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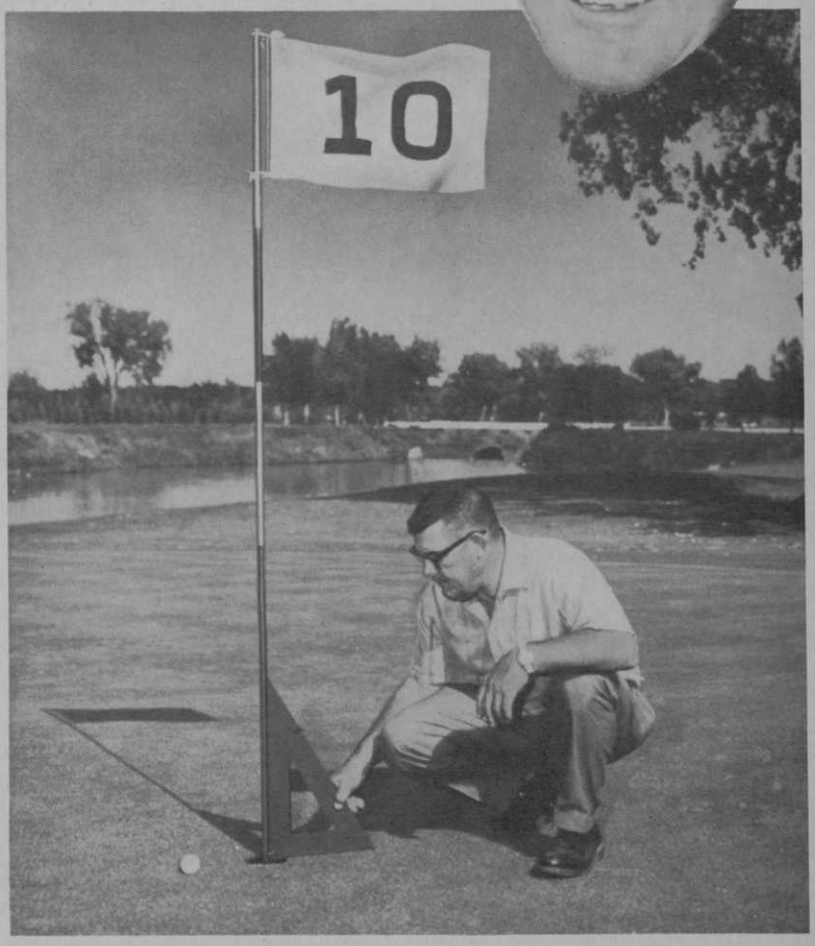

Ken Voorhies uses a triangle to demonstrate the vertical position of the new Lewis high-visibility Fluorescent Flagpole.

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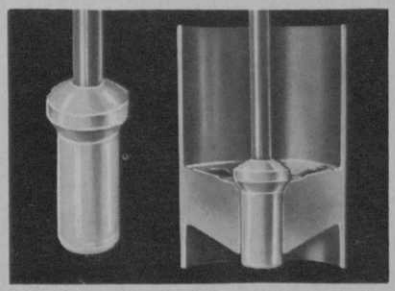

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Irrigation Systems: Potential Workhorses

By JAMES R. WATSON Jr. Director of Agronomy, Toro Mfg. Corp.

Although problems still must be solved, the feasibility of applying fungicides, herbicides and pesticides through an irrigation system is not so far-fetched

An irrigation system is designed to function as a water dispensing system. Because of this, it should be capable also of distributing chemicals, including fertilizers. Potentially, it *is* capable.

Using an irrigation system for these purposes could represent a substantial cost saving: first, it reduces labor costs; secondly, it saves equipment purchasing and maintenance. In addition, there is evidence from related fields—greenhouse culture of potted plants and flowers—to indicate, in the case of fertilizers, that small amounts of nutrients, applied regularly through irrigation water, produce plants of superior quality.

Despite these apparent benefits, it is most significant that to date, except for fertilizer injection (see "Fertilizing While Irrigating: A Reality?" GOLFDOM, August, 1969, p. 43), irrigation systems are not used to apply chemicals on turfgrass areas. Why? Because of the necessity for uniform application of water and proper concentration of the chemical.

Uniform application is the key to effective use of the system as a distribution vehicle for fertilizer, pesticides, fungicides and herbicides. Strength of solution or dilution limits the use of many pesticides through an irrigation system. With the exception of soil drenches and the possible exception of systemic compounds, the dilution rate of most pesticides would be too low to be effective. At the present time, therefore, these chemicals should not be considered for application through an existing irrigation system, unless the system was initially designed for that purpose. Before making any attempt to convert an existing system, superintendents should contact the manufacturer which would send a consultant to determine the feasibility of a conversion. Once it has been ascertained that conversion is feasible, a superintendent might work with a local engineer on possible designs.

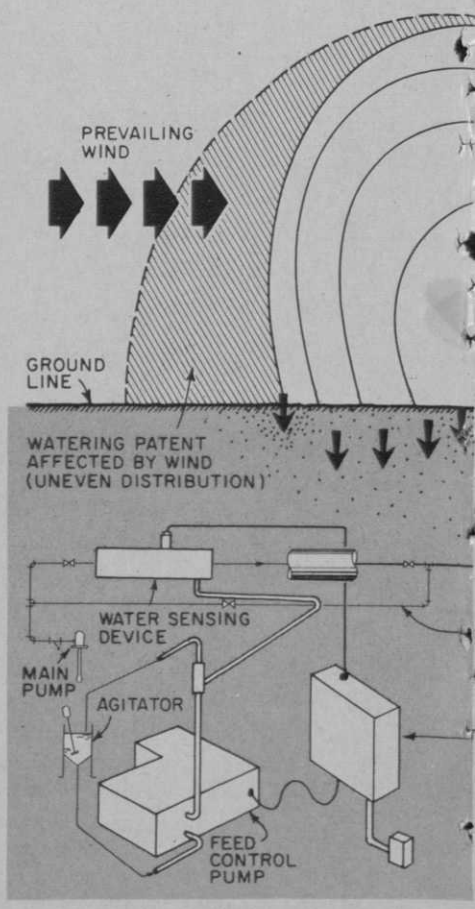
Designing a system for use in applying chemicals must take into consideration the area to be covered; hours available for watering; amount of water to be applied; source of water; type of system; precipitation rate; head spacing; wind velocity and service life of the equipment.

Soil and climatic variation

The physical properties of soil directly effect the uniformity of infiltration, percolation and drainage of water and chemicals. In addition, topography (especially degree of slope), the degree of soil compaction and wind velocity, influence the manner, amount and rates at which both water and chemicals will reach the root zone, even though the water may have been applied uniformly to the turfgrass surface. These factors can be compensated for with design. It must be recognized that any system, new or old, irrespective of how well it has been installed, used and maintained, is no better than its basic design.

Wind condition is frequently overlooked in both design and performance. Unfortunately, many heads are spaced on a "no wind" basis. This is wrong. Note how spacing varies with wind velocity:

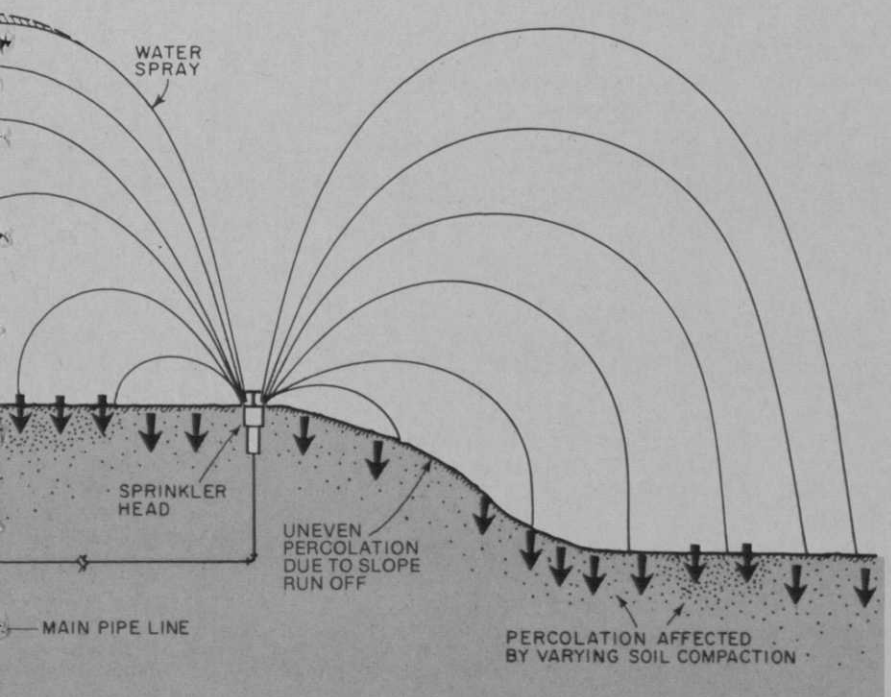
MPH wind	Maximum triangular spacing (% of diameter)
1-3	70
3-5	60
5-7	50
8-10	40



The number of heads required for effective watering goes up in inverse proportion to the square of spacing. Therefore, three times as many heads would be required in an eight to 10-mile-an-hour wind as are required in a zero to three-mile-an-hour wind. Substantial savings may be effected simply by the operator scheduling watering periods to coincide with periods of day or night when winds are low.

Irrigation equipment presently available permits the controlled application of precise amounts of water needed for chemical application. Further, such systems are capable of delivering the water in accordance with the needs of the grass plants and in conformance with the ability of a given soil to take in (infiltration capacity) and store water (water-holding capacity). Today's systems are economical and function to assure water conservation and minimal operating cost.

The technological advances in controllers, valves and sprinkler heads that have occurred within the past few years have been substantial. The development of two-speed gear driven rotary sprinklers has been essential in ensuring uniform application because they eliminate the problems associated with overlapping and non-overlapping areas. The head rotates at half-speed where there is no overlap, at full speed through the overlap area. Thus, an equal amount of water is distributed to all areas. Valve-in-head sprinklers also increase the accuracy of chemical application through underground sprinkler systems. They can be cycled by central programming for chemical injection, but can also be scheduled with satellite controllers in the field that can be operated manually for on-the-spot supervision of chemical application. The running time of each head can actually be timed to adjust to the turf conditions of the area it covers.



SCHEMATIC WATER DISTRIBUTION DRAWING AT TYPICAL SPRINKLER HEAD ON GOLF COURSE

Properties of materials

New component materials, such as plastic heads, eliminate the corrosive effects of chemicals. Problems of solubility and the abrasive action of some compounds may be eliminated completely by water soluble materials. The economics of such products may preclude their use in some cases.

In certain situations, fertilizer solutions may "salt out," *ie.*, the dissolved materials crystallize and settle. The resulting sludge may clog controls and valves, and the composition and strength of the fertilizer would be altered.

Salting out is a temperature phenomenon and may occur (depending on the material and the strength of the solution), from 55 to 60 degrees to well below zero. In general, the lower the temperature, the more likely salting out will occur.

Evidence indicates that low fertilizer rates, especially nitrogen, applied daily or at the time of irrigation are beneficial to uniform, healthy growth. This is the area which shows the most promise to date. Injectors and metering devices that place the correct amount of chemicals into the irrigation system are available. Golf course superintendents in different parts of the country have installed such devices to permit application of nitrogen through their irrigation systems. Their experiences confirm that chemical application is only as effective as the uniformity of water coverage. □

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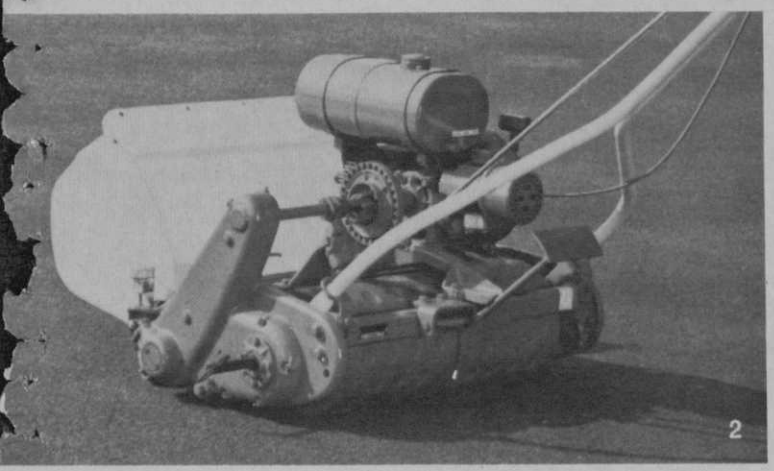

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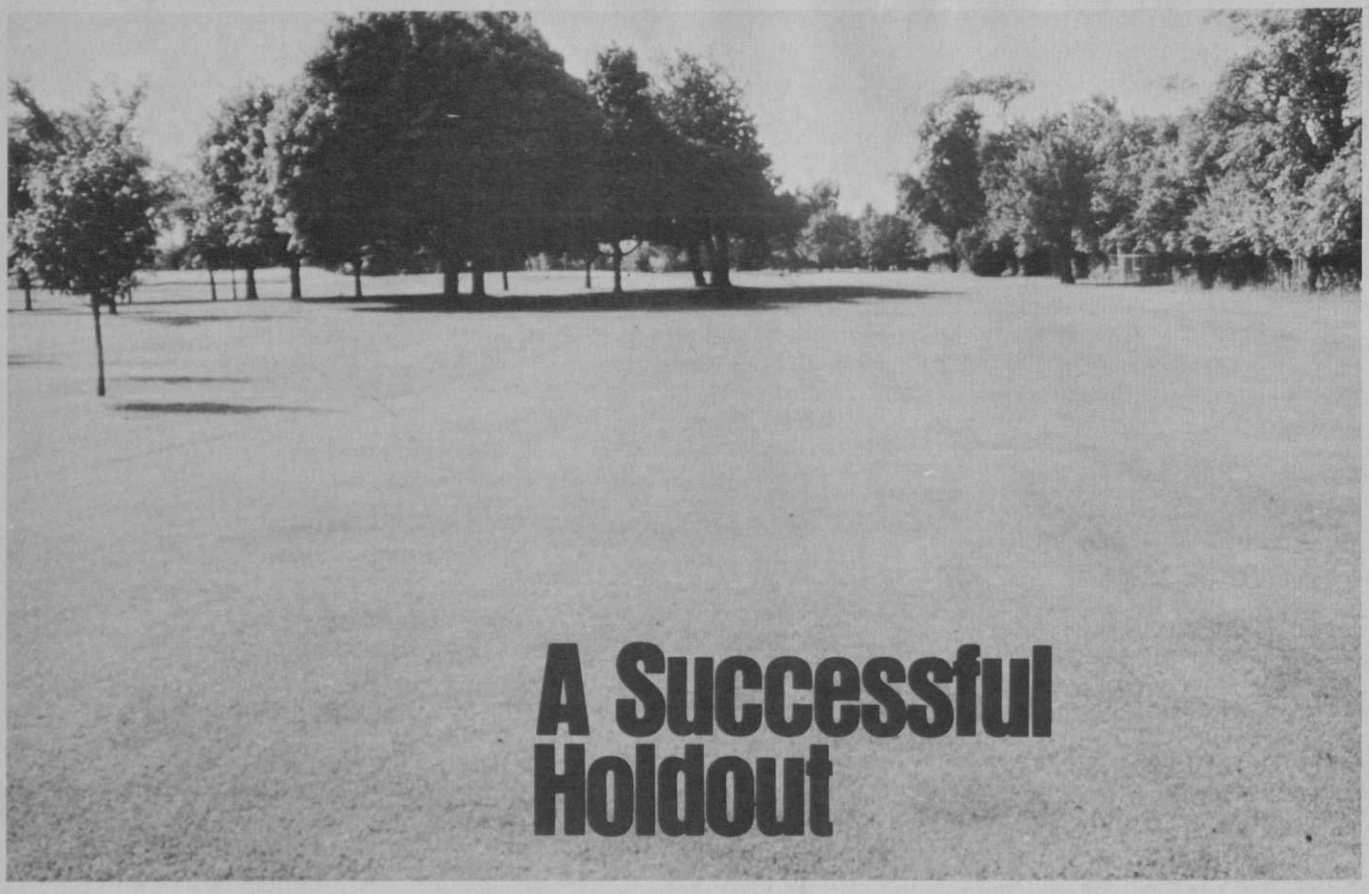


A Successful Holdout

At a time when bentgrass fairways were almost commonplace, Aurora's superintendent switched to bluegrass: " . . . bluegrass fairways, if properly maintained, beat the hell out of bentgrass fairways"

By JOE DOAN

ABOUT 10 years ago, a superintendent of a Chicago area semi-private club who spoke at the annual fall meeting of the Midwest Golf Course Superintendents Assn., became somewhat ecstatic in describing the beautiful fairways at Aurora (Ill.) CC and urged the bluegrass proprietors in the audience to corner Carl Hopphan, Aurora's superintendent, and get him to divulge some of his maintenance secrets.

"Naturally, I was flattered," Carl recalls, "but I was even more embarrassed. This fellow had visited my club in the spring and again in the fall and had seen my fairways at their very best. If he had come around in July he would have found them just as mangy as at any other place where 60 or 70 per cent of the turf is *Poa annua* and the remainder bluegrass. There wasn't much I could have told anyone except about my *Poa annua* program."

If the scene were to be re-enacted today and a speaker were to spew superlatives in praise of Aurora's exquisite fairways, Hopphan's reaction would be altogether different. He takes great pride in his fairways—year-round pride—without apologies for the way they look in July and August. He'll go into great detail in describing his maintenance secrets. Then, he makes a point that he has been waiting to make all along: Contrary to what most golfers think, bluegrass fairways, if properly maintained, "beat the hell" out of bentgrass fairways.

Carl quickly qualifies this declaration by stating, that is if the fairways, as they are at most clubs with which he is familiar, are from 50 to 70 per cent *Poa annua*. He goes on to explain that in most cases the term "bentgrass fairways" is a misnomer. Since bent fairways are almost invariably more *Poa* than bent, they should be called "*Poa annua* fairways." In line with this, Hopphan proffers the idea that so many fairways go out in the summer because the predominant *Poa* is cut at bent heights.

The fairways at Aurora CC are 99 per cent bluegrass—a rich, dense amalgam of Kentucky, Delta, Merion and Newport—and have been for about three years. They are cut throughout the season at one inch. They are

nearly as stiff and bristly as pure bent. Complaints from players that the ball nuzzles among the blades and has to be extricated before it can be hit, common with bluegrass, are rare. Even pros, who are so meticulous about the way a ball should be teed up on a fairway, are surprised and pleased with the buoyancy of Aurora's bluegrass.

What puts the resiliency in Aurora's turf? Probably potash more than anything else. Carl Hopphan's feeding formula calls for holding back on nitrogen and going heavy on potash. In 1969 he applied 6.3 pounds of potash to his 31 acres of bluegrass fairways, 3.6 pounds of N and 1.8 pounds of phosphorous, in three feedings. The formula produced such thick, stiff and disease-free blades that he is coming back with the same mixture this year. Either straight muriate or sulfate of potash is applied at a 2.1 pound rate twice in the spring and again in the fall.

The Aurora superintendent made the decision to knock out *Poa annua* in the late summer of 1966. He had had a particularly trying July and August—a couple of months, as he describes it, "where you look so good on Wednesday afternoon with perfect fairway turf, only to have so much of it turn brown by the following Saturday."

Permission to eradicate the *Poa* had to be obtained from the membership as is customary. Working with Dick Reedy, his green chairman who is uncommonly knowledgeable about turf, Hopphan was able to sell his program. He and Reedy colluded to the extent of making the program look more unpromising than they actually thought it would be because they wanted an ample cushion for error. But they emphasized that even if they were only 50 per cent successful the fairways would be greatly improved.

Hopphan followed the *Poa* eradication-replanting program worked out by Dr. William H. Daniel, Purdue University agronomist, with one exception. That was in the application of tri-calcium arsenate to knock out the *Poa*. Daniel, who served as Carl's consultant, visited Aurora on several occasions when the program was in progress and now sends non-believers to the club to be convinced that *Poa* can be wiped out, recommends that from 12 to 16 pounds of tri-cal be used as the eliminating agent. Hopphan, however, restricted the total dosage to 9.5 pounds. Applied over a period of one year, it did the job.

The initial application of tri-cal was 1.5 pounds per 1,000 square feet. It was put on in the fall of 1966. Seeding of Merion, Delta and Newport followed and was done via a McCormack-Deering five inch drill seeder, but Hopphan decided it didn't get the seed down to the soil.

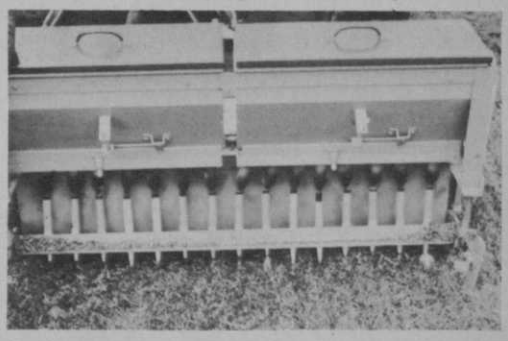
During the winter of 1966-67, Hopphan acquired a Rogers 548 Aero-Blade vertical slicer (now a Jacobsen product) and fitted it with a seeder rigged with flared electrical conduit tubes. They were set four inches apart and were made long enough so that they literally tubed the seed into the soil. The combination machine thatched, aerated and seeded simultaneously. Although only $90 was spent in parts to modify the original Aero-Blade and seeder, the machine worked perfectly through the entire renovation program.

The following April, four pounds of tri-cal per 1,000 were applied to start the second phase of the *Poa* eradication project. Seeding followed at a measured eight seeds per lineal inch, with the seed being socked in just below the thatch and in contact with the soil. Members who saw the fairways after the slice-seeder combination had made a few passes thought they were being plowed. But if they stayed around the club for a few hours and then looked out, they saw that the fairways had been miraculously restored. A topdressing mat dragged behind a truckster pushed the slitted soil back in place, burying the seed as it did so, and at the same time rolled up the fluffed thatch. Thereafter, the fluff was picked up by a sweeper. The slicing-seeding operation covering each fairway was completed in a matter of hours. After the sweeper cleaned up the debris each fairway was watered.

(Continued)

Poa annua *before initial application of tri-calcium arsenate*

Tri-cal arsenate is being applied to all fairways

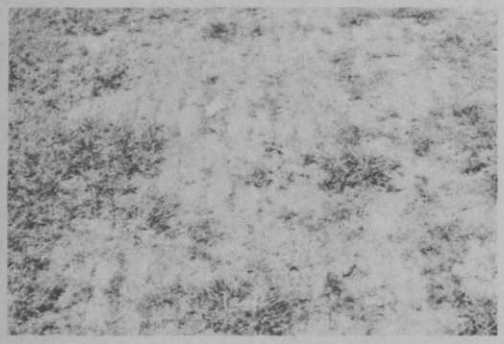


Seed is tubed into the soil after mat has been sliced away

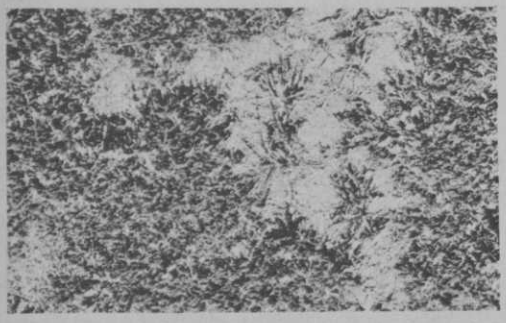
Poa *dies out, allowing bluegrass to spread*

Overseeding requires moisture for proper germination.

New bluegrass blend is starting to show in slitted areas



Desirable bluegrass now has a chance to germinate and survive when Poa *is dead*



A year after initial application of tri-cal arsenate, the Poa *has been knocked out*

All fairway low areas should be raised

Picture book bluegrass is a mixture of Kentucky, Delta, Merion and Newport

(Continued)

Even if only a minimal amount of *Poa* had been knocked out and the new seed had not taken hold, Carl Hopphan wonders if the vertical slicing of his 31 acres of fairways wasn't worth the time it took. It cut out a more than 50-year accumulation of thatch. (Aurora CC was constructed in 1914 and was originally planted to Kentucky bluegrass.) As much as he is sold on heavy applications of potash for putting bristle in bluegrass blades, Carl wonders if the de-thatching combined with aerating hasn't had as much to do in the strengthening of the grass as the potash itself.

One thing that leads him to this belief is an experience Beverly CC, also in the Chicago district, had a few years ago. After the *Poa* was knocked out at this club and the fairways de-thatched, bent seed which had been planted over the years and had never germinated, suddenly came on strong. Apparently, all it needed was aeration.

In May of 1967, the Aurora ground crew worked over the fairways again, cross-seeding where dead *Poa* was concentrated. The following month an additional two pounds of tri-calcuim was applied. Watering was restricted throughout the summer, with only enough applied to keep the new turf actively growing. If too much had been poured on, part of the tri-cal probably would have been washed away.

The final step in the conversion from *Poa* to bluegrass came after Labor Day when two more pounds of tri-cal were applied, and shortly after this another cross-seeding was made in areas where the turf was thin. Today, Aurora is occasionally bothered by the thinning of turf or re-invasion of *Poa*. This is exclusively in low spots where water accumulates. This spring, following three rainy weeks in May, water stood for several days in isolated fairway areas. There was a mild outbreak of leaf-spot, but it was countered by an Acti-Dione treatment. Weak areas were aerated and cross-seeded.

Contrary to what has been said before about emphasis on potash application, fertilization during 1967 when the new bluegrass planting was taking hold, was heavier on nitrogen. This was because Hopphan thought it was better to create a slightly lush growing condition. Five and one-half pounds of N were applied while the potash application was held to four.

In 1968, hardly any *Poa* germinated. The new seeding did a fine job of filling in the bare spots and to Hopphan's surprise and edification, old established bluegrass plants filled in many places where they hadn't grown before. So little *Poa* remained that it was possible to manually root it out. Several approaches to greens, where *Poa* had been quite dense, were patch-sodded rather than seeded due to heavy traffic conditions.

Fertilization in 1968 was tipped in favor of potash. Four pounds were applied in contrast to three pounds of nitrogen. A maintenance dosage of two pounds of tri-cal was put on in 1968 to prevent the comeback of *Poa*. The same application was made in 1969 and is being made this year.

Hopphan's fungicide program calls for four applications of Acti-Dione in April, May, June and July. These are made by helicopter. Herbicide treatments are made in the early spring and again in the fall. Insecticide is applied only once, in mid-June, and is kept light because the tri-calcium application is probably more than adequate.

As for watering, probably enough evidence isn't in yet for Hopphan to establish a boast that this is the crowning glory of the conversion from *Poa* to his bluegrass assortment. In 1969, he watered only three times at three or four hours per sitting. But 1969 was an unusual year. Until after July 4th there was a surplus of water, due to something like 16 or 17 consecutive heavy rains on the weekends prior to that date. Still, in 1968 when conditions were normal, it was only necessary to bring out the quick couplings five times at Aurora. That is probably par for the season. How does it compare with your schedule for those *Poa*-bent fairways? □

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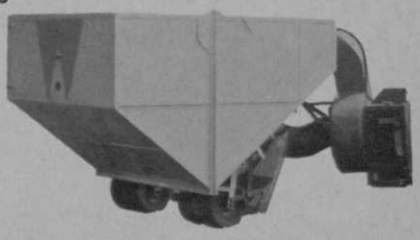

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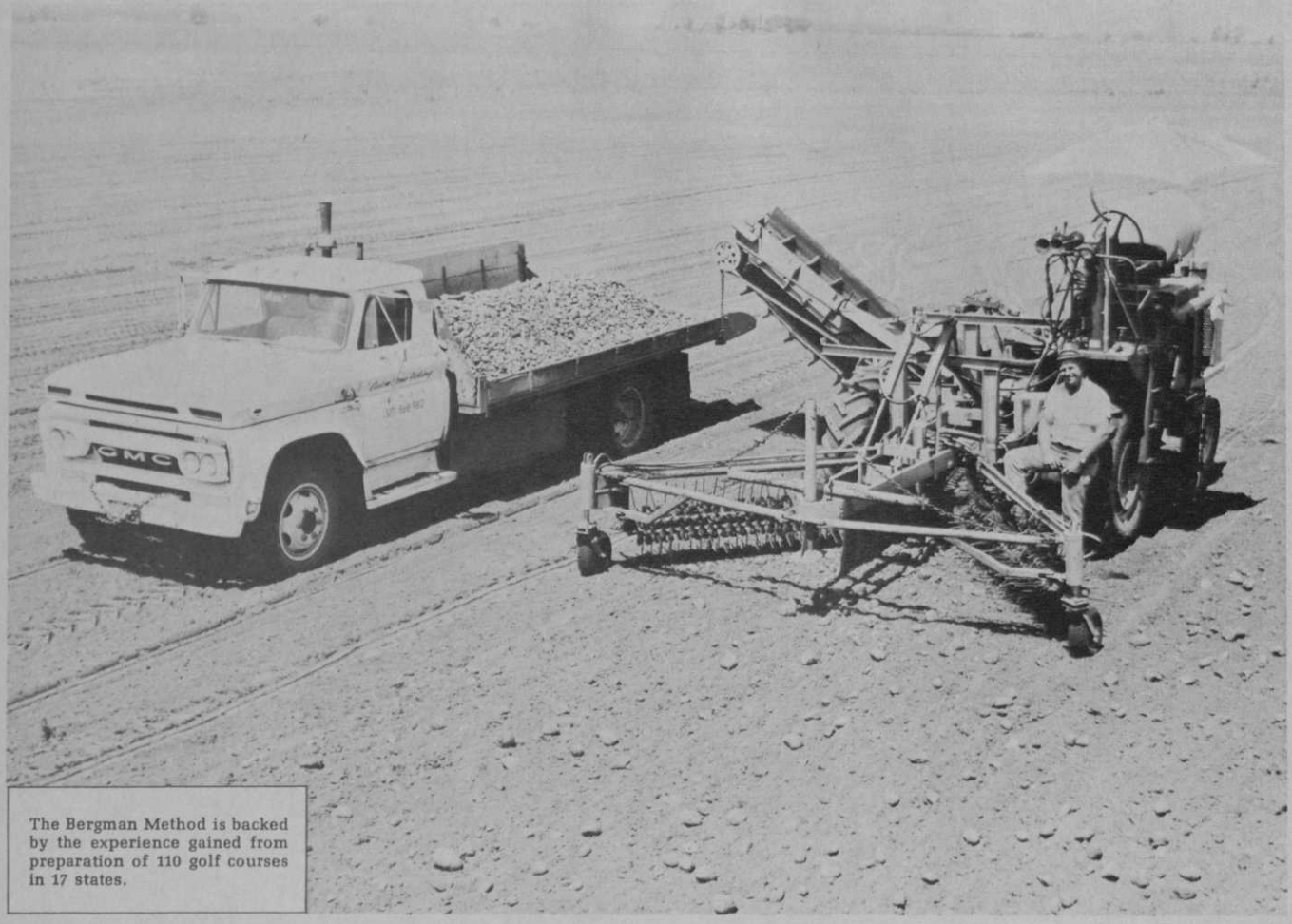

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