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THE WINTER GRAIN MITE WINTER PEST OF TURF

By **Dr. Harry D. Niemczyk,** Professor of Turfgrass Entomology
The Ohio Agricultural Research and Development Center, Wooster, Ohio

The winter grain mite, *Penthaleus major* (Dugés), is a well-known and important pest of small grains in the south central states. Though early literature lists bluegrass, *Poa pratensis* L., and fescue, *Festuca sp.*, as hosts, reference to this mite as a pest of turfgrass is not found. In 1969 and 70, Dr. Herbert Streu, of Rutgers University, studied the life history of the winter grain mite and was the first to collect it from home lawns, golf courses and other turf areas in New Jersey. He regarded this mite as a potentially important pest of turfgrass.

Fairways Damaged — In March 1977 a golf course in Pennsylvania reported large patches of what appeared to be winter desiccation on Penncross bentgrass fairways. Upon closer examination, extremely high populations of winter grain mite were found in the thatch and upper turf roots of these patches. Blades of grass from these areas showed evidence that the mite had fed on the surface cells, leaving a streaked appearance. Leaves severely damaged died and turned a light tan to gray color. Damage and mites appeared again in November and December 1977.

The winter grain mite has an olive-black body with the anal opening on the upper surface and 8 red legs, characteristic of this species. The body of each mite is usually filled with chlorophyll.

Greens Damaged — Brown areas on the bentgrass greens of a southern Ohio golf course were noticed in late November 1977. Examination of turf samples taken from these areas in December showed the winter grain mite was present. The golf course superintendent reported the mites occurred only in the damaged areas. The investigation is continuing.

Life History — Based on the work of Dr. Streu in New Jersey, the mites over-summer as eggs which begin hatching in late October. The new mites are active and apparently feed throughout late fall and winter whenever the temperature permits. Beginning in March, the mites lay bright orange eggs in the thatch and in the soil. Within a day or so the eggs turn white and appear shriveled. By early May the egg-laying population dies and no further mites are seen until the following October.

Feeding and Damage — Like most mites, the winter grain mite has mouthparts called chelicerae that are well adapted for rasping at plant surfaces. After removing the surface from epidermal cells, the mite sucks the cell contents into its body as food. Grass blades fed upon extensively first show a typical silvered or scorched appearance and later turn brown. Snow cover tends to accentuate areas of injury. Whether this mite feeds on turf roots is not known.

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Report Infestation — The extent to which damage from the winter grain mite occurs in late fall and winter is not known; therefore, turf managers are encouraged to carefully examine turf apparently damaged from winter desiccation or disease for the presence of this mite. If damage and the mite are found, this fact may be reported to Dr. Harry Niemczyk, Wooster, Ohio, (216) 264-2540.

No insecticides are specifically labeled for control of this mite on turf. Depending upon the extent to which this mite is reported causing injury to turf, it may be necessary to initiate research to develop methods and materials for control. **WTT**

Bright reddish orange eggs are deposited in thatch from March to May. Eggs turn white and appear shriveled soon after being laid.

Bentgrass fairways of a Pennsylvania golf course in March showing areas damaged by the mite. Courtesy Clyde Lyons.

TURF FERTILIZERS: THE TRENDS AND BASICS

Trends

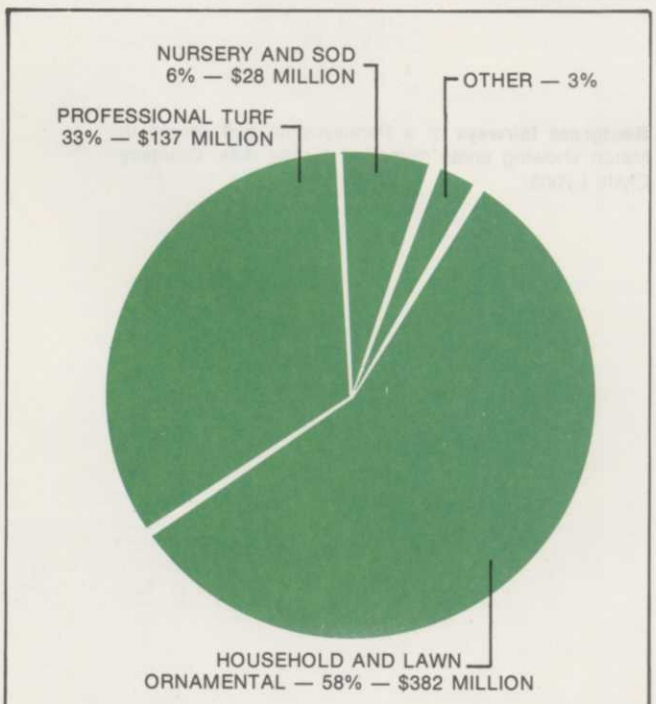
Exact statistics on fertilizer use are as hard to get as natural gas statistics from utility companies. Non-farm fertilizer statistics are even harder to find. One available study carries a $9,000 price tag.

Nevertheless, thanks to Robert Rund, secretary of the American Association of Plant Food Control Officials, we at least have some idea of non-farm fertilizer use in the United States. He undertook such a survey after The Fertilizer Institute told him of the need for such information.

Lyn Prestwich of USS Agri-Chemicals and Marilyn Messerly of O. M. Scotts & Sons presented an interpretation of Rund's results and other sources at the annual meeting of the American Marketing Association in Memphis, Tn., in October 1976. The figures are based on 1975 information.

The total non-farm market was estimated as $600 million at the manufacturers level. This total was broken into three major categories; professional turf, nurseries and sod farms, and household.

Household, the largest category at $382 million, included uses such as lawn, ornamental and houseplant fertilizers. In 1975, it is estimated that 20.5 out of 51 million homeowners cared enough about their lawns to buy fertilizers. By sheer numbers this category dominates the non-farm use figures. Since 1975, significant gains in both lawns, garden and ornamental uses have taken place, as well as an increase in the number of single-family homes. Annual increases of 15-25 percent were predicted.



The professional turf category represented 33 percent of non-farm fertilizer tonnage valued at $137 million. Significant uses were estimated as follows:

Uses	Tons (millions)	Mfg. Dollars (millions)
12,000 golf courses	290	$ 55
14,000 office parks	114	16
28,000 neighborhood parks	87	12
200,000 churches	60	11
28,000 high schools	56	8
15,000 suburban shopping centers	47	7
46,000 apartment/condominum complexes	46	8
19,000 government buildings & grounds	28	4
A whole host of others	107	16
TOTAL	835	$137

Prestwich and Messerly had interesting remarks about future trends in fertilizer usage on golf courses. They predicted less use of nitrogen on fairways to reduce mowing, use of higher analysis fertilizers with fewer applications and less tonnage, and narrower fairways. Growth for the golf course market was predicted (two percent annually) on the basis of an increase in the number of courses.

Finally, the report estimated that six percent of non-farm fertilizer was used by nurseries and sod farms. No prediction for growth was made.

Prestwich and Messerly perceived the significance of the lawn service contractor market but did not give special estimates for it. They did predict that it then represented four percent of the household market and 30 percent of the professional turf category. Deriving new figures from these percentages, lawn service contractors represented 7.8 percent of the non-farm fertilizer market. Using the $300 per ton figure Prestwich and Messerly did, the lawn market represented approximately $92 million in 1975. The lawn care market has grown significantly since then.

Overall, the authors predicted an annual four percent growth in non-farm uses with an increase in mass, chain merchandizing of fertilizer for the do-it-yourself market. Also, good increases in household ornamental fertilizer use and uses for the commercial building market were predicted.

Outlook

The outlook for ferilizer supply does not look at all dim, in spite of natural gas prices and a greater demand.

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Rico during the year ending June 30, 1977 was a record 51.6 million tons. This was 5 percent more than the 49.2 million tons used during 1975-76.

Nitrogen continues to be the main concern of most turf managers, primarily because it is the nutrient that is always needed, and in the largest quantities. At the center of the pessimistic outlook for nitrogen supplies is the natural gas situation. There is, however, an optimistic note, if you could call it that. While it may look that we are running out of natural gas, we are only running out of the most easily obtained and largest reserves of natural gas.

Annual use of natural gas in the U.S. amounts to some 20 trillion cubic feet per year. Proven reserves amount to about 216 trillion cubic feet, which would last only until 1988.

That is grim, in itself, but there are indications that an additional 25 years supply is discoverable, IF producers are given adequate incentive to find it. Basically, this means that it might be available, if you're willing to pay for it. Much hinges on government price deregulation and the resulting research and development.

Importation of nitrogen will become more prevalent in the future. Occidental Petroleum Co., and the USSR have negotiated an exchange of urea for superphosphate. Other possible sources of imported nitrogen are eastern European countries and Latin America. Mexico already has three plants under construction with a potential output of 900,000 tons of ammonia per year. Canada will also add to U.S. supplies of nitrogen.

Coal gasification is an alternate source of nitrogen. Estimates place significant nitrogen production from coal eight to ten years away.

Government regulation plays an increasing role in the cost of fertilizer and other chemicals. Standard Oil of California employs 115 people just to review regulations, according to Dave Barlow, vice-president of Chevron Chemical Co. Government intrusion may be symbolized, he added by the *Federal Register*, which now runs at more than 50,000 pages a year, ten times its size a few years ago. Costs represented by regulations arise not only from their numbers, but from their unpredictability.

A final consideration of nitrogen supply is the cost of transportation. It is presently estimated that more than half of the dollars spent on fertilization are for transportation. Anything that increases the price of transportation will also increase the price of fertilizer.

Basics

Turf fertilizers are more than just simple combinations of nitrogen, phosphorus and potassium. Each element has various sources which greatly affect the conditions for its use. If you consider these conditions for all three elements, the decision of which to use becomes more complex.

Soil test is key to proper fertilization

Probably one of the best known methods of determining how much fertilizer is needed, and the method most often ignored or performed incorrectly, is the soil test.

Whether the actual test is performed by a laboratory or you do it yourself with a good soil testing kit, it is vital to prepare a representative sample of soil to be tested. Each aspect of the area to be tested must be separated. Slopes will differ from flatter areas. Sandy areas will differ from an area with more clay.

A standard soil sampler, that removes small cores, should be used. The core depth will vary from 2 to 4 inches, depending on the recommendations of the testing laboratory or kit instructions. Measure the depth from the soil surface and remove any thatch or turf from the sample. Select ten or more cores in a uniform pattern over the area. Take more for large areas. Mix the cores in a large container. Of this mixture, 1 to 2 pints of air-dry soil is usually required by a laboratory. Remember, for a soil test to be representative, the sample must be representative!

A well-established soil testing laboratory will usually have a form for filling in the previous history of the soil under consideration. This is vital in interpreting the results of a soil test. Arsenic, according to Dr. James Beard, "Turfgrass: Science and Culture," will give the same type of reaction as phosphorus in standard testing methods. If the soil has a history of arsenic use, it is necessary to know this in order to properly recommend phosphorus levels.

Depending upon the intensity of management, a soil test should be made at least every four years. It is important that a good turf manager provides the turf with enough nutrients and to do it economically.

Standard soil tests determine phosphorus and potassium, calcium and magnesium. Often, iron is included. Cation exchange capacity and pH are important in determining nutrient availability and correcting any pH problem that might exist. Tests for measuring salinity and sodium content are available if you suspect a problem.

Nitrogen is the most difficult element to establish a criteria for application. Color is the most used denominator. However, it is important that, while maintaining a healthy color to the turf, color is not overemphasized.

On highly-managed turfs, an excess is usually more of a problem than a deficiency. Excessive nitrogen increases disease susceptibility, can stimulate shoot growth to the extent that root growth is decreased, and can stimulate thatch accumulation. Plant hardiness is also affected by nitrogen level. Excess can be worse than deficiency. **WTT**

Fertilizer

Nitrogen is probably the most difficult element to assess for turfgrass needs. Soil tests generally do not give an adequate reading of nitrates and tissue cultures only tell how much nitrogen the plant is using, not how much is there for it to use.

Determining how much nitrogen to apply brings together many aspects of turf management, including soil type, climate, irrigation practices, turfgrass species, and the level of turf use.

Nitrogen fertilizers are classified into three groups: natural organic, synthetic inorganic, and synthetic organic.

Natural organic fertilizers usually have the lowest nitrogen content. They include such materials as sewage sludge, animal by-products and seed meals. The nitrogen in these materials is not readily soluble in water and is dependent to a large degree upon microbial degradation. Bacteria initially convert the nitrogen in these materials to the ammonia form and then through nitrification the ammonia is transformed into nitrate form for uptake by the plant roots.

Because of the low analysis of these materials, it is necessary to apply them in large amounts. They are often more expensive per unit of nitrogen, but provide a good slow release form of nitrogen and generally improve soil.

Natural organic fertilizers are also characterized by reduced leaching potential, 4-8 weeks residual, and minimum burn potential.

Synthetic Inorganic nitrogen fertilizers include ammonium nitrate, which contains 33% nitrogen, ammonium sulfate, which contains 21%, and sodium nitrate, which contains 16%.

This type of fertilizer dissolves readily in water and has a high burn potential. It is important to apply them when the plants are dry so that fertilizer particles do not adhere to the shoots. Grass shoots which have been burned by fertilizer in such a manner generally have a bleached appearance. It is essential that you water them into the soil after application to avoid this.

Ammonium nitrate contains 50% nitrogen in the nitrate form and 50% in the ammonia form. Ammonium nitrate readily dissolves in water where the cations (NH_4+) and nitrate anions (NO_3-) separate. The nitrates are readily available for plant uptake. The ammonia cations undergo nitrification and are transformed into the nitrate form. The rapidity of this reaction leads to the high burn potential.

Ammonium nitrate has a lower rate of gaseous ammonia loss than other water soluble nitrogen carriers. It is slightly acidifying and is a substantial fire and explosion hazard. Because of its strong acidifying properties, ammonium sulfate is preferred for use on soils that have a more basic pH. Foliar burn potential is also high.

Sodium nitrate is seldom used. It is considered a fire hazard and has a high affinity for water that makes handling and storage difficult.

It is seldom desirable to apply more than one pound of actual nitrogen per 1,000 square feet when using a synthetic inorganic fertilizer. Because a fast growing turfgrass species requires 150-200 pounds of nitrogen per acre per growing season on unirrigated soil and as much as 225-300 lbs of nitrogen on irrigated soils, it is often necessary to make applications every ten days during the favorable growing season.

Synthetic organic nitrogen carriers can be subdivided into water-soluble and water-insoluble forms.

Urea, made by reacting ammonia and carbon dioxide under high pressure and temperature, is the primary water-soluble form. After application, approximately 60% of the urea will be transformed into the ammonium form in one day. This provides a rapid initial plant response, but gives a short residual period with the remaining urea undergoing transformation in 7-10 days. Volatilization, or loss of gaseous ammonia from the soil into the atmosphere, is somewhat of a problem with urea. It also has a tendency to leach and a high burn potential. Application recommendations are similar to the synthetic inorganic. Urea contains 42-46% nitrogen.

There are four basic categories of water insoluble fertilizers. They are ureaformaldehyde (UF), isobutylidene diurea (IBDU), sulfur coated urea (SCU), and the plastic coated fertilizers.

Ureaformaldehyde contains about 38% nitrogen, 70% of which is in a water-insoluble form. The nitrogen in UF is released by microbial degradation. The same factors (temperature, moisture, oxygen and pH) that provide optimum turf growth also provide optimum conditions for the bacteria. As a result, fertilizer release is greatest when turf growth and need is grestest. This offers an advantage, for example, during periods of summer drought stress. Excessive nitrogen could be detrimental as cool season turfgrasses go into a dormant stage and could affect turf recovery. Bacterial action would slow down at this time and, with a UF fertilizer, excessive nitrogen release would not be a factor.

The nitrogen in UF is broken down into three classes, based on water solubility: cold water insoluble nitrogen (CWIN), cold water soluble nitrogen (CWSN), and hot water insoluble nitrogen, (HWIN).

The CWIN portion is the portion that becomes slowly available over a number of weeks. HWIN is that part which becomes available over an extended period of time, usually a year or more. CWSN is available for immediate uptake.

It is generally advisable to have about 25% of the nitrogen in UF as CWSN.

Isobutylidene diurea contains 38% nitrogen, 90% of which is in a water-insoluble form. Nitrogen release from IBDU is controlled by the size of the particles and soil moisture content. The smaller the particle size, and the higher the temperature, the faster the release. The pH plays a slight role. Release will be more rapid at lower pH's. Temera-ture also affects release rate, but lower temperatures do not give an effect such as that with UF materials.

Turf response to IBDU is minimal during the first one to four weeks after application, but is excellent after that period. It has been shown that IBDU applied in the fall, because of its limited dependence on temperature, will provide an excellent greenup in the spring.

Sulphur coated urea is a relatively new product, researched and developed by the Tennessee Valley Authority. It will provide an excellent slow release form of nitrogen but its main benefit, it would seem, would be on soils deficient of sulfur.

The rate of N release from SCU is dependent upon the thickness of the sulfur coating (whether or not a coating of wax sealant is applied), moisture and temperature. The nitrogen is released through degradation of the coating and pores in the coating. Increases in moisture and temperature increase degradation of the coating, thereby raising N release.

Research at numerous universities has shown SCU to be an excellent turf fertilizer. The rate of N release in SCU is expressed as a 7-day dissolution rate. The higher the rate, the more WSN is available for immediate uptake. Commercially available SCU has a 7-day dissolution rate of about 30% and as a result gives rapid initial response.

Some mechanical damage can occur to SCU, altering its rate of dissolution. However, research by TVA has shown that the usual spinner type field applicators will not cause serious damage to the coatings if excessive disk speeds are not used and the backplate is cushioned. If these precautions are followed, disk speeds of up to 700 rpm are acceptable. High speeds, such as those used for spreading lime, must be avoided.

Plastic coatings are often applied to soluble sources of nitrogen, phosphorus, or potassium to slow the rate of release. The rate of release in this case is governed by the thickness of the plastic coating and temperature. Moisture has little influence, unless it's availability is limited. Mechanical damage from shipping, application and even mowing after application can seriously affect the slow-release properties of the plastic coated materials.

Because of the various conditions across the country, it is difficult to recommend nitrogen rates. General recommendations are made, but may be raised or lowered depending upon turf variety and the level of management desired.

The faster growing species of turfgrass, bentgrass, Kentucky bluegrass and bermudagrass, generally require 150-200 pounds of nitrogen per acre during a growing season on unirrigated soil. If there is irrigation, the needs are raised to 225-300 pounds per season. The slower growing varieties, fescues, and zoysia, generally require only half as much.

There is also variation among cultivars of species. Kenblue Kentucky bluegrass, for example, needs .4-.7 pounds of nitrogen per 1000 square feet per month while Merion needs one to one and one-third pound per month.

Phosphorus and potassium requirements are much easier to supplement because soil tests for these elements are usually quite accurate. Recommendations in general include 2-3 pounds per 1000 per year if levels are high and 6-7 pounds per 1000 per year until the deficiency is corrected if the levels are low.

The most common potassium fertilizers are potassium chloride, potassium sulfate and potassium nitrate.

Potassium chloride is commonly known as muriate of potash. It has a high chlorine content and salt index, but is widely used because of its relatively low cost.

Potassium sulfate is more expensive than potassium chloride but has a lower salt index and may contain no more than 2.5% chlorine.

Potassium nitrate has about 13% nitrogen. It has a high water solubility and provides a basic soil reaction. It can cause deflocculation, or separation of the soil elements, if used on a continuous basis. It is generally inferior to potassium sulfate and chloride.

Phosphate carriers are not as frequently used as nitrogen, but there are conditions when it may be beneficial. Often, soils on which turf is being established for the first time might require supplemental phosphorus.

Superphosphate is a treated natural phosphate carrier and is the most important source of readily available phosphorus for turf.

Triple superphosphate contains little calcium sulfate in comparison to superphosphate. It is widely used in compounding high analysis fertilizers.

The phosphorus in rock phosphate is relatively insoluble. In order to be of use it must be finely ground and used only on soils with a high level of decaying organic matter under acidic conditions.

Calcium metaphosphate can be an effective phosphorus source in an acidic soil. It has a relatively low cost.

Basic slag is an example of a by-product phosphate. It has a long residual activity, decreases soil acidity and also contains some manganese and magnesium. The degree of phosphorus availability depends upon the fineness of the material.

Ammoniated superphosphate is an example of a chemical phosphate. It is often used in high analysis fertilizers. It has an acidifying effect. **WTT**