

TUESDAY—NOVEMBER 15

Chairman—LAWRENCE I. CLARKE, President, Atlantic Processing Company, Amagansett, New York

**Potential for Fish Solubles —
Liquid Fish in the Fertilizer Industry**

ROY C. STEVENS

*U.S. Bureau of Commercial Fisheries
Jacksonville, Florida*

THE ORIGIN OF THE USE OF FISH as a fertilizer material is lost in antiquity. The practice has continued through the ages until in recent years, when it has largely been discontinued due to the relatively high cost of fish products for this purpose as compared to other materials available.

However, developments bringing about a depressed condition in the fish meal market within the past year and a half have rekindled the interest of the industrial fish industry and of the Bureau of Commercial Fisheries in the possibility of fishery products again entering this field. First, the production of menhaden in 1959 reached an all-time high of 2.18 billion pounds compared with 1.5 billion in 1958; second, the poultry market, which is by far the major outlet for fish meal, suffered a serious decline in 1959 at the time that our production of fish meal was the highest; third, imports of fish meal began to flood our markets at prices against which our producers could scarcely compete, particularly in a depressed market. This continuing situation, coupled with the intensified search for cheaper substitutes for fish meal as a source of the unknown growth factor in poultry feeding, has pointed up the need for research into other uses for industrial fish.

In one of our contacts a few months ago, it was learned that two grove service companies in Central Florida were experimenting with fish solubles as a fertilizer for citrus groves. We were told that the material had been found to be particularly effective with trees in high, sandy soil; that it had the effect of "binding" the soil to retard the leaching of nutrients and that it was providing excellent growth in young trees and good "greening" in adult trees. These claims were supported by the growers when they were visited a short time later, although they had not yet had time to determine the effect of the material on fruit production. One of their most enthusiastic claims was that the material brought about a restoration of trees that had become badly "run down" despite regular applications of standard fertilizers. They were using fish solubles at the 25 per cent solids level in quantities of about one ton per acre.

Feeling that we had something worth investigating further, we contacted different specialists in the fields of fertilizer research and plant nutrition to see what may have been done in the way of research on fish materials and to determine the possibilities for future research. In each instance, we were told

that fish was considered simply as one source of organic nitrogen. It was also their belief that, in most applications, the cheaper inorganic nitrogen was just as effective as organic. Research had proved conclusively that a citrus tree, for instance, could absorb and store, in one application of inorganic nitrogen, all of the tree's requirement of that element for an entire year. It was agreed, however, that the slower-releasing organic nitrogen provided some advantage in other applications. The trace elements contained in fish products were considered relatively unimportant inasmuch as most soils in this country are not deficient in these elements. Where such deficiencies do occur, the need, they said, can be supplied more cheaply by direct application. We stated that the results apparently being obtained through the use of fish solubles in Florida citrus groves and the many reports of outstanding results achieved with fish materials elsewhere, led us to suspect that fish may contain a factor or factors for plant growth and fruit production similar to that provided by the "unknown growth factor" for poultry growth and egg production. These results, we felt, could not be explained simply on the basis of nitrogen-phosphate-potassium content alone; firstly, because the N-P-K content of fish is relatively low as compared with those of most fertilizer mixes; and secondly, because in the tests previously mentioned noticeable improvement was observed where the solubles material was used as a supplement to standard mixes considered fully adequate in the essential elements. After considerable discussion, the researchers conceded that fish materials could possibly contain some factor or factors capable of providing a bonus or tonic effect beyond that to be expected from their basic elemental content.

It was obvious at this point that research would have to be conducted to determine whether the special effect theory is valid. We have already made arrangements for part of this research. The research director of the USDA Agricultural Experiment Station in Orlando has agreed to conduct small-scale experiments with citrus trees over the next two to four years using fish solubles and liquid fish to be supplied by a Florida menhaden producer. The owner of a liquid fertilizer manufacturing company in Kentucky has also agreed to conduct experiments on one to five acres of field crops if samples of material are provided. The industry is grateful for these offers of assistance and will certainly be taking advantages of them. However, the research with citrus trees will, of necessity, take from two to five years before any conclusive results can be obtained. The research in Kentucky will, likewise, require a minimum of two years. In addition, it will be conducted by a private concern and we have no guarantees as to its comprehensiveness or impartiality. These programs are fine, but they are not enough.

What is needed is a three-pronged attack on the problem—1: The industrial fish industry needs help *now!* A crash program of research should be contracted with a federal, state, or university organization to study the effectiveness of fish materials in truck crops in an area where three or four crops are possible within a single year. The results of thorough, unbiased tests by such an organization would be readily accepted by the fertilizer industry and by agriculture. 2: Concurrent with this crash program, and on a two-to four-year basis, modest-scale research should be conducted with various field and orchard crops. 3: If and when positive results are indicated in the crash program, large-scale tests should then be undertaken to determine the factors involved in actual commercial use of these products. These tests should be conducted using both fish solubles and

liquid fish. Solubles are a byproduct of the manufacture of fish meal, whereas liquid fish is a product prepared directly from the raw fish by controlled enzymatic hydrolysis. Both products are relatively inexpensive, although neither can presently compete with other sources of nitrogen on a per unit basis. Price, however, is a relative term, and if these materials should prove effective, they will demand a price commensurate with their value in increased production and growth.

The reasons for including liquid fish in this program are these: 1: If and when the unknown growth factor has been isolated, it is quite possible that it can be synthesized or derived from some source cheaper than fish meal. Another use or another market would then have to be found for industrial fish. 2: Liquid fish is simple and inexpensive to produce. The high cost of firing dryers is reduced materially and the byproduct oil can still be removed. 3: In the event that research should prove liquid fish to be an effective fertilizer material, it is possible that fish meal producers may realize greater profits by converting to liquid fish production than by continuing in meal production.

It is the opinion of many that a balanced fertilizer mix using liquid fish or fish solubles as the base will provide bonus effects in plant nutrition and production and that such a fertilizer can be produced at a price that will be competitive with other high-grade fertilizers available on the market. Only comprehensive, unbiased, fully-controlled research will give us the once-and-for-all answer.

Effect of the 1960 Law of the Sea Conference on the High Seas Fisheries

WILBERT MCLEOD CHAPMAN
*The Resources Committee
San Diego, California*

I LAST ADDRESSED THIS INSTITUTE on the subject of the Law of the Sea and High Seas Fisheries Management with a paper written in the late fall of 1955 (Chapman, 1955).

Nineteen fifty-five had been an eventful year for this subject. The General Assembly of the United Nations had ordered convened a Specialized Conference on the "Conservation of the Living Resources of the Sea" so that the International Law Commission and it would have the benefit of the advice of the fishery experts of the world on these technical aspects of the Law of the Sea, and it had instructed the Commission to have a final report on the whole subject of the Law of the Sea ready for the General Assembly at its 1956 fall session.

The specialized conference had taken place in Rome on schedule in April of 1955. Forty-five nations had been represented by voting delegations and another six had sent observers. All of the International Fisheries Commissions in the world and other such expert bodies had been represented by their top scientists. The Conference had been very successful and had presented a competent, agreed report on the subject to the International Law Commission, the General Assembly, and the member governments.