

The net result of the system recommended is that the nitrogen which would otherwise be lost is used to produce a crop which either has an immediate money value or else becomes a source of humus if returned to the soil. In the latter case the nitrogen is no longer in the nitrate form, but is present as a part of the plant tissues in an ideal condition to be converted into nitrates again when needed in the spring.

F. E. ALLISON.

**N**ITROGEN Supply of United States Much Dependent on Imports In this country an adequate supply of fixed nitrogen is essential both in time of war and in time of peace. The United States is a consumer of great quantities of nitrogen used in a variety of forms by several industries. Agriculture is by far the largest user. The chemical industry, the explosives industry, and refrigeration rank next, in the order of quantity used. Agriculture leads also in the variety of forms in which nitrogen is used. While other industries must have nitrogen in the form of ammonia or sodium nitrate, agriculture can use these inorganic materials and also organic materials including all sorts of animal and vegetable waste. All but about 320,000 out of several million tons of nitrogen going annually into the soils of the United States is produced on the farm as manure, or is carried down by the rain, or is fixed from the atmosphere by bacteria of the soil and legumes.

However, agriculture demands an auxiliary supply in the form of commercial fertilizers. This is supplied partly by such materials as dried blood and tankage, fish scrap and cottonseed meal, but mainly by Chilean nitrate, by-product sulphate of ammonia and cyanamide, and other products of the fixation plants. This last class is of special interest on account of the fact that its production is capable of unlimited expansion and can be made to supply the demands of all nitrogen-using industries.

The annual inorganic nitrogen supply of the United States is approximately as follows—700,000 tons ammonium sulphate equivalent containing 154,000 tons of nitrogen from the coke ovens and gas works; 50,000 tons of ammonia containing 40,000 tons of nitrogen from fixation plants; 1,000,000 tons of Chilean nitrate containing 155,000 tons of nitrogen; other imports, including cyanamide, amounting to about 50,000 tons of nitrogen. These figures, totaling about 400,000 tons, vary from year to year, the tendency being toward steady growth in coke-oven production and more rapid growth in air fixation output and marked fluctuation in imports. It will be noted that the United States is still dependent in a large measure upon imports for its nitrogen supply.

This country will use increasing quantities of nitrogen in the future, and agriculture will demand the major part of the supply. Aside from that produced on the farm it will come mainly from three sources—(1) the coke ovens, with production limited by the demand for coke; (2) imports from Chile, Germany, and Norway, and possibly other countries; (3) our own growing fixation industry, with unlimited possibilities for expansion.

For years the discussion has centered around the Government plants at Muscle Shoals. Ten years have passed since their construction, and rapid progress has been made in the industry, with the result that

these plants are out of date and of questionable value. Only 40,000 tons of nitrogen could be obtained from this source and would fall far short of supplying the demand, which requires the importation of some 200,000 tons annually. Evidently there is need of expansion in nitrogen-fixation capacity, and this situation is bringing about the development of an industry of the usual American type, assisted by the Government through its research activities.

P. E. HOWARD.

**O**AT Varieties That Resist Smut Grown by Experimentation In each of the three years 1924, 1925, and 1926 the oat smuts took a toll of about 50,000,000 bushels in the United States. In 1927 and 1928 oat smut appeared in epidemic form in various sections of the country. The annual losses in these last two years doubtless exceeded those of the three years noted above.

Oat smut may be controlled by treating the seed with formaldehyde, a treatment that is cheap, easy to apply, and very effective. However, in view of the heavy annual losses, it is evident that seed treatment is not practiced as extensively as it should be. Because of this fact the possibilities of discovering or developing satisfactory varieties highly resistant to the smuts of oats is receiving increased attention by agronomists and pathologists of the United States Department of Agriculture and the State agricultural experiment stations. The necessity for seed treatment with formaldehyde or other fungicides to control smut thus would be eliminated or reduced.

After extensive smut-inoculation studies by various investigators three varieties belonging to the common-oat group (*Avena sativa* L.) have been found which are highly resistant to or immune from the forms of both smuts now known. They are the Markton, Black Mesdag, and Navarro (Ferguson Navarro) varieties. Of these only the Markton has become of commercial importance. So far the distribution of Markton has been limited to Washington, Oregon, Idaho, and adjacent Montana, owing to its marked susceptibility to the rusts of oats. The Black Mesdag variety never has become of economic value owing to its poor yield and black kernels. The Navarro, a comparatively new and distinct oat, likewise appears to be poorly adapted and as yet is of no economic importance.

### Value for Breeding

The Black Mesdag and Navarro both have potential value for breeding purposes in spite of their agronomic disadvantages. With Markton, they now are being used by plant breeders in hybridization experiments as resistant parents for the development of new varieties. In a few years, therefore, numerous strains of oats highly resistant to both smuts should be available unless new physiological forms of smut appear in the meantime that prove capable of infecting the parent and hybrid sorts.

For many years the Red Rustproof, Fulghum, and Burt, the so-called red-oat varieties of the South, have been considered highly resistant to the smuts of oats. However, during the last few years the occurrence of smut in these varieties, especially in Fulghum and its strains, has been decidedly on the increase. This apparent breaking