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Soil Sterilant Materials

While none of the available sterilant materials meet all of the desired requirements, some offer certain features which should render them useful in the turf management operation. Table I summarizes some of the comparative characters of a number of sterilants, new and old.

Since soil sterilization has been largely overlooked as a turf management tool in the South, information is lacking on adaptability and effectiveness of many of these materials. To avoid serious turf damage or useless expenditures of money and labor it is necessary to have a thorough knowledge of soil sterilization principles and materials. When complete information and recommendations are not available, it would be wise to test carefully under local conditions any contemplated soil sterilization practices before attempting extensive usage.

POTASSIUM GLASS FOR PUTTING GREENS

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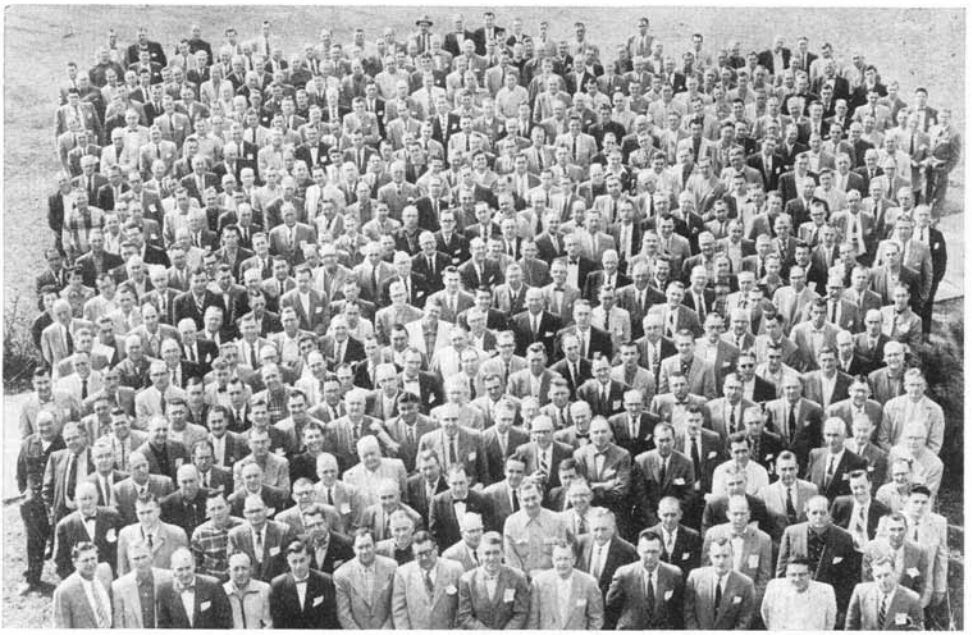
THE development of a special type of glass or frit containing 36% K_2O is promising as a means of maintaining fertility levels on putting greens under difficult conditions. The unique properties of this new fertilizer material are low solubility, thus providing a margin of safety against the hazards of over-fertilization, and relatively rapid weathering to provide adequate levels of potassium for prolonged periods. Potassium becomes available as the glass slowly dissolves.

Tests indicate that a single application of 20 to 30 pounds per thousand square feet on sandy soils may normally be expected to maintain adequate potassium levels for about a year even though irrigation or rainfall may be high. Under less extreme leaching conditions, yearly applications of 5 to 20 pounds of the frit, depending on climatic and soil conditions, would be sufcient to maintain adequate potassium levels. In use, the frit should be worked into the green by watering so as not to interfere with mowing.

The relative effectiveness of potassium frit in supplying potassium for prolonged periods as compared to a soluble source of potassium is shown in figure 1. These data were obtained by packing 45 grams of well aggregated Diablo clay soil, into which had been mixed 375 mg of potassium from the sources indicated, into glass tubes to a depth of three inches. At intervals, three inches of tap water were added to the tubes and the solution passing out the bottom analyzed for potassium. Essentially all of the potassium from the muriate of potash was removed with the first leaching while in the case of the frit substantial quantities of potassium appeared in the leachate after 16 leachings *or after leaching with four feet of water.* Small quantities of potassium originating from the soil were extracted in the first two or three leachings but potassium from this source was reduced to trace amounts thereafter.

The effect of frit particle size on potassium availability can be clearly seen in the two graphs for frit. Maximum availability of the coarser size frit occurred considerably later than did that of the finer mesh size. The particle size distribution in the frit now being commercially produced is wide with the bulk of the material in a size range much closer than that in the study summarized in figure 1. This particular size distribution tends to flatten out

The USGA has supported research work for several years on turf grass problems in the Department of Irrigation and Soils of the University of California for which appreciation is expressed.



The Midwest Regional Turf Foundation held a two day Conference at Purdue University, Indiana, in March, which drew a record attendance of 512. Here are most of the delegates who attended.

and extend the release of potassium substantially.

In tests designed to evaluate the recovery of potassium from frit by plants as much as two-thirds of the potassium applied has been recovered by plants. Thus, the potassium from frit is readily utilized by plant.

Soil temperature conditions have negligible effect on the availability of the frit and surface applications are preferable to mixing into soils.

Potassium Fertilization Practices

With good justification attention has been focused principally on programs for maintaining nitrogen levels in putting greens. Nitrogen is required by turf grass in larger amounts than any other fertilizer element and the forms available to the plant are relatively readily leached.

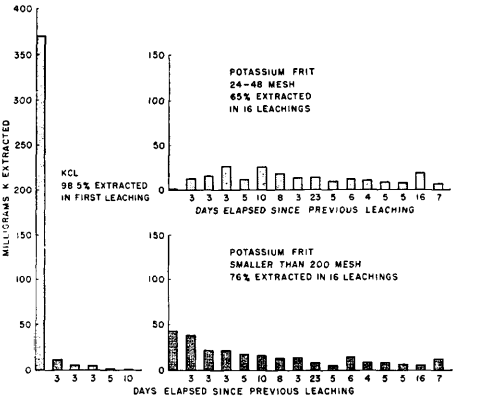
The requirement for potassium by turf grass is about one half to three quarters that of nitrogen. Thus, if 25 pounds of nitrogen are removed per year in the clippings of a green the potassium content would be about 15 pounds plus or minus a few pounds. The ability of soil to supply potassium to the green may vary from essentially zero to a very liberal supply depending on the soil. However even in areas where the potassium supply in the soil is normally very high such as Southern California, potassium deficiency may develop in a period of 5 to 10 years on putting greens unless potassium is included in the fertility program. Since potassium does not leach as readily from fine textured soils as does nitrogen sources, potassium applications of approximately 35 to 40 percent of the nitrogen applications are usually sufficient. Thus, if a green were to receive 100 pounds of nitrogen during a year about 40 pounds of K_2O would be required. In very sandy greens the proportion of potassium should approach the value of two-thirds the amount of nitrogen applied. The foregoing observations are generalizations which of course may be modified depending on the particular potassium supplying power of a given soil and rainfall or irrigation.

The Possible Role of Potassium Frit In Green Fertilization Programs

Potassium frit is relatively expensive although it is appreciably less expensive per unit of fertilizer than the specialty sources of nitrogen being offered for turf grasses* Cost of materials cannot be entirely ignored in developing fertilizer programs. On the other hand, studies now in progress show that the efficiency of utilization of potassium from frit even when nominal applications are made as compared to soluble sources is substantially greater under typical putting green practices. Furthermore, the actual cost of potassium materials is a very small part of the maintenance of a golf course, † and the assurance that potassium levels are adequately controlled through the use of potassium frit without resorting to soil or tissue tests may well be worth the difference in cost. In brief, the relative value of using potassium frit under conditions where leaching is not extreme will depend on a number of factors including personal judgment, and a considerable amount of field testing will be required to determine if the advantages outweigh the additional cost.

It is in sandy soils, low in potassium and in relatively high rainfall areas, however, where potassium frit would appear to be particularly advantageous. Under these conditions it is possible for most of the available potassium in the root zone to be lost during a single rain. This, of course, can adversely affect the quality of the turf grass besides result in an increased labor cost for replacement. Recent studies indicate that potassium is not only leached out of the soil but also out of the plant to an appreciable extent during a heavy rainfall. (1).

With the development of potassium frit it is now possible to add all six of the elements required by plants in large quanti-



Leaching losses of potassium from muriate of potash and two mesh sizes of potassium frit when mixed with soil. The soil columns were three inches in height and three inches of water were applied in each leaching.

ties from the soil in forms which are resistant to leaching. The following is a partial list of fertilizer sources which are resistant to leaching.

Nitrogen. Sewage sludge, or other organic forms or urea formaldehyde.

Phosphorus. Any phosphorus source is normally precipitated by one of several soil constituents and in the precipitated form is resistant to leaching.

Potassium. Pottasium frit.

Calcium. Limestone, gypsum.

Magnesium. Dolomitic limestone.

Sulfur. Gypsum, single superphosphate.

Summry

A potassium glass frit fertilizer material is discussed which is capable of supplying potassium at an adequate rate of turf grass for prolonged periods even though leaching conditions may be severe. While this material appears to be particularly advantageous under conditions where soluble potassium sources are readily leached, its advantages may well merit its consideration under less extreme conditions of leaching. Studies indicate that rates of application of 5 to 20 pounds of frit (36 % K_2O) per thousand square feet, depending on soil conditions, maintain adequate potassium levels for approximately one year under most conditions.

**Manufacturing processes currently being evaluated show promise of reducing manufacturing costs substantially.*

†Potassium frit used at the rate of 10 pounds per 1000 square feet per year would cost about $300.00 for an 18 hole golf course whose greens averaged about 8000 square feet each.

Note. The potassium frit discussed was developed jointly by the University of California and Glostex Chemical Co., 3056 Bandini Boulevard, Los Angeles 23, California. The commercial product has been trade named Dura-Ka.