job to be done. Renovation requires many aerifications. To improve soil and root depth aerify twice or three times over, or once over and repeat every three to four weeks. Each spoon size (1-inch, ¾ inch, ½ inch) has its place. Where putting green turf is well established the ¾ inch spoon may be used. Shallow-rooted turf requires greater care, thus indicating the use of ½ inch spoons.

Finishing operations must be done properly. Soil on the surface can be distributed by dragging with a wire mat or poling, or if soil is poor, the cores may be removed with a leaf sweeper. Rolling may be necessary to restore a true putting surface; mowing will remove any tufts of grass; and in dry weather careful watering should follow aerification.

The article further emphasizes the importance of aerification in protecting a golf club's investment by bringing about greater economy through greater efficiency when maintenance must be cut to a minimum.

Benefits of Fall Aeration

Those readers who have carefully digested the above excerpts will realize the need for aerification on their turf installations this fall. Results from all over the country indicate that there is no better way to establish a seedbed in existing turf. The myriads of pockets made by the use of an aeration machine catch and hold fertilizer, seed, and moisture. Conditions for germination are ideal, and, of course, the pockets serve as protection for the tender young seedlings until they become established. Turf authorities from many states inform us that knolls or humps on rolling fairways no longer present a problem toward seed and fertilizer placement when an aeration tool is used. Again, the pockets formed catch the seed and fertilizer under the heaviest of downpours.

Bentgrass greens are growing vigorously in the fall of the year, and thus heal rapidly the slight scars made by aerating. In areas where snowmold presents a problem, superintendents inform us that an open, well-ventilated green during the winter months is much less susceptible to attack. Dollarspot control often is adversely affected by excessive mat. Fungicide applications, supplemented by additional feeding and aeration, have proven of great value in overcoming this problem.

Entomologists tell us that long-lasting control of insect grubs is dependent on deep placement of the insecticide. Aeration before application will give the desired placement.

Today it is universally accepted that good management practices employed in the fall may mean the difference between success or failure the following season. Aerification is associated with most management practices.

— • —

FURTHER SUGGESTIONS FOR RESEARCH ON POA ANNUA

By FRED V. GRAU
DIRECTOR, USGA GREEN SECTION

The large question of POA ANNUA — FRIEND OR FOE (in the USGA JOURNAL, June, 1948) is receiving more and more attention as we see the possibilities in some of the improved turf grasses which are being developed under the National Co-ordinated Turf Programs.

The question is: "Are these new grasses good enough to replace poa where they are managed properly?"

The development of new improved techniques in the cultivation and aeration of soil under turf has led some to wonder whether these operations tend to encourage or to discourage poa. These questions can be answered only by repeated testing under many conditions backed by actual population counts made by trained research personnel.

This, then, indicates clearly the great need for the superintendent on the golf course to offer the facilities of his club to the research man at the experiment station. At Beltsville, for example, the Green Section staff can do no research on *Poa annua* at the Station because in our un-

watered turf we have no poa with which to experiment. We are forced to go to the Mid-Atlantic Superintendents (and gladly), who have acres of solid *Poa annua* to deal with on their golf courses. Actually, this is nearly an ideal situation. The research staff is relieved of the chore of mowing the turf under study. The research men assume responsibility only for the treatment and for the population counts and other data needed. The club, on the other hand, is getting the answers at first hand, under their own conditions at little extra cost.

Almost, But Not Quite

The situation is not ideal, however. The treatments may interfere temporarily with play, or they may discolor the poa, or, in some cases, they may damage the turf severely. This is difficult to explain to the membership, especially if a new green committee chairman has just been appointed who is not entirely in accord with the plan in operation or who does not understand what it is all about. Population changes in turf occur slowly under most treatments and there may be several green committee chairmen during the course of a single study. This, probably, is the greatest single reason why research on the golf course has developed so slowly when it could be the means of getting results much sooner. It has been terribly destructive to the morale of research workers to plan and to institute a project on a golf course, only to find it terminated the next year when the new officers decide on some architectural changes on the exact location of the experiments.

Years of observations, trials, discussions and arguments have indicated with a high degree of accuracy that the presence of *Poa annua* in turf is influenced by several factors which include:

1. MOISTURE. Unwatered turf seldom has poa except in areas of very heavy rainfall. Heavily-watered turf (and continuously-watered turf) usually is the most severely effected. Somewhere between the two extremes there is a balance which has not been discovered on most areas. *Poa annua* plants cannot recover from a period of severe drying. Perennial grasses have ample reserves which enable them to recover quickly after a period of severe drought. The presence of large quantities of *Poa annua* in arid climates is difficult to understand because grass diseases are minimized and the use of water largely is controllable. Members could help greatly by insisting that the turf on which they play be allowed to become thoroughly dry on occasion to give them practice in playing on "burned-out courses."

Grasses Weakened

2. TURF GRASSES. Ever since we began to develop closely-mowed turf for specialized uses we have accentuated the weaknesses of our turf grasses, especially from the standpoint of the diseases to which they are susceptible. We have developed to a high degree the art and science of dosing our turf areas (putting greens and similar) with chemicals to check diseases. In so doing we have tended to prolong the period in which we are saddled with weak, susceptible grasses. Unless the diseases are completely controlled (which they never are), the susceptible grass becomes weakened further, which allows *Poa annua* and other weeds to invade. We take the position that every effort must be made to discover and test the disease-resistant strains of turf grasses and to put them to use under a system of management which utilizes their best qualities.

Diseases (not close mowing) largely have been responsible for ruining the common grasses which we have been forced to use on golf course fairways. Every disease attack (uncontrolled, of course) is a "come-on-in" to poa. Added water to "keep the course green" has elicited another "thank you" from *Poa annua*.

Compaction Not Necessary

The introduction of disease-resistant grasses into existing poa turf should be the No. 1 effort of investigators and superintendents alike. The best method and the best time for the procedure are points that need thorough evaluation in each climatic region. The use of a chemical as a tool in the process is considered indispensable.

3. SOIL COMPACTION. This is a con-

stantly recurring condition which no longer need be tolerated. Equipment is available to all for relieving soil compaction whenever needed. Soil aeration under turf admits water (rain, too) quickly, thus permitting significant reductions in the amount and the frequency of water application. Fertilizers are admitted to the root zone, thus helping to promote deep, heavy root systems which build a desirable cushion and which minimize drought conditions. *Poa annua* is encouraged when compaction is allowed to develop and when a shallow root system is encouraged.

4. SEED PRODUCTION. Under many turf conditions in the United States, *Poa annua* acts as a true annual, which means that it dies completely in the summer (leaving ugly brown areas which fill with crabgrass, goosegrass, clover, milk purslane, knotweed, etc.) and returns when the *seed* germinates during cooler, moist fall weather. If seed production could be stopped in the spring flowering period through a succession of chemical sprays, it is logical to assume that less poa would come back from seed that fall. These chemicals (sodium arsenite, potassium cyanate, and 2, 4-D) show more than ordinary promise to accomplish this phase of poa control. Frequent light applications of the proper combination of chemicals during the entire blooming period is the indicated approach. The place to do it is where the problem exists—right on the golf course.

Caution: It is just as important to know *how and what* to *plant* to replace poa as it is to know how to get rid of it. The next step is to know how to manage the new turf, to keep poa out!

5. UTILIZE *Poa annua*. *Poa annua* has many characteristics which make it an ideal turf grass when at its prime. In many areas we find that poa makes the ideal cool-season companion to warm-season grasses such as Bermudagrass and zoysia. Practical research must recognize this phase and endeavor to utilize the good qualities of poa.

6. FERTILIZERS. The proper use of fertilizers may be very important in controlling or in using poa. It is an extremely difficult approach so long as we must work with inferior disease-susceptible grasses. It is anticipated that the fertilization of disease-resistant, drought-resisting grasses during the weak point of the life cycle of *Poa annua* will go far toward minimizing our present difficulties.

The *Poa annua* problem is international in scope. It is as serious in Paris as in Washington, D. C. The solution of the problem as we know it today requires a great deal of education at every level in the turf world. Many turf superintendents do not yet realize that some of their every-day practices encourage *Poa annua*. Golfers must learn to accept some temporary disturbance of their accustomed golfing pleasures in order to have the kind of superior turf which they constantly demand. Research men and extension specialists must be in close accord through frequent consultation in order to avoid further confusion which would result from conflicting recommendations. The ultimate solution of the problem largely is dependent upon close coordination of existing knowledge, research projects and recommendations.

— • —

More Interesting Reading

THE EFFECT OF SLOPE SOIL EROSION, by H. H. Krusekopf, Research Bulletin 363, University of Missouri, College of Agriculture, Agricultural Experiment Station, Columbia, Missouri.

This report gives the results of 11 years of investigation on factors influencing run-off and erosion. The author points out the value of sod in preventing run-off and erosion; how the amount, intensity, and time of rainfall can be modified by the density of cover; how soil erosion increases with increase in degree and length of slope; how the surface soil becomes shallower, tilth deteriorates and the surface becomes smooth and compact after rains; and how all of these factors bring about a slower penetration of rainfall and greater run-off.

— • —