrass turf in our tests of some years ago. We never, and do not now, propose that it can be used as an eradicant for annual bluegrass. When used in early spring during cooler weather, before the flush of heavy growth, several endothal treatments will depress the annual bluegrass content of the turf and control clover. This type procedure will help bentgrass remain dominant. The endothal treatment is inexpensive and leaves no residue problem.

When concerned about annual bluegrass, utilize the management tools that minimize this weed. First, avoid loss of turf by: (a) watering to save the bentgrass - not annual bluegrass, (b) disease control, (c) insect control, (d) discreet mowing and (e) spreading traffic. Secondly, use the minimum amount of water for bentgrass growth in late summer when annual bluegrass might germinate. Third, use a minimum of nitrogen required for the bentgrass.

No Mistakes with Herbicides

"No mistakes" is a big order but the disaster of a wrong herbicide application is about the worst thing that can happen to a turf. An important step in avoiding mistakes is knowing the chemicals. Do not rely on trade names only; learn to associate these with the common chemical name. Maintain information on such things as the safe rates of application, residue problems, safety concerns for the applicator, the weeds that are controlled effectively, etc. Possibly, such records should be maintained for each chemical and weed on a 5 x 8" card.

Check with others on the use of a herbicide. This is especially true for the newer chemicals. Opinions on such things as choice of chemicals, rates of application, effectiveness of the treatment, and timeliness of the application commonly need consideration. Do not hesitate to call someone else for a quick opinion. Mistakes in application rate and techniques can be avoided. Allow plenty of time to prepare for an herbicide application. This will permit rechecking the rate. Also, it gives time to check on the delivery rate of the application equipment and the uniformity of distribution. Continually recheck the application rate during use of the chemical.

Herbicides are one of our most valuable tools in turf production. Adversely, they are among the most risky practices. Keep up-to-date on herbicides and strive continually to improve your professionalism with herbicides.

CUTTING CORNERS WITH EQUIPMENT

Alexander M. Radko
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New courses today have a wider selection of better equipment than ever before. The golf course superintendent has a choice of the one motor and frame (power pack type) with several interchangeable units for various maintenance functions or the conventional complete unit each propelled by its own motor and used mainly for just one task. The former is not a new concept, it has been tried before, but now manufacturers are responding to golf maintenance needs better than ever before.

We all have seen recommended equipment lists for an 18-hole golf course. We have one of our own which has been published in our Green Section Record. It lists all the necessary equipment for normal operation, it emphasizes the need for a mechanic and a well-organized workshop as the beginning of a successful operation. "Down-time" must be kept to a minimum, otherwise it will ruin you. There's no better way to keep machines going than to employ a good mechanic. A superintendent cannot tie himself down to the bench - too much gets away from him, control is lost and soon he loses out if he tries to double as a mechanic.

Good equipment begs good operators; they must be trained in proper equipment use. They must know what the superintendent's goals are, they must know what is expected of them so that they can do everything right the first time. To do it right means that the equipment should be in good running condition at all times. Good mechanics know they must read and understand the service instructions that accompany every piece of equipment. A good mechanic has good rapport with the crew so that he can relay the special instructions for the use of every machine and the crew in turn can accurately report back trouble symptoms to him.

Efficient use of equipment also means the right machine for every job. The superintendent must organize and manage so that the machinery required is operable when needed. Mechanical sand rakes, triplex greens mowers, aerators, thatcher-seeders and all kinds of excellent mowing machines have made the job easier and have increased job efficiency far beyond what was possible not too many years ago. How you harness this efficiency and allocate savings to other areas of maintenance reflects upon your ability as a leader and supervisor. A harmonious relationship with your membership and crew is dependent upon your ability to set up job priorities in a workable manner and execute them with dispatch.

To have machinery in tip-top shape the year-around depends greatly on whether you are effective in winter repair. Major overhauling is done in the off-season by the work crew as directed by the mechanic or by sending it out to a repair shop. When spring comes, all machinery should be ready to go and hopefully will last the season, except for the usual minor repair, adjustments, spark plug replacement, back-lapping, etc. Read and abide by the service manuals - they are the key to more efficient repair, which in turn is the springboard to more efficient operation of all equipment.

There is no easy solution to the efficient use of equipment. Every supervisor has his own technique in blending man and machine to the most effective end. The goal for all, however, is the same and here are some of the important ways of getting the most out of your equipment.

(1) Train operators in proper use and handling of machines - correct speed, i.e., two-cycle engines are run at higher speeds and therefore more alert operators are required, four-cycle machinery should not be used on hills, etc.

(2) Allow the mechanic to attend service schools run by equipment firms.

(3) Assign one machine (where possible) to one worker who will be responsible for care and faultless operation of that specific machine; he will report problems in writing, clean and service it with oil, gas and grease it before storing it in its assigned place after each operation.

(4) Any service beyond that mentioned above should be handled by the mechanic. Air filter cleaning or changes, adjustments, grinding, back-lapping, etc. should be the responsibility of the mechanic. Keep needed small parts stocked - keep a good small parts inventory.

(5) Have a check list for every piece of equipment for inspection before and after every use.

(6) Use vehicles to transport smaller machines where possible. Single greens mowers especially could be knocked out of adjustment easily if walked from green to green.

(7) Be sure to use the warranty that comes with every piece of equipment. Warranty repair costs are figured into the retail factory price so why not take advantage of them.

Ways to Reduce Repairs

The best approach to minimizing repairs is to follow a preventative program of maintenance and care. Change oil and filters, lubricate, adjustments are all part of preventative maintenance. Common sense in operation - good operators who share a sense of pride in doing a job well will also see to it that their equipment is running properly; if it is not, they will be quick to check it out with the mechanic or superintendent. Good operators will not abuse the equipment - they will exercise care in transporting, using, caring for (cleaning, etc.) and storing all equipment. In storing equipment care should be exercised to insure it is not wrecked, abused or ruined in any way. Good storage technique again means abiding by the rules set down in the equipment manual - it will save you many dollars in repair bills. One common error cited by a salesman of sprayers is that the lid is closed tight while the sprayer sits exposed in the hot summer sun. it corrodes the insides and causes a host of other problems. Many sprayers have been junked long before they should have been had good air circulation been provided during storage.

When buying equipment, try to buy heavy duty types where possible - they will last longer and give better performance in the long run, i.e., double-edged bedknives, tungsten-carbide tips for aerator tines, etc. Lighter units such as rotary mowers and other equipment considered expendable after a year or so of use can be bought for the best price offered. We see all kinds of rotary units in our travels around golf courses which is testimony to this thesis.

Ways to Reduce Purchase Cost

(1) When buying new equipment, try to buy in bulk, i.e., one large order has a better chance of being discounted than several small ones.

(2) Put one manufacturer against another. Toro vs. Jacobsen can be an interesting battle and can possibly get some concessions on prices.

(3) Pay in cash. Most distributors give cash discounts.

(4) Trade-in. Don't forget the all-important trade-ins. Even a few hundred dollars allowed for old or used pieces of equipment can mean something in savings. This is also a good way of cleaning out old and obsolete equipment that would otherwise be cluttering up the shop. Try to get something for it.

(5) Lease equipment. With leasing there is no initial purchase cost, but rather a single monthly payment. Study could be given to the tax advantages in this method, especially where a club has little working capital. Some of these plans run on a 12, 18, 24 or 38 month lease. Some are open-ended where the equipment goes back to the leaser after the period of lease is up, whereas other lease plans at the end of payment period, the equipment becomes the property of the leasee. There could be some advantages here.

In conjunction with this, short-term leasing could also save you some money, especially on seldom-used pieces of equipment like rototillers, trenchers, or even seeders. It could be worthwhile looking into the inventory of local rent-all companies. They could surprise you.

(6) If money is tight, look to your distributor or other golf courses offering used or reconditioned equipment for sale. Some real bargains are available through this, but especially where a new superintendent comes into a club and, say, is a Jacobsen man and replaces all the Toro equipment, or vice versa. Some slightly used equipment can be had at real bargain prices by this method.

(7) Check into the distributor's demonstrator models. If covered by the original warranty, even though used, nothing can be lost and some dollars can certainly be saved.

(8) On some small purchase like rotary mowers, chain saws, rototillers, or even small garden tractors, perhaps the price of local discount stores could be compared with that of the distributor. A small hand rotary mower is a small hand rotary mower, so if some money can be saved by purchasing it at a discount outlet, then why not do it.

EFFICIENT LABOR MANAGEMENT

Richard E. Valentine
Superintendent
Merion Country Club
Ardmore, Pennsylvania

First off, let me make this perfectly clear...what I am about to say relates to the Labor Management Program as I have experienced it in over 20 years of employment at the Merion Golf Club. I will not attempt to suggest to you what you should do at your own golf course. I will tell you how we operate at Merion, (a non-profit private golf club). Every golf course is different. Every golfer's needs and demands are different. Consequently, every golf maintenance program varies somewhat.

Before attempting to describe a thorough,efficient Labor Management Program, let me first explain what kind of labor force I have at Merion:

My Labor Force consists of men that have been employed by Merion from one year to fifty years. Six or seven men are full time (year round) while some work 7-8 months each year. Others are part time. (Summer help included). Their ages vary from teenagers to eighty years. As long as a man can produce a fair days work, I shall continue to employ him - no matter how old he is. I get just as good and, frequently, better work performances from steadier, older, reliable men.

This is what Merion provides the Labor Force:

1. Good Pay Scale - better than average in area.
2. Cost of living and pay increases yearly.
3. Bonuses - Christmas time.
4. Blue Cross & Shield Program.
5. Excellent vacation program.
6. New pension plan.

I list these employee provisions because I think it is important to have these if a Labor Force is to be responsible and efficient.

Before the Golf Course Superintendent can attempt to be an efficient, effective labor manager, he should fully understand every phase of work under his charge. He should study and learn as much as he can about every duty performed on the golf course.

At this time of the year and especially while attending turf conferences such as this - my mind reflects back to this past year's course maintenance performances and I realize how I would have delegated assignments differently, better utilized equipment and applied materials differently in varying proportion. Hindsight is experience and is invaluable.

I feel that I can do and have done most of the daily tasks on the course. Upon this basis, I am ready to deliver assignments to others, knowing what performance to expect and how much time it takes to complete any job. Through

observation on how each man performs his duty, I make job selections, trying to place the right man in the best possible situation.

Merion Golf Club Green Staff

1. Superintendent - Should have an understanding of all phases of course maintenance procedures and I list just a few - not necessarily in order of importance:

   a. Agronomist, Entomologist, Nematologist, etc.
   b. Mechanical and electrical.
   c. Administrative - purchasing, budgeting, etc.
   d. Irrigation & drainage.
   e. Landscaping.
   f. Public relations.
   g. Construction.

   etc., etc., etc., etc.

2. Assistant Superintendent - Should be willing to assume all of the superindent's responsibilities and be willing to tackle any job.

3. Shop Foreman - The mechanic at Merion is presently one of the best around. He understand hydralics, diesel, etc. and is invaluable. He keeps me operable and doesn't work on the course. He is too busy servicing equipment for both courses.

4. Foreman - East - This man is a hard-working jack-of-all-trades. He can weave wickers, climb trees, build walls, etc., etc., etc. He is truly a masterful course renovation and construction man.

5. Foreman - West - Old timer in his 50th year at Club. Sets course up daily. Understands the entire operation. Doubles as driver and plumber.

6. Drivers (2) - Do all large range unit mowing. Understand mower adjustments. Older men that can go on and on and on -- I hope. These 2 men double as applicators and understand techniques in applying materials.

7. Sectional Equipment Operators (4) - Mow daily. Operate all mowing-renovation equipment, etc. Power spray and power rake as well.

8. Common Laborers (2) - Hand rake - weed traps. Scythe around bunkers. Pick up debris, etc., etc., etc.

9. Groundsmen (summertime) 3-4 (turf students - when available) - Do every job imaginable. If turf students then I can usually make out with 3.

10. Irrigation Man - West Course (summer) - Evenings and early morning. Sometimes use part time worker.

11. Club House Gardener part time - (Industry retired man) - works 3 days a week. Excellent situation. Conscientious and neat.

12. Cart Man - West Course Guard, Gardener all in one - Retired chauffeur. Excellent worker. Loves to work and give service.

With a staff such as I have listed, it is easy to see how Merion is able to be self sufficient.

We operate as a do-it-yourself club. This isn't new - we have always operated as our own construction and maintenance team and, hopefully, will continue to do so in the future.

All of this makes for pleasant, interesting working conditions, leading to effective management.

WAYS TO SURVIVE IN 1975

John R. Hall
Assistant Professor
University of Maryland

There can be no doubt that we are living in a very fast changing world. As we read the daily newspapers and listen and watch radio and television newscasts we are constantly aware that events are occurring at an astonishing pace. The turfgrass industry is changing at the same rate as the rest of the business world. The rapid increase in Maryland's population from 3.1 million in 1960 to 3.9 million in 1970 provides adequate evidence that we are living in one of the most rapidly growing areas in the United States. The number of home lawns in Maryland is estimated to have increased 74% in that ten year period. Homeowners in Maryland were spending an estimated 42.2 million dollars annually to maintain lawns in 1971. During that same ten year period the number of golf facilities in Maryland increased from 93 to 164. It was estimated in 1972 that more than 80 million dollars was being spent by the turfgrass industry to maintain turf in Maryland. (1)

There can be no doubt that turfgrass in Maryland is big business. Few people are aware of the real economic impact of the turfgrass industry upon the State of Maryland, however, the more progressive associations are making every effort to bring this fact to the attention of the people of the state.

In this rapid moving world the superintendent's job responsibilities have not remained stagnant. Todays progressive superintendent has to be a qualified agronomist, entomologist, nematologist, pathologist, labor management specialist, business manager, purchasing agent, accountant and almost a lawyer to keep abreast of current Environmental Protection Agency (EPA) and Occupational Safety and Health Administration (OSHA) directives. Today's superintendent needs to stay on top to survive. Unlike "spoon fed" executives in big business, the superintendent must personally design and implement his educational programs. He must seek the educational information that he needs.

What sources of information are available to the progressive superintendent?

Every superintendent must rely heavily on the vast volume of turfgrass management information that exists in the minds of the 300 or more superintendents in the Mid-Atlantic Region. The valuable practical experience which serves to make up the ART of turfgrass management is within the minds of the experienced superintendents in the Mid Atlantic Association of Golf Course Superintendents. The exchange of information between peers is essential to the maintenance of a viable and functioning body of knowledge on turfgrass management.

Several turf courses are offered by the University of Maryland and Virginia Polytechnic Institute and State University. A four year program in Turf and Urban Agronomy is available in the Department of Agronomy at the University of Maryland. This program leads to a Bachelor of Science Degree. The Institute of Applied Agriculture offers a two year technical degree and in depth training in Turfgrass Management preparing students to become Golf Course Superintendents. Every spring the University College Division of the University of Maryland offers an advanced course in turfgrass management, Agronomy 405, during the evening as a part of their continuing education program.

The Cooperative Extension Service is designed to serve the superintendent's educational needs. It organizes Field Days, educational conferences and Short Courses to keep you aware of changes in turfgrass management. There are several educational pamphlets and publications available which are designed to communicate knowledge to the Golf Course Superintendent. The Extension Service continues to be available to provide input, when asked, that is helpful in keeping Associations viable and active. Associations are essential to the educational process because they provide an important means of transmitting and accumulating knowledge.

The progressive superintendent remains aggressive in constantly pursuing research information as it becomes available. Extensive research programs are underway at several of the Universities in the Northeast. These programs continuously provide vital information to superintendents about new varieties, fertilizers, pesticides and management techniques.

It is the job of the progressive superintendent to make Research and Extension work for him. This means designing educational programs which are relevant and valuable. It means communicating your individual needs through your association to University personnel, legislators and administrators. It is your mind that is at stake. Strong research and educational programs can make or break your future.

It is essential that progressive superintendents work for their association and keep it active and viable. It is essential that the Associations work for their membership and provide meaningful educational programs. Continuing education is your life blood.

Reference

1. Hall, John R. 1972. Turfgrass Maintenance: Importance to Maryland Economy, The Agronomist, University of Maryland, Vol. 9 No. 12.