Nitrogen Dioxide for Direct Application Fertilizer?

Possible availability by Wisconsin process and successful preliminary soil tests may make nitrogen dioxide a prime fertilizer material

ST. PAUL, MINN.—Soil losses of nitrogen injected as nitrogen dioxide appear to be quite low, suggesting its possible use as a new nitrogen fertilizer.

D. G. Aldrich, University of California, Riverside, has found nitrogen dioxide losses in soil to be negligible

Oxidation to nitrate is rapid in acid, neutral, or unbuffered alkaline soils so that there is no accumulation of nitrites, according to D. G. Aldrich, University of California, Riverside, who reported this work at the 46th annual meeting of the American Society of Agronomy here Nov. 8 to 12. Highly buffered alkaline soils, however, do retard the oxidation of nitrites formed so that 25 to 32% of the injected nitrogen is found in this form at the end of 24 hours. Since nitrite toxicity is lower in high-pH soils, it is hoped that plant growth may not be inhibited in alkaline calcareous soils. Greenhouse experiments are now under way to determine whether there is inhibition or not.

Nitrogen dioxide is an intermediate in the Wisconsin (Daniels) process for direct fixation of atmospheric nitrogen. A demonstration plant using this process has recently been closed down (AG AND FOOD, Nov. 19, page 1152) because it is commercially unfeasible in an integrated nitrogen fertilizer plant. This process produces nitrogen dioxide by oxidizing air at a high temperature. The dioxide is then dissolved in water to give nitric acid, which is not used for fertilizer as such, but is used for making a nitrate—usually ammonium nitrate. Thus a Wisconsin process installation would need to be located near an ammonia plant. Ammonium nitrate plants get their nitric acid by oxidizing part of their ammonia, so it is only with this phase of the operation that the Wisconsin process competes under present conditions, and half of the nitrogen in the ammonium nitrate would still have to be fixed via ammonia synthesis.

If nitrogen dioxide could be applied directly to the soil, however, the process would then compete with the ammonia synthesis and the competitive picture might be different.

New Type of Selective Herbicide May Emerge from British Work

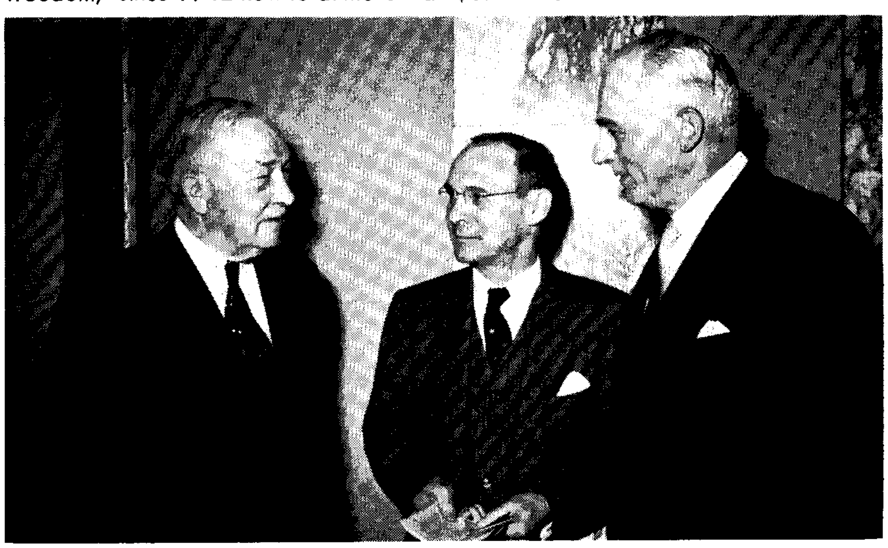
Action is based on production of active growth hormone by enzymatic breakdown of chemical structure within tissues of susceptible plants

HARROGATE, ENGLAND.—Recent experiments carried out at Wye College here in England have opened up new possibilities in the field of selective weed control. British investigators have shown that various derivatives of γ-phenoxybutyric acid will destroy certain plant species owing to breakdown of the chemical within the tissues to the hormone active acetic derivative. Results of the work, which at this stage must be considered preliminary, were presented by R. L. Wain before the British Weed Control Conference, held here Nov. 2 to 4.

Most of the compounds studied at Wye have been related to established growth promotors, such as 2,4-D, MCPA, and 2,4,5-T, but have differed structurally in having more than one methylene group in the side chain. The homologous series of acids, starting with the acetic derivative with one methylene group up to the octanoic derivative with 7 methylene groups, has been prepared; each of the acids has been examined, at

Nutrition Foundation Elects New Board Chairman

Oliver C. Carmichael (left), president of the University of Alabama, who was elected chairman of the board of the Nutrition Foundation in New York on Nov. 11 to succeed the late Karl T. Compton. To the right are Charles G. King, scientific director, and George A. Sloan, president. Research supported by the foundation during the past year has brought out new knowledge in connection with plant, animal, and human growth. Grants to 75 colleges, under conditions of "complete freedom," since 1942 now total more than $3.2 million



least in a preliminary fashion, for growth-promoting activity.

The first experiments on crops and weeds were carried out with γ-(2,4,5-trichlorophenoxy) butyric acid (2,4,5-TB). The chemical was sprayed on peas at a rate equivalent to two pounds of the acid per acre. Annual nettle was killed and certain other weeds were affected; the peas were unaffected.

The butyric, caproic, and octanoic acids derived from other chlorinated phenols were also examined in the field during the past season. The results obtained, says Wain, leave little doubt that some of these acids, especially γ-(2-methyl-4-chlorophenoxy) butyric acid (MCPB) and γ-(2,4-dichlorophenoxy) butyric acid (2,4-DB) must be considered for use as selective weedkillers in commercial practice.

In field experiments, control of annual nettle, creeping thistle, fumitory, and fat hen has been achieved with MCPB and 2,4-DB, applied at two pounds per acre. Clover and celery are little affected and carrot, parsnip, flax, and peas are much less damaged by MCPB than by MCPA or 2,4-D.

At Wye, Wain has obtained a striking control of annual nettle infesting celery plants in the field with one application of 2,4-DB or MCPB at two pounds per acre. No damage to the crop occurred, but 2,4-D and MCPA, applied at a corresponding rate, killed the celery outright within three weeks.

Wain uses the conventional wheat cylinder elongation, pea curvature, and tomato leaf epinasty tests for preliminary assessment. Starting with the homologs of 2-methyl-4-chlorophenoxy acetic acid, he found that derivatives having an even number of methylene groups are inactive and those having an odd number are active. He explains this alternation in terms of a breakdown of the side chain by a β-oxidation mechanism. In his laboratories, chemical evidence was obtained that β-oxidation of the side chain of ω-phenoxyalkylcarboxylic acid can occur in the flax plant. This has recently been supported by results of biological and chromatographic work using another series of related compounds.

As the investigation continued, certain series were found to exhibit exceptional behavior. The expected alternation in activity was exhibited in the wheat cylinder test, but in the pea curvature and leaf epinasty tests, only the acetic derivatives were active. The immediate conclusion was that the β-oxidizing enzyme systems present in pea and tomato tissue were incapable of degrading the side chain of these particular substituted phenoxy acids to the acetic derivative.

Wain emphasizes that these new compounds that have had the preliminary field testing will not control as wide a range of weed species as the well-known MCPA and 2,4-D. He points out that unless the weed possesses the particular enzyme system capable of degrading the side chain to the acetic derivative, no growth response could be expected.

Rotation of Herbicides Advised to Prevent Resistance Developing

HARROGATE, ENGLAND.—Continued and extended use of growth-regulating weedkillers is developing a resistance that may well be met by rotation of the chemicals applied. Control of weeds on agricultural land by means of chemical weedkillers should be considered in relation to all the crops in the rotation as a whole, and not to any individual crop, according to Pest Control's technical director, A. L. Abel.

Crops in the rotation should be selected bearing in mind what weedkillers and what cultivation methods can be employed in each or between one crop and the next so that the most effective attack can be made on the particular weed or weeds.

In his report before the Second British Weed Control Conference, held here Nov. 2 to 4, Abel explains that resistance to chemical weedkillers can arise in one of two ways: first, there may be a segregation of those plants which, by virtue of some character, have survived and with subsequent spraying a higher proportion will carry this character of resistance and will survive the treatment. As an example, he cites the case of creeping thistle, control of which now requires higher dosages than in previous years.

Secondly, a resistance may develop from change in the botanical composition of the weed flora, so that a weed not susceptible to the weedkiller being used becomes dominant in place of the formerly susceptible weed. A third possible way in which weeds might develop resistance would be by a genetic mutation induced by chemicals applied. So far there is no evidence to support this theory.

It is by the second method that resistance is most likely to develop, believes Abel. Fortunately, there already exist such alternative weedkillers for use in cereal crops as growth-regulating materials, dinitro chemicals, and sulfuric acid. These achieve their weedkilling action in different ways and are effective against different weed species. If used alternately in two successive cereal crops or other crops in which they can be used, a resistant weed flora is not likely to develop.

The British have recently carried out experiments indicating that dinitro materials, applied in late autumn or early winter to established winter wheat, are effective in controlling seedlings of autumn-germinated grasses, including black grass (*Alopecurus agrestis*). Abel emphasizes that these indications are the result of only one season's work and conclusions should not be drawn at this time. The work is, however, being followed up.

Dinitro materials have been used as pre-emergent sprays for the potato crop in the United States. The treatment is cheaper than the two or three cultivations that it replaces, but it is not a complete answer, and later cultivations are needed in addition to the spray. In Britain, such advantages for the pre-emergent treatment of potatoes cannot be demonstrated while the present ratio of cost of chemical to cost of cultivation holds.

Industry

U. S. Steel to Build Ammonia Plant in Utah

U. S. Steel has announced that construction of 200-ton-per-day ammonia plant will begin early near year at its steel plant in Geneva, Utah. The $18 to $20 million plant for 70,000 tons of anhydrous ammonia and ammonium nitrate has been designed by Blaw-Knox.

U. S. Steel said that its decision to build the first of its previously announced coke oven ammonia plants at Geneva is a result of the expanding agricultural and industrial markets in the Intermountain and Pacific Northwest areas. The plant will utilize gas from the vertical-type coking ovens at Geneva as a hydrogen source. Details of the process to be employed have not been announced, but a German-Linde patent is involved. The gas is currently being used in making by-product benzene, naphthalene, and ammonium sulfate prior to its use as metallurgical fuel. Hydrogen will be removed from the gas between current by-product plant and use of gas as fuel.

Some time ago, Salt Lake City Chemical and Utah Chemical each announced plans to build ammonia plants in the Salt Lake City area which would use natural gas or petroleum residuals as a source of hydrogen. Neither plant has reached construction, and, although