operates National Weed Control Company at Orlando) used a 14-foot fiberglass hulled airboat, powered by a Corvair engine. About 5.4 surface acres were treated per hour.

Results

Areas treated the first and second days could be spotted on the fourth day of treatment by presence of dead duckweed. Strands of elodea were gathered from treated areas and showed discoloration and stem darkening on some strands.

Between three and nine days after treatment, elodea exhibited visible decay and reduction in abundance. A small fish kill was evident within a 16-acre test area long one shoreline. Death of fish was attributed to an oxygen sag caused by rapid decomposition of dead elodea. Some kill such as this was expected because of the size of the treated area and the luxuriant elodea growth. Heavily infested feeder creeks, even where less than half the total surface area was treated, showed some fish kill because of the marked oxygen sag. But the main fishing streams, Lacey and Johnson, experienced very light fish kill.

Eleven days after the final day of treating, no elodea was visible in the lanes treated along the reservoir proper. All major fishing lanes and fishing spots were clear enough to allow free boat passage.

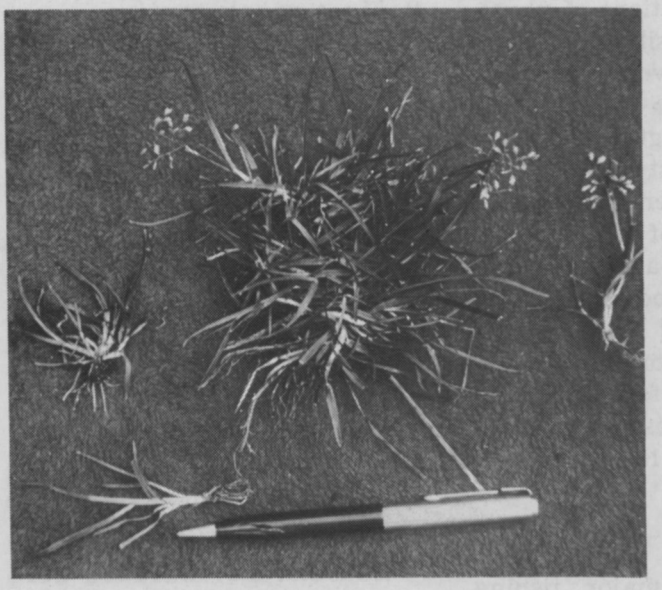
An inspection made much later—213 days after treatment—showed that no elodea could be dredged from either treated or untreated areas in water depths which exceeded 5½ feet. In water one to five feet in depth, occasional strands of live elodea could be dredged up. Dredged strands from these shallow area were four to 12 inches in length and showed no signs of new growth.

A mid-summer inspection in 1968—319 days after treatment—led to important findings. Extensive concentrations of phytoplankton were visible in all portions of the reservoir. Luxuriant growths of elodea averaging 29 to 38 inches in length were found in the uppermost part of the reservoir. However, this was far from the sites of the original treatment. Only a few strands of elodea could be dredged up in other areas of the reservoir and these were confined to water depths of 3½ feet or less. In these shallow areas, new growth averaged nine to 15 inches.

Conclusions

1. Clearance of major fishing lanes and favorite fishing sites in the main reservoir was relatively successful within 1½ weeks of treatment. The basic treatment rate was ¾ gallon Diquat and an equal amount of Potassium Endothal per surface acre.
2. Most creek sections were heavily infested with elodea and were treated at rates above the recommended 1½ gallons herbicide per surface acre. Elodea reduction in these sections was considered fair to good. Short term treatment success in the creek sections was not directly proportionate to an increase in application rates, implying factors other than concentration were involved.
3. Shallow protected coves and guts treated at the rate of 1½ gallons Diquat-Potassium Endothal per surface acre gave ineffective control initially, but by the 34th day nearly all of these regions had been cleared.
4. Herbicide applied in fishing lanes within Johnson and Lacey creeks exhibited an

(continued on page 42)



Relative size of **Poa Annua** plant, seedhead and parts may be compared with pencil.

Control Program

Poa Annua

By WILLIAM H. DANIEL
Purdue University, Lafayette, Ind.

ARSENIC toxicity can selectively remove *Poa annua* in turf, thus *Poa annua*-free turf is a reality already proven in research and on entire golf courses. Recently a speaker used kodachrome pictures from over 30 golf courses to illustrate observed progress in this. Currently over 300 courses have some control program underway.

A four-step program is basic:

(1) Add no more soluble phosphorus. Why juggle two items? Why build reserves higher?

(2) Start accumulating toxic arsenic. Repeat lighter application, get uniform distribution. Allow time for new grasses to grow and fill in;

(3) Start improving stand of desired turf by using Aero-blade seeder or any way to get seed into the soil; repeatedly overseed as space and weather permit;

(4) Short or cloudy days, wet soil and time favor selective *Poa annua* weakening. Chickweed, *Poa annua,* crabgrass and goosegrass are less tolerant to arsenic than bentgrass or bluegrass. Arsenic interferes with the transfer of carbohydrates within the susceptible species.

Several states have declared *Poa annua* a weed in seed. For example, in 1968 Florida required that the number of *Poa annua* seed per pound of grass seed be listed on the label. Further, seed is prohibited from sale if above 5,000 seed/lb. And, it is hoped this limit can be reduced after one year of review.

Basically there are five points relevant to the control of *Poa annua:*

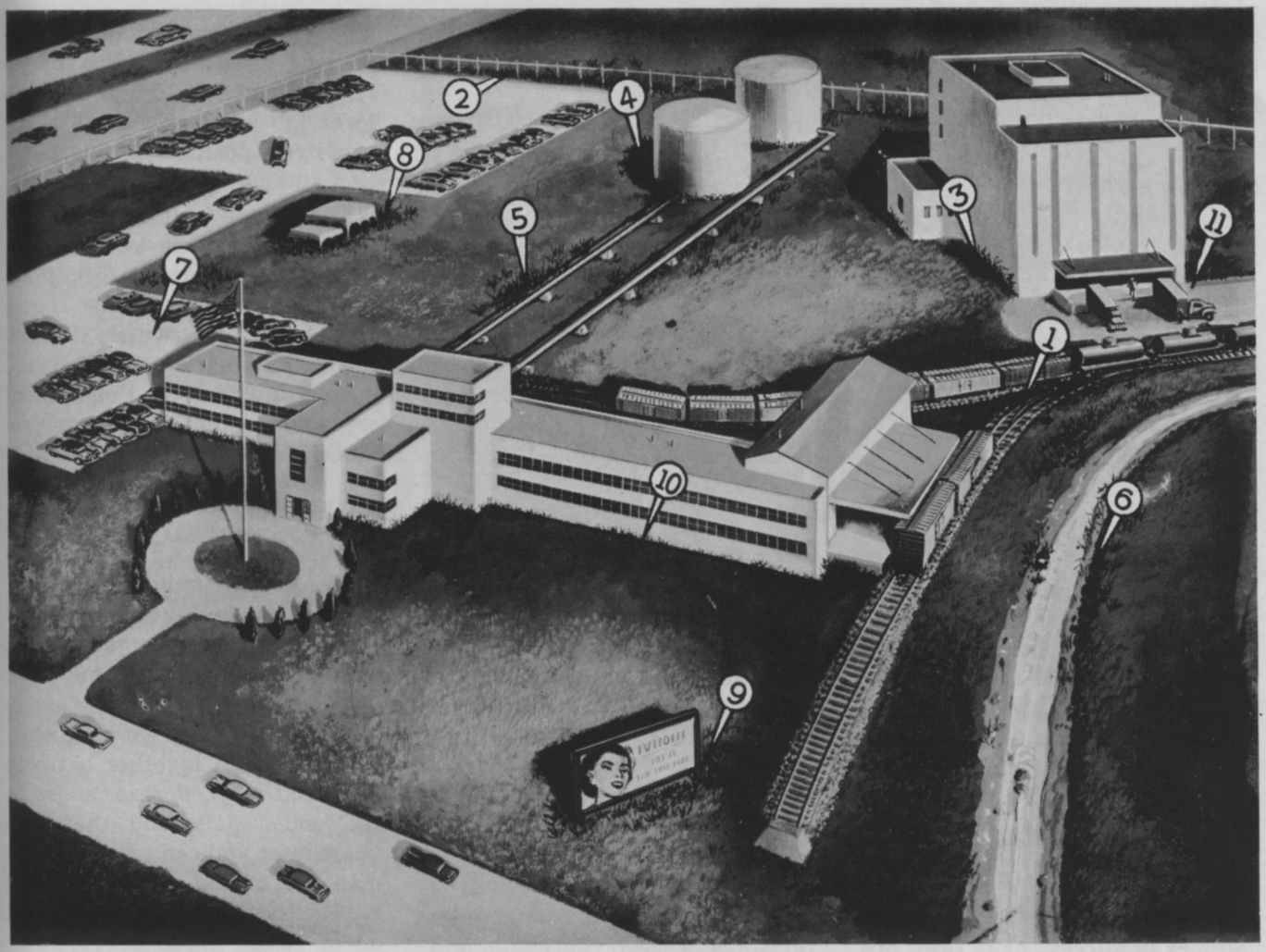
- **TECHNOLOGY**
- **TOOLS** to accomplish the work
- **TECHNIQUES** of using men and equipment
- **TIMING** for plant and user benefit
- **TIME** for biological processes

What Is Poa Annua?

Let's describe *Poa annua. Poa* means "of the meadow" in Greek. This includes hundreds of species scattered almost world-wide, of which *pratensis, compressa* and *annua* are representatives. The early botanist seeing *Poa annua* germinate and produce seed in the same season, which was in contrast to perennial types, called it *annua,* i.e., it seeds in 6 to 8 weeks after germination under some conditions. Now, it is just like tomatoes, coleus, etc.; it will vegetatively increase until some adversity kills the plant parts. You have seen summer desiccation, severe disease smothering under ice as such damaging failure points. Also, you have seen a beautiful sheen of new *Poa annua* come up.

I recall such on August 5 at Cleveland Country Club one year. The cycle of a normal *Poa annua* plant under watered fairway conditions in Cleveland would include fall germination, winter survival, spring lushness, summertime weakening, some disease, some wilting and, when things get really tough, complete loss either in the winter under ice or in the summer; but then new germination occurs. We can break this cycle and reduce the

Poa Annua



Railroad sidings (1) and security fences (2) are among the many locations where unsightly vegetation is a problem. Other locations in a typical plant where weeds can cause trouble are warehouses (3) tank areas (4) pipelines (5) ditches and roadsides (6) parking lots (7) storage areas (8) signs (9) around buildings (10) and loading docks (11). Take advantage of this market opportunity by selling "Hyvar" X, "Hyvar" X-WS bromacil weed killers or a product containing bromacil.

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Much work on annual bluegrass and other turf problems has been done at Purdue University, Lafayette, Ind. Visiting at last month's Midwest Turf Conference are Purdue stalwarts, J. B. Peterson, head of agronomy department, left, William H. Daniel, agronomist and author of this article, center, and Richard L. Kohls, dean of agriculture.

competitiveness of *Poa annua*—the technology is available. Examples of success have been observed, reports of progress have been disseminated.

Technology

Selective repression of existing *Poa annua* and selective prevention of new establishment are the keys to effective control. It is a small job to control *Poa annua;* The **big** job is to grow desired grass!

We know that arsenic accumulated in the rootzone can over-ride phosphorus uptake and selectively stunt existing *Poa annua* as well as seedlings. We also know that Betasan, Balan and Bandane, among others, can prevent *Poa annua* seedlings from becoming established. Each chemical has its good and bad points; each will do certain things and permit the turf manager to do certain things.

The turf manager should select a chemical for use in a *repeated* program to provide him with *continued* control. Technology is understanding the inner-relationships of weed repression and forced growth—if desired—and the principles one must follow to benefit from the selective program. Forcing growth with fertilizer, protecting existing grass with fungicides, overseeding when thinness is evident—these are all part of technology.

Tools

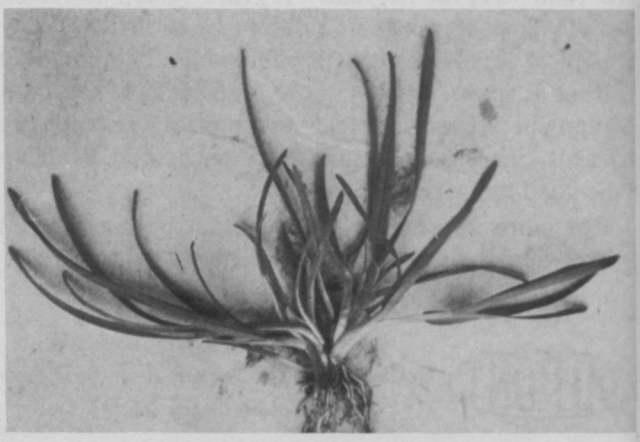
The new Rogers Aero-blade seeder combination was recommended to five out of six golf courses considering *Poa annua* renovation because it does a uniform job of placing seed in the preferred position for germination and survival.

There are combinations of tools that may be available for spreading materials, for applying seed and reducing thatch and for applying water. Upgrading to automatic irrigation and purchasing of needed equipment are just preliminary steps providing tools for improvement.

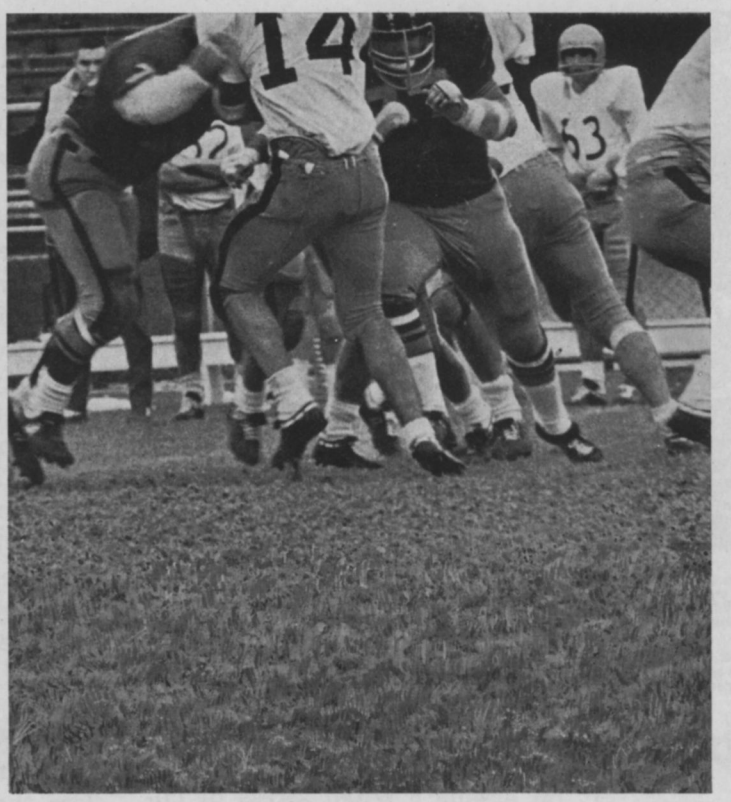
Techniques

Techniques vary widely depending upon tools and terrain. Basically techniques are related to habits. I have seen golf courses start at the edge of the fairways, overlap in the middle with arsenicals just like they were mowing. They crowded together between the sand trap, spread apart in the wide spots, and then two years later you can see where the man did or did not go twice. I have seen where sprayers slowed down and killed everything, where equipment going downhill went fast and uphill slow so that extreme differences in results were achieved. Even calibration, simple as it is, can be overlooked.

With repeated accumulations, records are important. If we miss out on how much has been applied, uncertainty prevails. For example, we strongly recommend that no soluble phosphorus be used when arsenic is being



Young immature **Poa Annua** plant is typical of those found in turf areas.



Golf Brand Turf lives happily ever after 726 football players and 20 marching bands

Think you've got a turf problem? What would you do if you had 6 schools playing their games on one field? Plus several big marching bands? You could put in synthetic turf at a cost of about $250,000. Or you could call on Northrup King's Golf Brand sod for help.

This was a very real problem at Kingston Stadium in Cedar Rapids, Iowa. Every year this stadium is home field to 3 Cedar Rapids public schools, 2 parochial schools and one college! They played 33 football games there last year and hosted 20 half-time marching band ceremonies.

The Director of Plant Facilities for the Cedar Rapids Community Schools told us that the turf in Kingston Stadium became awfully bad long before their season was over. He felt they had two choices. They could put in a synthetic turf at a cost to the taxpayers of about $250,000 or they could make one last try with real grass.

And they chose Golf Brand sod to make that one last try with. In May, 1968, Martinson Sodding and Grading Company of Cedar Rapids laid Golf Brand sod in Kingston Stadium. It was fertilized four times, aerified once a month and watered as needed.

How did Golf Brand turf do? Great! The best playing field ever. The turf stayed green right down the middle through the very last game. A great playing surface . . . and a great savings for taxpayers too!

This fall, the sod in Kingston Stadium was top-dressed with ¼" to 1" of dirt and they'll reseed as soon as the snow is gone. Then the stadium—and our Golf Brand turf—will be ready for another winning season.

Golf Brand lawn seed is often the solution to big turf problems. It adapts itself very well to a wide variety of conditions. It takes terrible punishment and keeps on growing thick and strong and green . . . like a "living carpet". It could be the answer to *your* problem. Let us tell you more about growing grass in problem areas. Send for the two free Northrup King Technical Bulletins below.

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by Howard E. Kaerwer Jr.

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accumulated in *Poa annua* reduction. With this in mind it takes understanding of technology and different techniques of purchasing. If one does change his program and uses some soluble phosphorus, then arsenic, who knows where he is? In contrast, if only arsenic is used, then one seeing results can interpret the end results and know where he is.

Timing

Timing is always important, whether it be fighting the bull in the arena or working to get the most from nature's normal responses. When shall the program start? Early fall is preferred. When shall it achieve toxicity? One year later. When shall I put on seed? When there are openings. When shall I put on arsenic? When stress of climate is medium. How soon may I repeat overseeding? Every two weeks. How often may I apply arsenic? After next rain or irrigation. How much shall I apply? All of these are related, thus it is very wise to have samples, models.

Take trips and see other areas previously treated. And, as mentioned earlier, it is strongly suggested that timing be concentrated into one fairway, three fairways, or nine fairways. Don't start on eighteen fairways. Set some timing fast and some slow. Treating half fairways is simplest and safest during initial programs for the "best" half can be used. All clubs I know of that started a program later enlarged the control program. (At Brae Burn, Art Anderson used lead arsenate in 1938, '40, '44, '47, '51, '55, '59 and '64 to maintain his program.)

The Bluegrass Cycle

You understand a bluegrass seed. It will germinate in 6 to 18 days, puts up one leaf, starts a crown, puts up a second and third leaf. As it starts its fourth leaf it also starts a tiller at the crown, then a second tiller. Now it has some 8 or 9 leaves, and it is at least two months old—still a seedling. Then it puts out underground rhizomes, a horizontal stem that, as it emerges, causes spread characteristic of bluegrass. Now it is a "teenager." A bluegrass planted August 1 with irrigation could have rhizomes in November, but a seedling dropped carelessly in October may be useless and dried by desiccation in the winter so there is nothing next spring. Meanwhile, *Poa annua,* which grows more normally and vigorously, completely overmasks it.

For example, at Meridian Hills Country Club in Indianapolis overseedings made in two successive falls produced a very sparse bluegrass cover of less than 5%. When arsenics kept out the *Poa annua* and crabgrass, the less than 5% advanced to over 95% in one season.

The purpose of overseeding is to initiate sparse starting plants which, by spread, can fill in. Bentgrass grows similarly, making stolons. Bentgrass plants two to three months old are still very small. Actually, where arsenics are being used, at least 90% of the turf increase is from spread of existing plants. For high budget courses, plugging of thin areas is a real possibility in critical spots.

Arsenic Toxicity

Toxicity with arsenic can be summarized by the following steps:

(1) Stop applying soluble phosphorus;

(2) Improve poor drainage areas with vertical trenching;

(3) Gradually build arsenic toxicity by repeat divided applications;

(4) Repeatedly introduce the desired by overseeding and plugging;

(5) Resod the worst first (for example, fronts of tees and aprons); and,

(6) Cloudy days, short days, wet soils and time favor selective *Poa annua* weakening.

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Extend the safe transplant season through summer, winter, any time the ground isn't actually frozen. WILT PRUF Anti-Transpirant protection costs just pennies a plant. Thousands of growers, nurserymen, landscapers, ground maintenance men and foresters use WILT PRUF to minimize losses from transplant shock, winter kill, summer scald, city air pollution. *Write on your letterhead for 50-page technical manual of applications.*

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Turf Management

Thatch Removal

TEN years ago, few were aware of a "thatch" problem. Yet today, it is a much discussed topic in turf management circles. Recognized as a common culprit in most grasses and virtually every area, thatch condition is inviting more and more investigation.

Opinions differ in what thatch is, and why it exists. One authority defines thatch as "the accumulation of a dense felt of undecomposed dead roots and stems through which water cannot penetrate." This felt, or matting, forms between the soil surface and the visible green vegetation. Thickness may sometimes increase to one foot or more.

Few turf areas are immune. Many landscapers are astounded to find how far such a build-up can advance. Once thatch build-up begins, a cycle is started which feeds upon itself rather rapidly until grassed areas may become almost choked out.

A principal reason for the relatively recent emergence of this problem is the pressure for lush, ultra-green turf areas, whether in lawns, parks, institutions, roadsides, or whereover. New strains of grasses have been introduced which guarantee a quick, dense cover. High-potency fertilizers and chemicals are used in profusion to speed the growth. Mowing increases, as does the layer of thatch when clippings are returned to the soil. Clippings, of course, are hardly the only reason for thatch build-up. Yet the fact remains that thatch seems to thrive best in highly managed turf areas. By contrast, this problem seldom exists in poorly kept, thin lawn areas which receive minimal attention and few chemical aids.

Probably the most troublesome effect of thatch is build-up of a barrier to water penetration. More frequent watering in increasingly larger amounts become necessary to meet plant needs. Runoff becomes a problem. Fertilizers and chemicals lose effectiveness because of difficulty in penetration to the soil. The cumulative result is a turf low in vitality and subject to disease. Further, the thatch barrier continues to build.

Though there is disagreement on cause and effect of thatch, most turf specialists agree on the need for removal by powered-rakes, introduced some years ago by several manufacturers. First real usage of this type of equipment came in the tool rental field. Residents of "suburbia" became alarmed when their lawns didn't measure up to the expected blue ribbon of beauty. Reading of the thatch problem, they rushed to their local rental store seeking a method to escape the back-breaking chore of removing thatch with a hand rake.

Several manufacturers responded as many as 10 years ago. They developed units to do the job mechanically. Today these are as varied as the opinions on why thatch exists in the first place. Different units comb, slice, pull, flail or cut the thatch out. Most do a fair job. Some are excellent. An important point to remember is that it does little good to remove one inch of a six-inch thatch mat. The unit used should employ a dependable height adjustment so all thatch may be removed. Equipment must be sturdy. Few turf jobs are as rugged as thatch removal. Another important consideration is the ability of equipment to get close-in to beds and other tight areas. Some units offer a variety of rotors, adaptable to various types of grasses and all areas.

When considering addition of power-raking equipment, a turf manager may do well to check with his local tool rental dealer. Rented tools are subjected to daily abuse. Such equipment gets little care or consideration from the user. Few units are jolted and jarred more than a power-rake. Finding equipment which will hold up under years of thatch removal duties may well save both money and headaches.

When to Rake

The next question is when to rake. Early spring seems the most popular time likely because at this period turf care is on the agenda. The tendency is to rake, fertilizer, weed, and seed. However, there are drawbacks. In effectively removing a dense thatch barrier, it is often necessary to lower a rotor considerably. Resultant appearance of a turf area can be alarming. Though this condition is only temporary, fears of the operator sometimes result in less than the most thorough job.

Many authorities maintain that early fall is the ideal time for raking. Removal of thatch at this time, when lawns are receding into a dormant stage, results in no dramatically disappointing appearance. Further, winter moisture is allowed to penetrate.

Other management procedures are often recommended, depending on intensity of the problem. Aeration can help considerably, as can proper fertilization.

The thatch problem exists virtually everywhere. Any good management program should include power-raking, probably once each year. A plug cut from a particular turf area quickly spells out the extent of the problem. Various types of power units are designed to solve any particular situation. But the operator is to be reminded again that in attacking the problem, he should remove it properly and completely. An effective program can produce gratifying results.

At Last... An Answer to Thatch Problems!

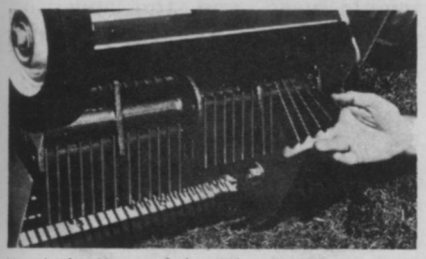
Thatch... a relatively new term, but a growing problem each year. We, at "Blue Bird", recognized the need for mechanical means of solving this thatch situation years ago.

Turf Management Headaches

We had learned from turf authorities that thatch meant many things, each a headache to turf management: plant growth was hindered; fertilizers couldn't reach the soil; water penetration was inhibited. Plus the fact that this matting provided an excellent environment for disease. Yet no means of removing it was available except the back-breaking chore of using a hand rake.

Machine Built to Do the Job

Thus the "Blue Bird" Lawn Comber was born. And from its beginning, it was built to do the job *you* want it to do. We made it durable... a unit for commercial use. Flexible blades *comb* out the thatch, but because these blades are free-swinging, they bounce back when encountering rocks or other obstacles... no metal fatigue, no costly breakdowns.



Here's the Heart of the "Blue Bird"... a Multi-Bladed Rotor of Free-Swinging, Case-Hardened Blades.

Unmatched Performance

The "Blue Bird" has seen many imitators since its inception. But no other has matched the response it has received from turf management personnel.

Ease of Performance is Unequalled. And Look at the Thatch It Combs Out!

Why? Because of the speed with which the "Blue Bird" completes a job. Because of performance... thoroughness no other unit can boast.

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And because of durability. We offer a warranty unprecedented in the industry. The "Blue Bird" Lamb Comber is guaranteed unconditionally against any breakage for one full year! One full year of commercial use. Which guarantees *you* continuous top performance, with no expensive downtime. Job after job... month after month.

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What does all this mean? It means customer satisfaction first of all. Better lawns, better turf management. Profit? Well, it just about goes without saying, the "Blue Bird" is *the* top profit producer. High performance, virtually no maintenance. Figure it out... isn't the "Blue Bird" the unit *you* want to use to eliminate the thatch problem?

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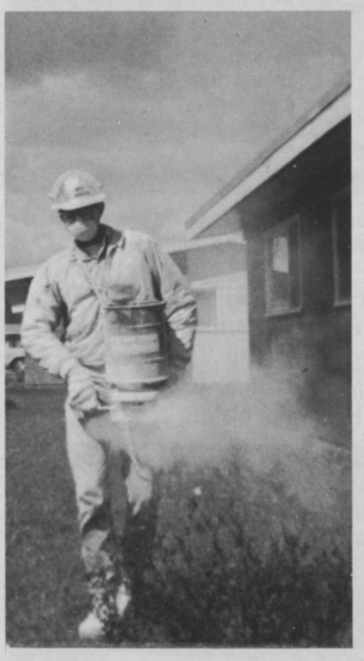

Pictured above, Yeats' spraymen don face masks and goggles when applying fertilizer. Supply truck and equipment are standard in Yeats' operation.

Yeats' Northwest Spray Fertilizes Home Lawns In Minutes.

Few homeowners would attempt to fertilize a lawn in three minutes—even if it contained only 6000 square feet.

But this is routine with John Yeats, owner of the Northwest Spray Company at Spokane, Wash. Yeats, a ground sprayman and a member of the Pacific Northwest Spraymen's Association, also handles turf fertilizer contracts.

One special job has been fertilizing home lawns for personnel at Fairchild Air Force Base in the state of Washington. This is a government contract bid. The one this last year called for putting fertilizer on 1566 lawns. The contract allowed him exactly 10 eight-hour days to cover the lawns which averaged 6000 square feet in size. That's roughly three minutes per lawn.

Yeats handled the job with a 4-man crew, using both hand and small tractor distribution equipment. The 36½ tons of fertilizer used was a 26-10-10 formulation; 23% of the nitrogen was derived from urea formaldehyde and 3% from ammonium phosphate. With 1200 pounds of urea formaldehyde per ton of fertilizer, an extremely dusty material, Yeats found it necessary for his applicators to wear face masks and goggles.

For the uninitiated, bidding on a government contract can be a unique experience. Bids are made on regular government invitation bid forms. These are normally very specific as to materials used and the specified time when the work must be done. For example, once the fertilizer application bid was awarded Yeats, he had only 10 days from the date of notice to complete the job. The contract period could be extended only in event of adverse weather or spreading conditions, and then for only another 10 days. Most bid forms call for basic bids plus various alternates.

Subsequent to award of the contract and also prior to doing the job, Yeats was required to attend a pre-service conference at the Air Base procurement office, to become acquainted with all aspects and requirements of the contract.

This type operation, while routine for a government installation, may offer some suggestions for home owner community type projects. Homeowners as a group could no doubt attract more favorable service contracts if able to act as a group.