

Ag and Food Interprets . . .

- ▶ Importance of calcium, magnesium, and sulfur often overlooked
 - ▶ Inventory control gets close attention in the pesticides industry
 - ▶ Rural Development Program teaches farmers about chemicals
 - ▶ Future of fritted trace elements is in hands of experiment stations
 - ▶ Food, agricultural agencies can help get answers to role of dietary fat
-

Ca, Mg, S

The so-called secondary elements, often neglected, can be as yield-limiting as N, P, and K

INCREASING ATTENTION in recent years has been focused on the so-called "trace" elements—and to plants' dependence upon them. Farmers are no longer totally unfamiliar with boron, zinc, manganese, or other elements that plants need in small amounts. In fact, some say they have even been oversold, at least in a few areas where they were not a serious problem.

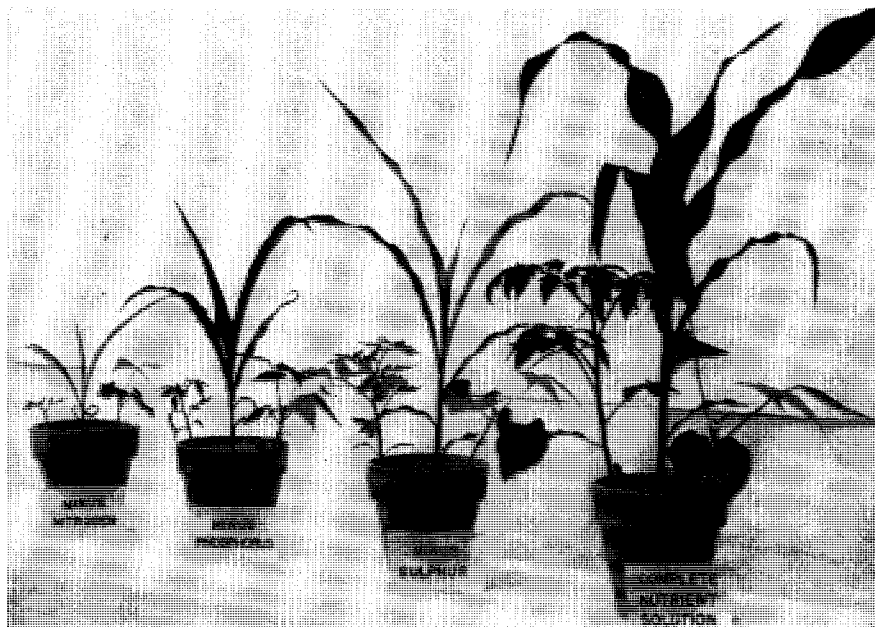
At the same time, the country's farmers have been shifting toward higher analysis fertilizers—a continuous trend over the past decade.

But with notable exceptions in some geographic areas, an important triad of elements has been virtually lost in the shuffle. The three, calcium, sulfur, and magnesium, are usually known by the misnomer "secondary" nutrients.

They are more than secondary factors. As one industry spokesman aptly puts it: the chain of adequate plant nutrition is no stronger than its weakest link.

USDA's W. L. Hill divides the 16 elements essential for plant growth into two groups: macro and micro (or trace) nutrients (AG AND FOOD, February 1957, page 100).

The three "secondary" elements are among the macro nutrients. All are quite necessary, and sometimes deficient in soils to the point of limiting crop growth. The trend toward higher analysis is not always a boon where they are concerned. In the shift to higher nitrogen content, for example,



Bean, corn, and tomato plants grown by Shell Development scientists show the relative importance of sulfur, one of the so-called secondary elements

formulators have moved away from lower nitrogen materials like ammonium sulfate to higher analysis ammonium nitrate, urea, and anhydrous ammonia. Result: in some sulfur-poor areas, sulfur-starved crops—and the need for subsequent sulfur additions.

At the same time, increased crop yields have aggravated the situation, and helped develop the need for constant attention to "secondary nutrient" supply. While increasing N-P-K concentrations are squeezing out more and more of the Ca-S-Mg that once were present in commercial fertilizer more or less by accident, bigger crops bring both larger demand and more rapid depletion.

Where are shortages a real or potential problem? Recent USDA year-

books clearly map out the vast major areas. Magnesium, for example, is deficient for one crop or another throughout almost the entire eastern seaboard.

AG AND FOOD questioned most major plant food producers. The majority agree that this aspect of plant nutrition which *should* be a very important phase of any fertility program has too often been relegated to a secondary level.

Illustrating the problem's scope, Ca-Mg-S are short in most southeastern soils, except where corrective steps are taken. Magnesium is often a problem with the area's cotton; calcium and sulfur with peanuts; sulfur a potential one with alfalfa. Tennessee Corp., which markets heavily in the region, says it feels all three pose potential

problems on the majority of crops in the Southeast. Other area producers echo the possible future danger.

Sales Approach

The South is one place where producers have been active both in educational efforts and in marketing and publicizing fertilizers with specific "secondary" nutrients present. Many more are now beginning to do so. F. S. Royster Guano notes that it has been guaranteeing Ca, Mg, and S content of fertilizers in its entire market area for some 20 years. It has used its guarantees as a principal sales story, and expects to continue. Tennessee Corp. sells certain mixed fertilizer grades on the basis of magnesium content. Allied Chemical's Nitrogen Division has been emphasizing magnesium content (as well as nitrogen) for almost a year, and today has a grade with 7% MgO and 10.5% CaO.

Even with these sales approaches, educational programs, and much work by universities and government scientists, it is highly doubtful that many area farmers are aware of potential "secondary" nutrient problems, unless soil tests have been made on their land. But then, as one producer notes, they are not yet so aware as they should be about the N-P-K primary ones, either.

In the Northeast, magnesium deficiencies are common, particularly in New England, New York, New Jersey, and Delaware. Calcium is also generally short throughout the territory. Both Eastern States Farmers' Exchange and GLF, two of the major sellers in the area, market fertilizers with magnesium guaranteed.

Limestone (particularly dolomitic) is usually the most economical way to supply both magnesium and calcium, although some researchers question the effectiveness of limestone's calcium carbonate. However, potatoes are one crop seriously affected by shortages, and even though university agronomy departments encourage dolomitic lime's use, potato farmers have shunned it. They like to control potato scab by keeping soils quite acid—both in Maine and on Long Island. Soluble magnesia is effectively employed to circumvent farmer resistance to limestone. On other crops, annual lime use in the area is no more than a quarter of what authorities say it should be. One state agricultural college cites cost—\$10.50 per ton applied in the field—as a major factor.

Many northeastern farmers (particularly potato-growers on Long Island and in Maine) are aware of the

problem of magnesium shortages. Not so with calcium, however. And one seller notes that most farmers are curious but mystified about talk of the presence of minor or secondary elements in fertilizers for which they are not guaranteed. Still, one impartial university authority believes that no fertilizer company would today try to market a potato plant food without magnesium. Sulfur may also be a problem for potatoes; the University of Maine now has sulfur-magnesium nutrition studies under way.

Other eastern crops showing up deficiencies: cauliflower (that follows early potatoes) and some other truck crops, apples, grapes, and tobacco. Over-all, magnesium is the serious problem, calcium much less so, and sulfur far less so today. Sulfur is no problem in highly industrialized areas like New Jersey. However, elsewhere sulfur malnutrition is potentially a big headache if sulfur-free fertilizers are used for a period of years. Crops particularly sensitive to lack of sufficient sulfur include some vegetables, alfalfa, clovers, cotton, and tobacco.

In the Midwest, while the need for lime indicates calcium shortage, few deficiencies actually show up. Magnesium lack, while it occurs, is not too widespread yet. Sulfur deficiency has shown up in heavy consumers like alfalfa, particularly in areas remote from heavy industry (northern Minnesota, for instance). Nebraska is another area where much sulfur shortage exists. Deficits have been steadily growing for the past three to five years. Ammonium sulfate and calcium sulfate sales there have picked up lately, and some dealers have had some success pushing their mixtures merely on the basis that sulfuric acid was used in production. Over-all, there has been a large increase in the sale of sulfur and sulfur compounds for direct application. No big push to sell in the Midwest on the basis "contains Mg" or "S" is seen soon by trade experts.

The Far West situation is serious; all three of the "secondary" elements are deficient along the West Coast. Sulfur is in great need in California (San Joaquin-Sacramento valley) and the Pacific Northwest. Little comes through rainwater as it does in more industrialized regions. Sulfur is needed here both as a nutrient for adequate crop growth and as a soil conditioner to give better tilth.

In some western areas, sulfur applied in fertilizer creates an acid zone which helps the plant with other nutrients that are only slightly soluble. Historically here, ammonium sulfate

is preferred for rice—and recent university tests in California show that sulfur-containing plant foods increase cotton yields more than 10% over those from fertilizers lacking it.

Sulfur on the Range

Effects of sulfur deficiency on range land have been marked. And Best Fertilizers Co. agronomists say it is apparent in many areas, such as California's Imperial Valley (where vegetables grow during the cool season of the year), that sulfur is almost as important as phosphorus in stimulating added plant growth.

Calcium is deficient in certain northern California soils, and in the acid soils spotted throughout the West. Magnesium deficiencies are being recognized in more areas along the coast.

As a general rule, individual farmers in the West are not aware of the necessity for "secondary" nutrients. A major producer says sulfur requirements particularly are poorly understood. Another disagrees to the extent of saying that farmers in general are quite aware of the importance of sulfur in the fertilizers—but grants that few of them know just how much it is worth. The latter producer sees here a challenge for every manufacturer to establish in the farmer's mind a "price" on the value of sulfur in fertilizers.

Yet, many manufacturers have found sulfur shortages a useful target in their promotional activities. Collier finds aqua ammonia solution containing sulfur a key to larger markets—and expects label listing of sulfur analysis to become common practice before long. Best Fertilizers guarantees sulfur and calcium content, and has committed its sales force to a strong promotional program, advancing the merits of fertilizers containing both calcium and sulfur.

The problem can exist further inland, too. Sulfur shortage is a severe problem on cotton and some truck crops in Arizona, for example. Solution: some add as much as 200 pounds of elemental sulfur per ton of mix.

Opinion on the alleviation of deficiencies is not all one-sided, and several major manufacturers disagree on the best approach to a cure. One says that wherever these elements are short, needs should be fulfilled on the basis of specific soil tests, and from the most economical sources—limestone, gypsum, soil sulfur. These should be supplied as *direct application* materials every four or five years, and not necessarily as ingredients of mixed fertilizers. In disagreeing with

some others it says that "no substantial fertilizer manufacturer has found secondary elements a key to larger markets for mixed fertilizers." Still it admits showing guaranteed content of combined S or MgO in areas in which these elements are "an important consideration."

An experienced fertilizer man at the National Plant Food Institute cautions against sounding too alarming—pointing out that the use of 15 million tons of agricultural lime annually illustrates that American soils are not being terribly neglected in so far as secondary elements are concerned.

Is the trend to high analysis continuing? The region east of the Mississippi and south of the Ohio Rivers offers the most promise for raising the national average. Newer consuming areas to the north and west have already reached rather high levels.

Nearly all industry leaders say the move to higher primary analysis has not leveled off. Yet, some disagree, and one points to an increasingly important economic force that tends to level off this trend: lower analysis materials provide a better gross margin for dealers.

Another notes that average nutrient contents could move to still higher levels, particularly in the Southeast, if "a program is instituted whereby the secondary and trace element problems are given due consideration, and corrective measures taken." But there is limited strong feeling, notably in the East, that secondary elements should be added directly rather than in mixtures.

Another influence working against Ca-Mg-S additions is the growth of liquid fertilizers, which for the most part contain no calcium or sulfur. Some westerners are concerned, saying that this is true of liquid mixed goods as well as straight nitrogen materials.

But the trend to higher analysis in primary plant nutrients is the product of progress and improved technology—plus strong economic considerations. With N-P-K so universally short, producers cannot lose sight of their goal of supplying needed primary plant foods. And a return to lower analysis would not assure adequate supplies of secondary nutrients.

At the same time it is in the farmers' best interests for the industry to keep in mind, and constantly to stress, the fact that a deficiency in any macro element, including the so-called "secondary" ones, is a limiting factor—affecting not only the yield, but also the nutritional value of his crop.

Pesticide Inventory Control

Latest treatment for No. 1 pesticide headache coordinates production and marketing with supplies

UNCERTAINTIES of insect and disease infestation, weather, and other seasonal factors all add up to a very troublesome inventory problem for manufacturers and distributors of pesticides. The agricultural consumer buys his chemicals when an infestation appears. Then he wants help at once—not next month or next season.

The disturbing sequence of pressures on production schedules and inventories that follows the farmer's urgent order explains why the industry is constantly grappling with inventory problems. The remedies prescribed are varied—and not always successful. In one of the latest, announced by California Spray-Chemical, a network of regional coordinators is set up to coordinate estimating of needs, ordering of supplies, and control of inventory.

In the Calspray plan the coordinator at each regional plant receives quarterly estimates from the field, and on the basis of these he schedules production at the plant over a 90-day period. The coordinator also gets

interim estimates from the field on a 30-day basis; checking these reports against shipments, he modifies the original estimate up or down. Establishing ratios of inventory to sales by area, says Calspray, is one approach to the problem. Setting dollar inventory figures by area, based on sales, is another. But in either case, inventory levels must be coordinated with plant production levels and marketing programs.

When industry produces materials ahead of the use season in the absence of infestations and during unfavorable weather, it often means inventory is carried over for 12 months, says H. J. Grady, vice president of Calspray and its eastern regional manager. This poses a serious problem if industry is to make a return on investment.

Production plants must build these inventories primarily on the basis of field estimates, and if the field estimates are incorrect, production costs may fluctuate widely at the expense of profits. There could also be an undersupply or an oversupply on the basis of the field guesses. Continual revision of proper estimates, in Mr. Grady's view, is one of the key requirements, and an efficient line of communication between the field and the production plants must be open and flexible at all times.

Ample Plant Capacity

Several pesticide makers have adopted the approach of providing

A supply of insecticide is being rushed by Military Air Transport Service to fight a locust plague in Iraq. One of the problems of inventory control is the need to strike a balance between supplies sufficient to meet such an emergency and the financial and physical burden of large inventories



excess productive capacity. In this manner, according to Melvin E. Clark, Frontier Chemical, they are able on relatively short notice to produce large amounts of pesticide chemicals to cope with larger than expected demand. Further, they are able to avoid the costly alternative of building large inventories against a demand which may never develop.

A large pesticides producer in the East also maintains productive capacity in excess of demand, where economic conditions justify, eliminating inventory build-ups. At bimonthly intervals the company reviews sales estimates, inventories, and production schedules. And like a growing number of other producers, it refuses to sell on consignment or accept returns from customers.

Frequent reporting on stocks, and transference of stocks to points where they would be needed, are important measures in Stauffer Chemical's inventory control. A major staff executive has been appointed to set general inventory policy and to watch and advise line personnel of developments in this field. It is important to acquaint all personnel, sales and production, with the need for proper inventory control, says Daniel J. Keating, vice president and general manager of Stauffer's agricultural division. With a far-flung sales and manufacturing organization, personnel at the local level must serve as the key to good inventory and production control.

Raw material needs at Stauffer are cleared through a central point. The need for ordering new supplies in a given area thus may be obviated by transferring stocks from another point where demand has been lost through seasonal or infestation conditions. Other facets of the Stauffer plan:

- Monthly reports to local personnel of their inventory situation and trends.
- Close control, locally or centrally, on stocks out on consignment with customers.
- Preseason production of safe, minimum levels of finished materials.

Monsanto depends heavily on field salesmen. Prior to each season the salesmen contact all of their distributors in each sales area to learn their monthly requirements by product and package size. Each sales area is served by a warehouse supplied from one of two producing plants, and the accumulated sales information is plotted out for each warehouse.

Half of the estimated requirements are delivered to the warehouses before the end of April (midseason). Re-

quirements exceeding the 50% level are supplied directly to distributors from producing plants. Inventories are kept to a practical minimum so that at the end of the season they do not exceed one third of the season's sales.

During the peak of the season each warehouse reports inventories and withdrawals daily by Teletype. The method, used for the first time this year, has resulted in no shortages or oversupplies to date, according to Monsanto.

USDA Surveys

Government reports, including the Shepard (USDA) reports on pesticide inventories, are read and followed closely by the industry, inquiry directed at the manufacturers reveals. Still, some feel that the statistics available are wanting in some respects and could be improved. More detailed figures would be helpful, provided they are more reliable than has sometimes been the case in the past, according to an eastern producer.

Another in the eastern area feels that the USDA surveys, although read with intense interest by the industry, come out too late to be of much value for on-the-spot management operations. Reliance still must be placed on companies' own reports for interim periods.

Government reports, say another large manufacturer, are of limited value in forecasting demand for the industry's products. They (government pesticide surveys) are a step in the right direction as far as they go, but generally "the horse is out of the barn" by the time the information is received.

On the basis of comments made to AG AND FOOD, it appears that timeliness is accorded more importance by the industry in this instance than is the quality of the government surveys. Harold H. Shepard of the Commodity Stabilization Service, USDA, author of the inventory reports, readily admits the reports are not all they might be. Shepard acknowledges the cooperation he has received from the industry through the National Agricultural Chemicals Association, but says that removal of certain restrictions would assist him further.

"Production statistics for primary pesticidal chemicals are now reported in about as much detail as possible, unless producers will agree to disclosure of individual operations. Export figures published by census in greater detail beginning with January 1958 will be more informative. U. S. Government collecting agencies operate under regulations which in general re-

quire that specific data in their files be withheld from qualified analysts in other U. S. agencies. Some relaxation of these legal restrictions would assist both government and industry by permitting publication of additional studies without increasing industry reporting."

Job for the Grower

Swings in demand for any one particular insecticide, says C. A. Clark, vice president and general manager of McLaughlin Gormley King Co., are too great to be borne at any industry level.

Efforts to operate a pesticide business without recognizing this truth, he continues, have led to such practices as consigning stocks at distributor, and sometimes at dealer, levels, cutting prices and dumping distressed stocks at low prices into late growing areas. While convincing arguments are advanced to support many of these practices, their ultimate result has always been demoralizing and expensive.

The only conceivable way of carrying the large inventory burden and having stocks available at the time and place needed, it is contended, is to convince the grower that it is a job that only he can do. Perhaps it is too big a job for him. But he will never attempt it so long as someone else is trying to do it for him.

As one step toward a cure for the inventory headache, pesticide producers have lowered the boom on consignment selling in the Midwest, at least as far as herbicides are concerned. These products are being sold on a cash basis, "30 days net," and expectations are that the step will discourage dealers from stocking too heavily. Consignments are cited as one reason for the industry's unsatisfactory financial position, although there are other even more important reasons, such as the lack of direct inventory control.

The provision of adequate statistics which would permit closer production and inventory control, would improve the position of the industry, in the view of a New York manufacturer. But there is a reluctance on the part of all industry members, he says, to cooperate fully in supplying this type of information. There are literally thousands of products manufactured by this industry. If a simple, fast, and effective reporting system could be designed, it would be helpful to everyone concerned with pesticide production, sales, and use.

This is the first of two interpretives on inventory control.

Rural Development

Government's Rural Development Program is catching on as a program that really does small farms some good. Reason: entire communities cooperate

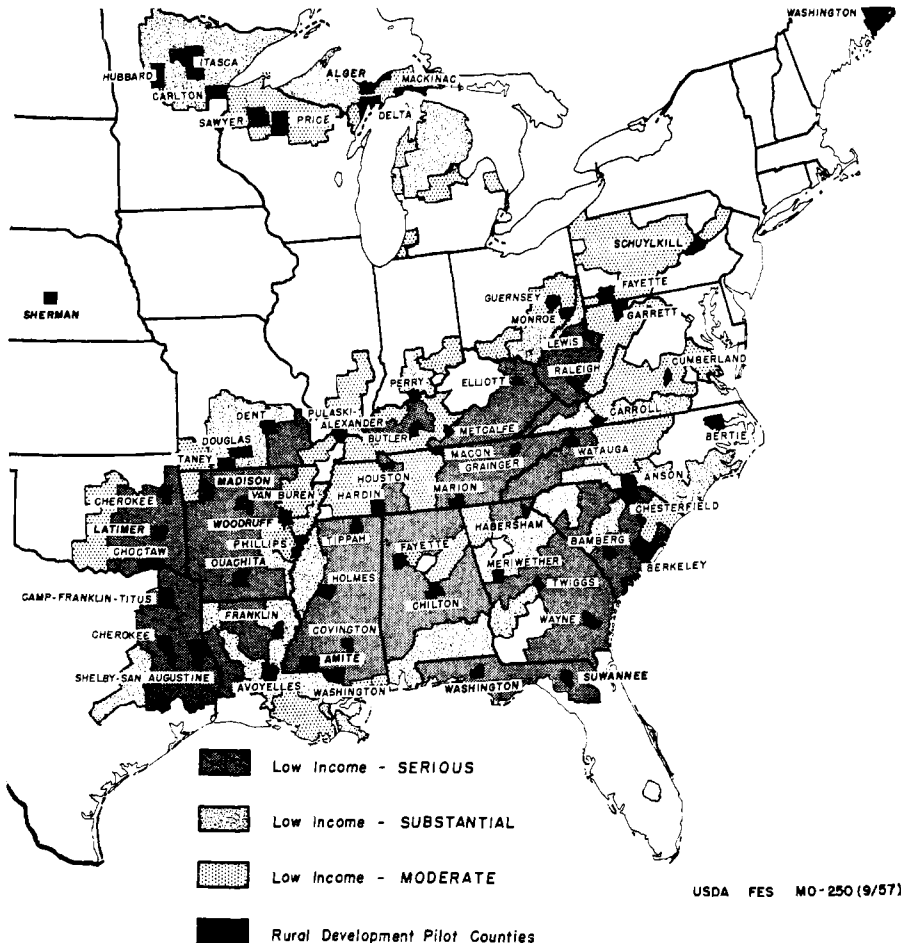
ABOUT 7 MILLION PERSONS, farm and nonfarm, live in the 315 rural counties having the nation's lowest annual farm income. And about one fourth of America's 5 million farm families had total incomes of less than \$1000 in 1954, a year of great prosperity. These two facts add up to a national problem—one that goes far beyond the borders of the farms or counties themselves. The Rural Development Program was started in 1955 to help improve the situation. Its aims: teach better farming methods, enlarge farm units to make them more economic, help farmers to better themselves through off-the-farm jobs.

During its first year, RDP proved a relatively slow starter. But it is now firmly established, embracing almost 100 pilot counties in 30 states and Puerto Rico. Its concepts are not entirely new. But its method of operation—all-out mobilization of an area's social and economic structure to raise living standards—goes far beyond any previous method in terms of concerted effort.

Deficiencies Are Additive

What factors have contributed to the problem's existence? Limited resources, small farms, poor soils, and insufficient managerial ability were among those stressed by President Eisenhower last January in his message to Congress. Certainly any of these factors in itself would be enough to limit a given farm as a money-making proposition. But in most cases several of them are present, each adding to the farm's over-all inefficiency.

RDP recognizes the fact. And it brews its medicine to fit the ailment. The program's philosophy, however, is that the primary job of development must be done at the local level by local people. This does not mean just one or two selected persons. It means that everyone in the community who has anything at all to contribute is invited to do so. All courses of action are decided at the local level. And at the national level these people are



Most of the low income farm communities in the U. S. are located in the Southeast where most of the pilot counties in the 1957-58 Rural Development Program are located. A few others are located in the West and Puerto Rico

backed—not bossed—by the committee for the RDP.

Result is that the projects of the various pilot counties move by many routes to reach the same destination. "Some will get lost and others will reach their goal," says L. I. Jones of the Federal Extension Service, "but we'll learn something from all of them, and that's the main point of any pilot program."

An Unhappy Cycle

RDP wants to help all low income farmers to improve their lot, whatever their difficulties and whatever their interests. But it especially wants to help those who want to improve their farms, and who can improve their farms, strictly through farming operations. For these, the stress is on education in better methods, use of farm chemicals and equipment, and knowledge of credit sources.

Some farmers are ignorant of the possibilities in farm chemicals. Others, having heard of such possibilities, are skeptical. Still others know the possibilities and would like to take advantage of them, but are financially unable to do so.

Stan Ceglinski, assistant farm advisor in the Pulaski-Alexander Counties pilot area at Illinois' extreme southern tip, regards farm credit as

the key in many farmers' woes. Local banks do the best they can. But Ceglinski feels that if the farm chemicals manufacturers themselves could come up with some practicable, fairly liberal direct credit program, it would help many deserving farmers. "Many a farmer," he says, "wants to buy fertilizer to get better crops and more income. But without credit he must use whatever cash he gets for his crops to buy fertilizer. And without fertilizer he can't get enough cash for his crops to buy fertilizer." The farmer who can increase his own income by using chemicals, Ceglinski notes, also helps the chemicals manufacturers.

There's another twist to this matter of credit, too. RDP is convinced of the necessity of educating farmers in the use of farm chemicals. But if he feels he is unable to buy them, the average low income farmer isn't likely to be very much impressed with the importance of learning about farm chemicals.

Austin Robinson, a 45-year-old mid-western farmer, owns 40 acres of badly eroded fill land. Most of it is overgrown with brush and shrubs, with only four acres suitable for crops. Robinson, who has 14 children, works part-time driving a school bus and spends the remainder on the farm. Until recently he knew nothing about fertilizers and, under the circum-



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60 years with the company is the record of Arthur Gayle, President and General Manager of the entire Kelly-Weber organization. He maintains a special interest in operations of the fertilizer division.



Best selling grades... such as 5-20-20, 10-20-10, and 12-12-12 for rice... are formulated with International's Triple Super. The Westlake plant formulates 15 different grades of fertilizer.

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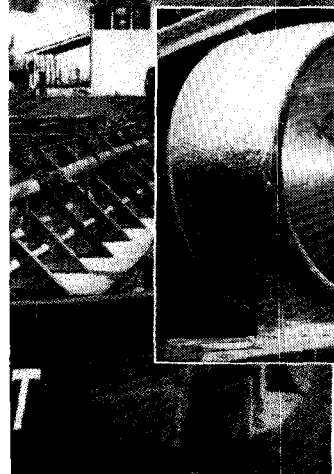
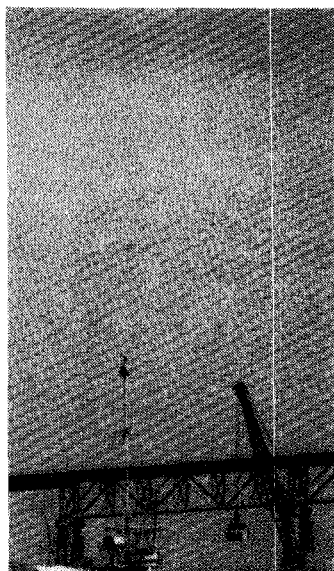
For some 32 years, the Kelly-Weber plant at Westlake, La., has been making use of their Lake Charles "water life-line."

"We get our Triple by carport from International (at Tampa, Fla.)," says Plant Manager Damon Robinson. "Their regular carport shipments help us meet peak season schedules... no worry about unloading or handling, either."

The Westlake plant is closely related to the ship channel that connects Lake Charles and the Gulf of Mexico. Construction of both was completed in 1926... and the first ocean-going vessel to use the channel carried a load of fertilizer.

In those early days, Arthur Gayle managed the fertilizer division. Together with his son, W. Gedge Gayle, and Damon Robinson, he developed a growing market for Weber-King brand fertilizers. An acidulation plant was built in 1944... a granulation unit installed in 1954. International's Triple Super is an important ingredient in the high-analysis, granular fertilizers their farm customers require.

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Basic goods are weighed into batch hoppers by Cleveland McCraney. In addition to operations at the Westlake plant, non-nitrogenous grades are produced in plants at Lake Charles and Eunice, La.



Strong demand for Weber-King fertilizers carries over from planting season into top-dressing, then fall pasture seasons. Sales area covers southwestern Louisiana and southeastern Texas.

INTERNATIONAL MINERALS



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VOL. 6 NO. 6 JUNE 1958 421

Interest in agricultural frits is growing rapidly, particularly along the Atlantic and Gulf Coasts, and in the West. In the coastal areas, heavy cropping or leaching (or both) has depleted these elements from the soil, depriving the root zone of needed chemicals. In the West, high pH and the general calcareous nature of the soils render these minor elements unavailable to plants.

Today, use of frits is limited, and their future rests largely in the hands of state agricultural experiment stations. There have been few recommendations for their commercial use, but many stations have reported favorable test results:

- At Clemson in South Carolina, field tests on cotton, alfalfa, corn, and peaches show the frits now manufactured are as effective on a pound-for-pound basis as are quickly soluble minor element sources. There is a recommendation for the use of manganese-boron frit under cotton, and one for a boron frit with alfalfa. Under South Carolina conditions, from 30 to 40 pounds of frit per ton of mixed fertilizer will meet the minor element requirements for most crops. When applied at the rate of 10 to 15 pounds per acre, the frit is used up in about a year.

- Results from Florida's agricultural experiment station place the minor elements in frits on par in availability with the equivalent minor elements applied as soluble compounds. Comparison tests were made on corn, peanuts, oats, vegetable crops, and pastures.

- In New Jersey, the experiment station at Rutgers explains, general use of frits would be primarily a matter of providing "insurance" quantity additions of minor elements to commercial fertilizers. There is not, however, any recommendation for their use, although the frits have caused considerable local interest.

- Testing is also in various stages of progress in Virginia, North Carolina (on carnations), and Georgia (on clover).

Most testing completed thus far has been conducted in the coastal states. The midwestern and south central states appear to have little need for frits, and in those areas there is little practical advantage for frits over other trace element products. But in the West, this year, many state experiment stations are planning or now running tests:

- In Arizona, on deciduous fruits, tomatoes, lettuce, and soybeans.

- In California, on peaches, pears, walnut and cherry trees, potatoes, and ornamentals.

- In New Mexico, on vegetable crops, peanuts, trees, and ornamentals.

- In Idaho, on hops.

- In Colorado, on cherries, peaches, and pears.

These widely varied tests point up the fact that frits are aimed at areas in which trace elements are deficient in the soil—usually sandy and rainy

areas. In heavy (fine textured) soils, minor elements are not lost so rapidly through leaching from the root zone; thus the need for supplementation may not be so great in these as in sandy soils. In general, growers who raise high-value crops such as vegetables, and who seek early markets, are likely to give serious thought to premium fertilizers containing frits.

Today only one company—Ferro Corp. of Cleveland—makes frits commercially. They are made simply: glass components along with com-

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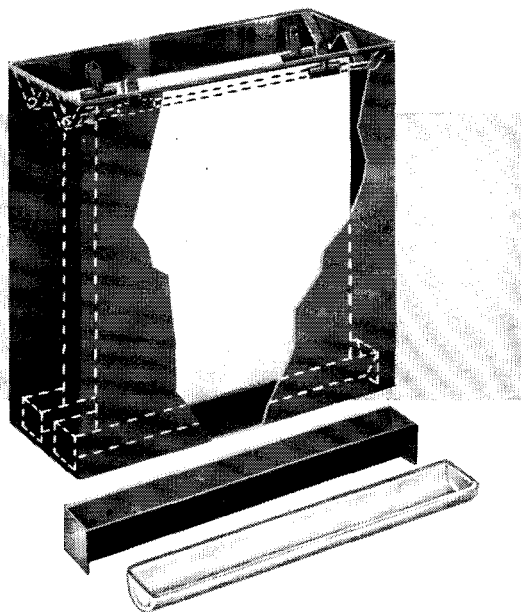
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A simple, compact unit, designed for the development of two paper chromatograms 8 inches square, by one-dimensional or two-dimensional ascending techniques, using micro quantities (1 microliter portions) of test solution. See *"Ascending Paper Chromatography: A Way To Do It," *Journal of the Association of Official Agricultural Chemists*, Vol. 40, No. 4 (November, 1957), pp. 999-1029, by Lloyd C. Mitchell, U. S. Division of Food, Food and Drug Administration.

Tank is approximately 9 inches long \times $3\frac{1}{2}$ inches wide \times 9 inches deep, of Stainless steel; easy to clean; its small size relative to the paper area speeds achievement of vapor equilibrium.

In use, paper sheets are attached by means of Stainless steel spring clips to rods of either Stainless steel or glass, $8\frac{7}{8}$ inches long \times 3 mm diameter, which rest on removable, W-shape supports at top of tank. Lower edge of paper sheets is suspended in removable troughs which, in use, are filled with the mobile solvent. The V-shape Stainless steel troughs, 85 ml capacity, are $8\frac{3}{4}$ inches long \times 1 inch wide \times $1\frac{1}{8}$ inches deep; borosilicate glass troughs, 75 ml capacity, have round bottom and are $8\frac{3}{4}$ inches long \times

$1\frac{5}{16}$ inches wide \times $\frac{9}{16}$ inch deep. A flat glass cover, with ground edges, permits observation of the ascending solvent front. In the author's technique, cellophane tape is applied around edges of cover to form a vapor-tight seal to retain volatile solvents.

*Author's article, cited above, also describes an adapter to support solvent troughs $3\frac{1}{2}$ inches below top of tank and a slotted cover, permitting use of the Thomas-Mitchell Tank for continuous one-dimensional chromatography employing paper sheets 8×4 inches. Information on request.

3677. Chromatography Tank, Stainless Steel, Thomas-Mitchell, as above described, Consisting of Stainless steel tank with two supports for rods, glass cover, two Stainless steel troughs, two Stainless steel rods, four Stainless steel Spring Clips, 1 package of 100 Whatman No. 1 paper sheets, 8×8 inches, and directions for use..... **31.20**
Each, in lots of 6.. **28.25** Each, in lots of 36.. **26.71**

3677-B. Ditto, but with two glass rods and two half round troughs of borosilicate glass in place of Stainless steel rods and troughs..... **29.50**
Each, in lots of 6.. **26.69** Each, in lots of 36.. **25.26**

3678-L. Paper Sheets (Filter Paper), Whatman No. 1, size 8×8 inches, selected for chromatographic analysis, in which application this high grade, unwashed paper is considered to have medium flow rate. As supplied with 3677 and 3677-B. Per pack of 100 sheets.... **1.70**



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pounds which contain minor elements are mixed and smelted; the molten material is quenched in water, dried, and ground. The end product is a moderately soluble glass. Ferro, which calls its product F-T-E (fritted trace elements), sells it to fertilizer manufacturers as an additive for premium fertilizers.

The physical nature of frits, usually finely ground and relatively inert, provides handling ease in plant operations. Frits can be added to mixed fertilizers at any stage of their manufacture without causing the product to cake during storage—a problem found with, for example, ordinary zinc salts.

The amount of soluble trace nutrients supplied by some glass carriers is relatively small in the early and most sensitive stages of crop growth. Therefore, material crop damage from toxic concentrations of the nutrients, especially boron, is much less likely to occur.

A boron frit (with no other trace elements) has been quoted at 8 cents a pound, while the multinutrient types go for 12 cents in tonnage quantities. Costs for separate application usually run somewhere around \$1.20 an acre, depending upon crop and soil conditions.

Most frits, however, are applied to the soil as ingredients of mixed fertilizers. Very little frit is added directly to the soil. But there have been tests of application by injecting a water suspension around the roots of trees. Another possibility is to apply the frit by use of crop dusting equipment.

But frits are not yet in wide use by farmers. Many do not know much about them and those who do, in many cases, are awaiting test results from state agricultural stations.

The stations themselves are looking very seriously at frits. Should their work lead to widespread recommendations for commercial use, frits would doubtless take on very quickly a role of greater economic significance.

Dietary Fat

Much evidence links fat intake to health damage, but it's circumstantial; food processors can help get facts with research

DIETARY FAT—what kind and how much is good, or bad, for the human health? This question comes from many quarters, among them

plain John Citizen in whose daily newspaper words like “unsaturated” and “saturated,” “cholesterol,” and “lipid” are getting to be common ones.

Food processors, doctors, agricultural agencies, and medical institutes are particularly interested in the part fat plays in diet. A new report by the Food and Nutrition Board of the National Academy of Sciences emphasizes its import. The report, “The Role of Dietary Fat in Human Health,” by no means answers flatly the big questions as to what kind and how much.

Rather, it traces the chemistry of food fats, fat metabolism, the nutritional role of fats, and cardiovascular disease.

More important, it points to the need for expanded research on fats. For a long time now, fat intake and heart and blood vessel disease have been linked. Some people are drastically cutting the fat in their diet on their own; others on the advice of physicians. But the Food and Nutrition Board warns: “Until it is clearer which fats are more desirable nutritionally and which, if any, are undesir-

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able, major changes in American dietary habits are not to be recommended."

The data that condemn fat as the cause of atherosclerosis, coronary artery disease, and other similar ones are so incomplete and conflicting, says the board, that one can't draw conclusions that nutritionists and medical authorities accept universally.

Cholesterol most often gets pegged in connection with heart and vessel disease. Containing 27 carbon atoms, cholesterol, theory says, is formed from squalene. This hydrocarbon, first found in shark liver oil, has also been found in plant and animal food. Work at the National Foundation for Metabolic Research and at the Institute for Metabolic Research shows that blood cholesterol can be lowered in humans by administering the higher unsaturated fatty acid glycerides.

However, this may not be enough in itself. The important question, and the one that provokes much thought, is the fate of cholesterol when its concentration drops. "Whether it is metabolized, goes into another compartment of the body, is excreted in some form, or goes into the blood vessel walls themselves remains unanswered," the board says.

And, it adds, plasma cholesterol is not a true index of just how much of the substance is in the body. Liver cholesterol levels can shoot up, for instance, when plasma cholesterol levels change but little. The opposite may also occur. Perhaps more important than the cholesterol level, itself, is the ratio of cholesterol and phospholipid. Both make up lipoprotein complexes in plasma. Phospholipids are a group of complex lipids having a phosphate radical, an esterified fatty acid, and usually a nitrogenous base.

Ratio's the Thing

The NAS report says the ratio of cholesterol to lipid phosphorus (C/P) in plasma tends to stay about the same even though "normal" cholesterol and phospholipid levels fluctuate widely. An upset C/P ratio has been seen in certain pathologic states. Some medical authorities suggest a tie between lipid collection in intimal artery cells and increased C/P ratios. This adds to the idea—or at least suggests—that C/P ratio may be an index of the atherosclerotic state.

Many hypotheses like this are touched upon in the dietary fat report, which may thus at first blush seem to

cloud the picture. But, among other things, the report brings under one cover the thoughts of many on an important subject. And, above all, it guides agricultural agencies and food processors to the responsibilities they must shoulder.

Going on the premise that differences in fatty acid structure of dietary fats and oils may have nutritional significance, the board says, "Agricultural agencies can anticipate the need for better understanding of the biochemistry of fat synthesis in animals and plants and the influence of nutrient supplies on the process."

It is already known that fatty acid composition of algae, fish, and animal fat depots can be changed by changing food supply. Exploring ways to influence fatty acid production in plants, both qualitatively and quantitatively, could be turned to the profit of the human race. Comparative biochemistry in the lipid field will doubtless be rewarding, says the board.

Food Process Research Needed

As for food processors, the report recommends that they re-evaluate nutritional effects of today's processing arts. Current trends demand that processors compare the naturally occurring fatty acids and the many isomers made during fat hydrogenation. Methods must be worked out to make pure fatty acids and their isomers in amounts needed for human feeding tests on a pilot plant scale.

Chemical changes in fats and oils brought on by heating present another important field for processor research. This work should not be confined to effects of heat during processing, but should include changes that occur under home cooking conditions, also. Shortening and margarine makers should take another look, re-evaluate the merits of blended fats, and at the same time, anticipate the problems that will come up with more demand for such fats, the report advises.

These recommendations to agricultural agencies and processors alike supply just that much more fuel to fire up the idea that agriculture and food processing add up to one. If a gap does stand between the two, it is hidden by mutual interest and cooperation.

One of these days, maybe not too far off, the cloud that shrouds the fat-human health problem, if indeed there is a problem with fat, will be swept away. And when credit is doled out, those representing agriculture and those for food processing will stand side by side to receive what could be a major portion of the credit.

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