specialists recommended foliage applications of zinc sulfate for beans. This year they are recommending soil applications of $ZnSO_4$ because of its longer effect. Cost of applying the recommended eight pounds per acre is $4.00 an acre, which would be offset by a yield increase of 50 pounds per acre. Where used, zinc sulfate has increased yield about 500 pounds per acre, certainly justifying the cost.

While zinc applications will boost yields, exact understanding of all facets of zinc deficiency are not known. Currently under way are studies to determine how the amount of nitrogen and the carrier used affect zinc availability.

Trace Elements via Chelates. While zinc sulfate is helping Pacific Northwest farmers beat a trace element problem, work with iron and zinc complexes of ethylenediamine tetraacetic acid show promise for stone fruit growers of California. Nearly every California county has orchards or vineyards which can benefit from applications of zinc, boron, iron, manganese, or copper, according to C. E. Scott, University of California, Berkeley. Present methods are satisfactory for correcting boron, manganese, and copper deficiencies. But for iron, trunk injections are the only (and high cost) solution at present in calcareous soils, while more efficient methods than zinc sulfate sprays are needed for cherry, walnut, and grape.

Economic Guidance Needed. The economic analysis of various rates of fertilizer application can serve not only to increase the farmers income on the crops he is currently growing, according to W. R. Allstetter of the National Fertilizer Association, but also it can furnish a guide as to the crops he should grow to increase his net return. For the farmer with limited capital, such analyses may tell him how to ration his capital or help him to borrow more.

Guidance in the economic use of fertilizers is urgently needed by many farmers, said Mr. Allstetter. Fertilizer recommendations based on sound economics can probably do more to improve farming efficiency quickly than can any other factor.

High Fertilizer Use Predicted. The estimate that by 1965 our agriculture will consume about 40 million tons of fertilizer or 10 million tons of actual plant food is not at all fantastic, declared Vincent Sauchelli, Davison Chemical Corp. In the 1920's it would have been considered lunacy to predict a consumption of 22 million tons of fertilizer in 1953, he said, but that was what happened; in addition, about 30 million tons of lime was used. Sights should be set high, said Mr. Sauchelli, then let creative salesmanship hit the target.

MCP Use Increase Expected In Canada

2,4-D will remain most popular, however, because of its already strong position

SASKATOON, SASK.—MCP (2-methyl-4-chlorophenoxy acetic acid), older by approximately one year than its better known counterpart 2,4-D, has been used more in England and Europe than in North America, but its use here is expected to increase as farmers become more familiar with its potentialities. It is unlikely that its use will equal that of 2,4-D, however. These are the conclusions G. R. Fraser, Chipman Chemicals, Ltd., Winnipeg, related to those attending the 33rd annual convention of Agricultural Institute of Canada here June 22 to 25.

MCP's use overseas as contrasted to the use of 2,4-D on this side of the Atlantic stems from several reasons. 2,4-D's faster kill means a greater saving in moisture, an important factor in many regions here. Also important is the fact that Americans are satisfied with results from low dosages of 2,4-D whereas the British, for instance, prefer higher dosages permissible with MCP which give better control of semiresistant weeds. Likewise important is the cost of basic chemicals—phenol, a 2,4-D raw material is more plentiful here while Europeans have more *o*-cresol for MCP.

In tracing the development of MCP, Fraser noted that interest in it increased sharply when Minnesota workers demonstrated in 1949 the wider tolerance crops had to it. This wider tolerance is particularly true of flax, a highly susceptible crop that requires careful control of weedicide application. With the wider safety margin afforded by MCP, a greater number of weeds can be controlled, although flax is still considered susceptible and reasonable caution need be exercised.

One deterrent to wider use of MCP is its higher cost—nearly twice that of 2,4-D. Greater use should bring that cost down, he said. The high cost, however, is already offset to some extent by greater increases in yield; MCP in many cases provides greater return per dollar invested. It may not be as spectacular a chemical as 2,4-D, he concluded, but its use should gradually increase as farmers gain confidence in it.

Oil Seeds Stability Desired. While Canadian officials are urging farmers to step up oil seed production (AG AND FOOD, June 24, page 496), here are some of the possibilities B. C. Jenkins, University of Saskatchewan, sees for improvements in the industry: Sunflower, although introduced in the 30's to Canada but only recently of commercial importance, should gain in importance when better rust-resistant varieties become available. The photoperiodic response of soybean makes it unsuitable for western Canada; unless this is changed or the seeds are made to mature more rapidly, soybean will not be an important western Canada crop. Rape seems assured a place in the industry, especially if edible and other uses are developed for the oil in addition to its present use in marine lubricants.

An extensive program is under way—including radiation-induced mutation—to produce new strains of safflower. Present varieties used in the U. S. are not suited for the shorter season of Canada. Flax, mainstay of the industry, will have a better chance of competing with the other oil seed crops provided a large-seed variety high in oil having a low iodine number is developed. Taken together, these improvements Jenkins sees as lending to a more stable oil seed economy in Canada.

Free Energy Change Influences Uptake of Cations by Plant Roots

The free energy change in the ion exchange reactions between plant root and the substrate has a decided effect on the uptake of certain cations by the plant. The competition between the plant root and its environment for the available cations can now be placed on a quantitative basis. This was the opinion expressed by C. E. Marshall, University of Missouri, at the ACS Division of Colloid Chemistry's 27th National Colloid Symposium held at Iowa State College June 25 to 27.

Within the last several years it has become generally accepted that ion exchange is the first step in the passage of a cation from the substrate to the root. It is thought that three factors govern the exchange reaction against hydrogen at the root surface. These are the activity of the cation in the substrate, the corresponding activity of the hydrogen ion, and the free energy change for the exchange reaction. By growing soybean plants in several substrates in which the first two conditions were held essentially

constant but in which the last was varied, Dr. Marshall was able to compare cation uptake with the free energy change involved. The plants were grown in dilute suspensions of Amberlite IR-120, Wyoming bentonite and Putnam clays containing adsorbed calcium or potassium ions, as well as solutions of the chlorides and bicarbonates of these elements. Potassium and calcium uptake were measured by analyzing the roots and the tops of the plants.

An example of the type of results obtained in these experiments is found in the comparison of potassium uptake for three substrates having different free energy changes in their ion interchange reactions. For the potassium chloride solution, with a free energy change of 0, 74 milliequivalents of potassium were taken up per 100 grams of root material. For the potassium bicarbonate substrate, with a free energy change of 3300 calories per equivalent, the uptake was 118; for the potassium Amberlite IR-120 suspension the free energy change was −100 calories per equivalent and the uptake was 32. It is readily seen that the greater the free energy change the greater is the cation uptake.

Calcium behaved in a similar manner. Dr. Marshall pointed out that there was considerable variation in his experiments because he was dealing with living plants and also because free energy changes are not easily measured. However, now that a start has been made it may some day be possible to correlate growth with free energy differences of only a few hundred calories.

Industry

Mathieson Hydrazine Plant Goes on Stream at Lake Charles

The first large-scale plant in the United States for making hydrazine was put into operation by Mathieson Chemical earlier this month at Lake Charles, La.

Hydrazine has many important uses in the agricultural chemicals field, as well as military and industrial uses. A hydrazine derivative, maleic hydrazide, is showing good results as a plant growth retardant. Another hydrazine derivative is said to kill mites without poisoning the birds that feed on dead mites.

Some of the over 200 hydrazine derivatives reported in the literature are useful in preparing drugs, antioxidants, textile processing agents, explosives, and photograph developers, and large numbers of other useful products. Military uses, for rocket fuel, will probably account for the major portion of the production of the Mathieson plant, which cost around $3 million.

One other company, Fairmount Chemical Co., also produces hydrazine at its $150,000 plant in Newark, N. J., by a different process than the one used by Mathieson.

Phosphoric Acid Plant to Be Built by V-C near Cincinnati

Virginia-Carolina Chemical Corp. has announced that it will construct a new production unit for phosphoric acid, sodium tripolyphosphate, and other sodium phosphates at Fernald, Ohio.

The plant will be located in the vicinity of the atomic energy plant and the Miami research laboratory of Procter & Gamble near Cincinnati. V-C has a fertilizer plant in the area also.

United Industrial Constructors will begin construction immediately, the announcement says.

V-C has a plant under construction in Nichols, Fla., a contact sulfuric acid plant and a wet-process phosphoric acid plant with provision for uranium extraction.

Lunsford Buys Out Hayes-Sammons

C. S. Lunsford has bought out the interest of Hayes-Sammons in their joint company, Empire Chemical and Supply Co., Inc. (Ag and Food, June 10, page 431). The Texas company, no longer incorporated, is under the sole direction of Mr. Lunsford.

People

Frankenburg Made VP for Research by General Cigar

Walter G. Frankenburg has been elected vice president in charge of research and development for General Cigar Co., Inc. Dr. Frankenburg established General Cigar's research laboratory at Lancaster, Pa., in 1942 and is credited with being the first to organize a purely scientific research laboratory in the American cigar industry.

In announcing Dr. Frankenburg's election, the president of General Cigar, Julius Strauss, stated that: "By his election the directors recognize the tremendous importance of scientific research in the future development of our company and the industry."

Dr. Frankenburg, who serves on the advisory board of Ag and Food, came to this country after resigning his position with I. G. Farbenindustries and leaving Germany in 1938 because of political conditions there. His research in Germany was concerned with photography and a photochemical process for producing vitamin D from ergosterol. In this country, his research on the chemistry of tobacco has led to improvements in curing and fermenting tobacco, seed selection, and growing methods.

Paul L. Salzberg has been promoted to director of the chemical department of Du Pont Co. He succeeds **Cole Coolidge** who died recently. Dr. Salzberg has been with Du Pont since 1928 and has moved up through various positions to his most recent one as assistant director of the chemical department.

George D. Wilson has been appointed chief of the newly created division of food technology of the American Meat Institute Foundation. Dr. Wilson has been an instructor at the University of Wisconsin and has been engaged in research on the effects of hormones on lambs and pigs and on the influence of protein levels, aureomycin, and B_{12} supplementation on pork carcass values.

Truman E. Laningham, former entomologist at the Shell agricultural laboratory, has been made a field representative for the Eston Chemicals Division of American Potash & Chemical Corp. His headquarters will be in Modesto, Calif.

Leonard S. Silbert has been appointed senior fellow under a multiple fellowship recently established by the National Renderer's Association at the USDA's Eastern Regional Research Laboratory at Wyndmoor, Pa. The fellowship is part of a new research program being initiated by the association to find new uses for inedible tallow and grease.

Max F. Mueller has been made chief technologist of Grace Chemical Co.'s nitrogen plant now under construction near Memphis, Tenn. He was formerly chief engineer for J. T. Baker Co. A chemical engineering graduate of the University of Michigan, he has been engaged in project and process engineering work. Mr. Mueller will be at the company's development department in New York until he takes up his duties as chief technologist at the plant.

Christian H. Aall has been made director of development for Monsanto's phosphate division in St. Louis. He has been assistant research director for the division in Anniston, Ala., since 1949. **Donald A. Roper** will replace Dr. Aall as assistant research director for the division.

E. C. Stakman has retired from his position as head of the department of plant pathology and botany at the University of Minnesota. He is now professor emeritus.