SYMPOSIUM ON CONTROLLED-RELEASE FERTILIZERS

Introduction

A fertilizer which will release its nutrients, particularly nitrogen, at the rate needed by growing plants seems a worthwhile objective from many points of view. Any of us who has ever got a burned strip on his lawn and any farmer who has not been able to get fertilizer to a growing crop when it needs it, as well as the agronomist trying to match plant uptake and fertilizer release curves, have all keenly felt the need for such a product.

Nature makes a fairly successful attempt at creating such a fertilizer by immobilization of soluble nitrogen and gradual release of the combined nitrogen, but this release is too slow and incomplete for most purposes. The natural organics come closer to the objective but have serious limitations. The development of a synthetic controlled-release nitrogen fertilizer has been the object of agricultural and chemical research for over 50 years. Solutions which could be used to generate insoluble nitrogen have been commercially available for over 30 years. The commercial solid urea-forms, carefully produced to meet rigid specifications, have also been available since the mid-1950's. It has been an active field of research with a variety of urea-aldehyde condensates and various coated fertilizers being reported since the introduction of the urea-forms.

The progress in this field has been well reported to the Division of Fertilizer and Soil Chemistry in the past, both in individual papers and groups of papers. Although this is an active field of research, holding a symposium on controlled-release fertilizers at this time is justified more by a need to evaluate our position than to report strikingly new developments. Our objective in this symposium is thus to see where we are, to see how far we have come, and to attempt to define obstacles still to be overcome. It is appropriate that we begin our symposium with a review paper by Dr. Lunt, an outstanding researcher in the field, and that subsequent papers concentrate on uses of the various types of products.

It is interesting to point out that in the group of five papers in the symposium we have only two speakers who are members of the American Chemical Society, one chemist and one chemical engineer; the other speakers include a biologist, a horticulturist, and an agronomist. This is very much as it should be; it clearly emphasizes the multidisciplinary nature of agricultural research. We chemists are happy to have these visitors; we have much to learn from them and look forward to similar joint research meetings in the future.

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Controlled-Release Fertilizers: Achievements and Potential

Owen R. Lunt

Techniques for achieving controlled-release fertilizers are reviewed. These fertilizers are used mostly in turfgrass, ornamentals, and for other specialty situations. Use for rice and as a starter fertilizer for tree crops also looks promising. Data indicate that controlled-release fertilizers often provide greater efficiency, reduce labor requirements, reduce burning hazard, and improve crop performance. Concern over the introduction of nitrates into streams and lakes will require greater attention to efficient utilization of applied nitrogen. Although denitrification generally keeps nitrate contamination of streams, from fertilizer, at low levels, some studies show 50% or more of applied fertilizer nitrogen appearing in the drainage water. In view of the complexity and importance of pollution problems from fertilizers, which are briefly reviewed, more research on the effectiveness of controlled-release fertilizers, as contrasted to conventional materials in minimizing these problems, is needed.

Research on the first commercially successful, synthetically produced, controlled-release fertilizer was done about 25 years ago. The object of this research, ureaformaldehyde (UF), has been the most widely used specialty fertilizer. The market for UF nitrogen runs to several tens of thousands of tons, compared to about 7 million tons of soluble nitrogen sold for fertilizers, or not more than about 1% of the market. Thus, while the potential of controlled-release fertilizers is interesting, their use is still limited.

Controlled availability fertilizers in use are, in addition to ureaformaldehyde, crotonylidene diurea, 1,1-diureido isobutane (IBDU), metal ammonium phosphates, trace element glass frits, and coated soluble nitrogen sources. Various other materials such as oxamide have been shown to have desirable, slow-release characteristics. The basic approaches

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