Ag and Food Interprets . . .

- **Sales of pesticides in Canada expected to double in 5 years**
- **Mixing trace elements with fertilizers brings up new problems**
- **Gibberellins hold vast promise for agriculture**
- **Labor saving machines not whole story in cotton mechanization**
- **Foods a mile from A-blast safe for human consumption**

Canadian Pesticides

Pesticides expected to share in Canada's vigorous economic growth; Canadian scientists are turning up new products

THE CANADIAN ECONOMY is in a vigorous growth stage, and agricultural chemicals sales are no exception to the general trend. At the Canadian Agricultural Chemicals Association meeting in Niagara Falls, Ont., D. K. Jackson of Monsanto Canada Ltd. predicted the industry's sales will double in the next five years. In 1955 pest control chemical sales were $22.8 million. Value of agricultural production in Canada is roughly a tenth of that in the United States.

The nature of Canadian agriculture makes for important differences in relative consumption of the various pesticides. For example, DDT, as might be expected, is the largest volume insecticide sold in Canada, but BHC has a much smaller relative use than it does in the U. S. Some of the crops which account for the greatest pesticide consumption in the U. S. are completely absent or much less important to Canadian agriculture. Cotton is missing, and the midwestern corn belt is not duplicated in Canada. The cooler climate and consequently shorter growing season have an effect on pesticide use too.

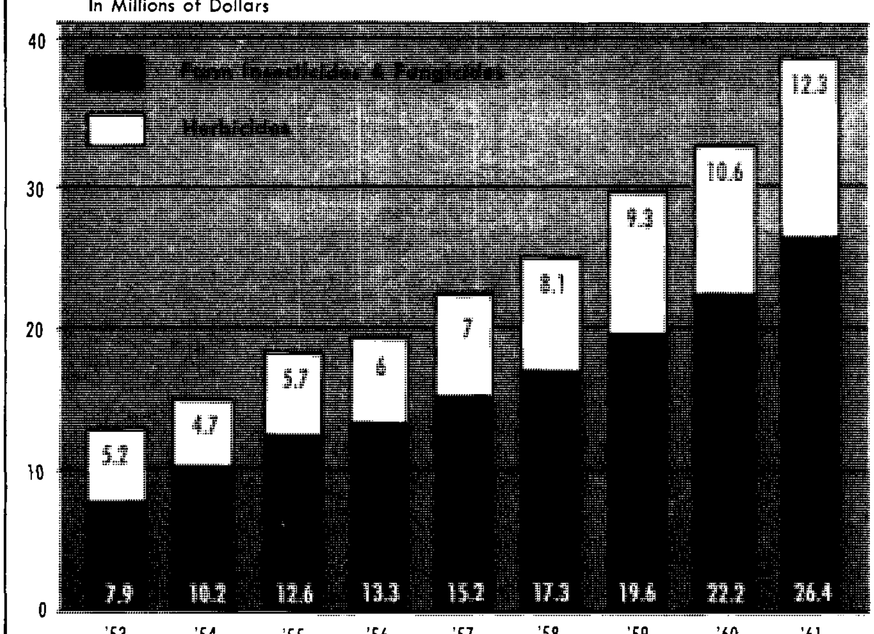
Wheat is the largest crop. Over 24 million acres were seeded in 1954. Other small grains and hay are big crops too. Acreages for tobacco and vegetables are smaller, but account for a sizable volume of pesticides. About 20% of the total crop acreage in Canada, including over 90% of the orchards, is treated with agricultural chemicals of some sort. Slightly less than half the total crop acreage is planted with seed treated with chemicals to combat diseases or wire worms. Herbicides are quite important in the prairie provinces.

Few basic pesticidal materials are manufactured in Canada. Naugatuck formerly produced DDT in Canada, but does not do so now. It does produce 2,4-D, and 2,4,5-T, however. Most companies formulate from imported materials. These come chiefly from the U. S. but importing from Europe is more attractive in Canada than it is in the U. S. MCP is now imported from England and is achieving a relatively greater importance as a herbicide in Canada than in the U. S. Some lindane is brought in from Germany, and other European materials are also marketed.

In addition to the strictly Canadian companies, most companies leading in the pesticide field in the U. S. have Canadian affiliates. But activities of the Canadian companies may differ from their U. S. counterparts. Shell, for example, is a big formulator of brush killers and insecticides in Canada, while the Shell company in the U. S. concentrates on basic materials. Some U. S. companies are merely rep-

Pesticide Sales in Canada

In Millions of Dollars



resented by sales organizations in Canada. One of the largest sellers of pesticidal materials in Canada is Green Cross Products, a division of Sherwin-Williams—a U. S. company, but not a major factor in U. S. pesticide sales. Chipman Chemical in Canada is jointly owned by Chipman in the U. S. and Canadian Industries Ltd.—controlled by Imperial Chemical Industries in England.

The basic problems of increasing sales of agricultural chemicals in Canada are much the same as in the U. S. —getting good pesticide information to the farmers, and convincing them of the value of treatment.

Pesticide tolerances are generally similar to those in the U. S., although *not automatically the same by any* means.

At present, the only laws controlling use of agricultural chemicals are Dominion laws—uniform for the entire country. However, some of the individual provinces have considered enacting local regulations.

While government research on agriculture is at a high level, expenditure for private industrial research is comparatively lower than in the U. S. Many U. S. companies with Canadian affiliates carry out most of their research in the U. S., and merely pass on the results to Canada—a situation generally deplored by Canadians. There are signs that this may be changing. At Naugatuck, for example, Canadian researchers have passed their first new product on to the U. S. for testing. As the Canadian economy continues to expand, more of this type of thing can be expected.

Minor Elements in Fertilizer

Trace element deficiencies promise new markets for fertilizer makers, but many problems must be solved

A SOIL PROBLEM beginning to show itself more and more in various regions around the country is trace element deficiency. For the fertilizer manufacturer, the problem promises new markets. But the manufacture of commercial fertilizers fortified with trace elements poses some new problems to the industry in production, application, and promotion. Because of the widespread deficiency of various elements, many agricultural experiment stations and fertilizer manufacturers, as well as trace element manufacturers, are currently studying methods of alleviating these deficiencies. The use of mixtures containing trace elements is so new in this country that little information is available on the methods of mixing, storing, and handling them.

One example of the manufacturer's problem occurs in Wisconsin, where growers have to contend with an acute boron shortage. About 60% of Wisconsin's 2.5 million acres of alfalfa stands shows a lack of boron. Therefore, borax is recommended as an application for top dressing in combination with 0-13-20 fertilizer, 10% of the fertilizer being borate, or borax. In this area, the main problem that the manufacturer encounters is in equipment to incorporate boron into the fertilizer. Separate bins are necessary for such mixes, which are usually made to order in small quantities for growers. Normally, such a fertilizer cannot be used for any crop other than alfalfa. Tailor-making a trace element-containing fertilizer is often necessary because even in one locale, the deficiency may not be of a general nature. Using too much of a trace element on a crop with a narrow tolerance limit or in soil where deficiency is minor can damage crops.

Another thorn in the side of the manufacturer is that adding trace elements dilutes the grade, and requires another license. An alternative is to make a new grade in which the N-P_2O_5-K_2O content is upgraded.

According to Olin-Mathieson, it is difficult for fertilizer manufacturers to adopt any specific quantity of a minor element for any given grade of fertilizer. This is because rates of major plant food application vary from farm to farm for the same crop, even in the same community. Also, the need for and the response to applications of one or more minor elements vary according to soil and seasonal climatic conditions. For these reasons, separate application of trace elements appeals to most fertilizer manufacturers. And it may be more economical for the farmer in many instances.

Zinc made the difference in this Wisconsin corn. Row behind farmer received zinc sulfate addition at the time corn was seeded, while row in front received none

Interest Varies

Fertilizer producers' interests in incorporating trace elements into their mixtures vary with the region of the country. As is to be expected, interest and activity parallel the extent of the problem. For example, in certain sections of the Midwest, the Southeast, and East, where the soil has been cultivated for a considerably longer time than in the rest of the country, the problem is more pronounced than it is in the Southwest or in the West. Perhaps least affected by trace element deficiency are the Northwest and parts of the Southwestern region. In general, much of the cultivated land in these areas has been broken from native sod cover only within the past 50 years. According to one southwestern agronomist, the relatively short period of cultivation, along with the fact that much of the soil was handled as a dry farming operation for the first 20 to 30 years of cultivation, leaves the area in a condition where minor element deficiency development is still mostly in the future. Ornamental plant growers probably make up the best potential market for trace elements in the Southwest.

The most common southern deficiency element is iron but producers in the area have not attempted to add iron to fertilizers prepared for field crops. However, some of them promote the desirability of using their product because it happens to contain more iron than does a competitor's product. Zinc deficiency also occurs in the South, primarily in the Gulf Coast area east of the Mississippi. Many Florida soils show deficiencies in copper, zinc, iron, and molybdenum.

In the Midwest, on the other hand, other elements besides boron that check out as low are copper, zinc, manganese in some soybean growing sections, and iron.

On the West Coast, areas in the high rainfall belt and soils of volcanic origin show sulfur deficiency, although sulfur is not properly a minor element, being required in rather large quantities.

In the East, boron, manganese, zinc, and copper deficiencies are known to exist in some sections. In New Jersey, for example, boron is most likely to be deficient. Fertilizer producers in this area have definitely shown an interest in the problem. GLF Soil Building Service in New York state adds borax to most of the mixed goods that it sends into New Jersey. Magnesium deficiency has been noted in many regions, particularly in tobacco and potato growing regions.

For the nation as a whole, a general deficiency in molybdenum has been noted. As a matter of fact, according to Climax Molybdenum, 35 separate areas of the United States are deficient in the element. Davison is currently marketing a molybdenum-containing, water soluble 20-20-20 fertilizer.

Production Problems

Currently, Climax is making an intensive study of molybdenum application in New Zealand and in Australia where the element is used regularly to make up deficiency. Local mixers in the Pacific Northwest are being particularly cooperative in developing some method of incorporating molybdenum into their mixtures, says the company.

According to Climax, "moly" is incorporated into solid fertilizer in three ways:

- Dissolving molybdenum oxide or sodium molybdate in sulfuric acid which is used to make superphosphate. This procedure complicates storage, but several overseas fertilizer producers use it.
- Mixing the molybdenum compound with solid fertilizer by mechanical means. Mixing must be very efficient or faulty distribution of the element results.
- Spraying a solution of sodium molybdate into finished fertilizer as it moves along the conveyor belt to storage or to baggers. This may introduce a little water, but it is a very flexible method. The same equipment can be used to introduce other trace elements.

One major fertilizer producer says that there is little difficulty in incorporating manganese, copper, or zinc sulfates into almost any type of fertilizer. Iron as ferrous sulfate runs into trouble in high phosphorus material, since it tends to precipitate as ferric phosphate in the mixture or in control analysis—or both. Borax cannot be added to finished, acid-forming fertilizers that contain nitrogen because the water of crystallization is released and the fertilizer becomes damp. Adding borax early in the manufacturing process is satisfactory, since subsequent drying removes the water formed. Water release does not occur in phosphate-potash mixtures in which the free acid of the phosphate is neutralized with lime.

Most of the trace elements, except molybdenum, function as oxidation catalysts within plants. Under certain conditions, they can substitute for one another to some degree. Because of this, it is difficult to determine which element is deficient in locations where deficiency is incipient rather than severe.

Through its own trace elements studies, and by cooperating with agricultural experiment station and other researchers, the fertilizer industry is again helping to achieve more efficient crop production.

Gibberellin Growth

New growth regulators cause many plants and trees to grow 2 or 3 times taller. Research holds the key to host of agricultural possibilities

Pepper plant on the right received gibberellin spray a week before being photographed. Control plant at left had been 1 in. taller than the treated one before start of experiment

A NEW CLASS of chemicals produced by fermentation have been exciting agricultural scientists in the past few months because of their amazing performance as plant growth regulators. Called gibberellins, these materials can double or even triple the height of many plants and trees—and at concentrations as low as 1 part per million in some cases.

Gibberellins are metabolic products of *Gibberella fujikuroi,* a fungus that causes elongation of rice shoots in the disease called "bakanae." So far three chemically different forms have been isolated and identified through the efforts of Japanese, English, and American research workers.

- gibberellin A_1, also known as gibberellin A
- gibberellin A_2
- gibberellin A_3, also known as gibberellin X or gibberellic acid

All three types apparently act in much the same way, but gibberellic acid has received the most attention. P. C. Marth and J. W. Mitchell of the USDA at Beltsville, Md., say that as little as one-millionth of an ounce in water will make many plants grow taller. Within three to four weeks after treatment, ornamentals such as geranium, poinsettia, sunflower, rose, and others grow from one-half to three times taller than untreated plants. Also, the acid will double or triple the height of snapbean, soybean, peanut, pepper, and corn. It even increases the growth of young willow oak, tulip poplar, and maple trees.

British research workers P. J. Curtis, B. E. Cross, and P. W. Brian, Imperial Chemical Industries, add that gibberellic acid stimulates growth of wheat, oats, many grasses, clover, cucumbers, tomatoes, and peas. And the acid causes potato tubers to sprout without going through the "normal" resting period.

Back in the U. S., B. O. Phinney of UCLA points out that dwarfism in corn is reversed. From the same school, Anton Lang notes that flowering is advanced one to several weeks in some cases, although in others, gibberellic acid retards flowering.

Phinney, working with C. A. West, also of UCLA, turned up gibberellin-like factors in extracts of young seeds from plants such as corn, beans, and peas. These extracts give growth responses very similar to those produced by gibberellic acid. Work is now under way to isolate and identify the active substances.

The combined research efforts of government, academic, and industrial scientists hold promise of a vast potential for this new contribution to agriculture. But there is still much to be done before the final role is determined. What, for example, will be the effect on the final plant or crop? Already it is known that not all plants respond in the same way to gibberellins. What about nutrient consumption—will it increase or decrease? What will happen to cell structures of plants? What about advantages over competing growths? Are the gibberellins a new class of compounds or are they auxins? Will there be a residue problem? What about enzyme activity—will it increase or decrease? There are many more questions, but these illustrate the problems facing researchers today.

Overseas Research

Several workers have been delving into the mechanism of gibberellic acid action. Japanese scientists Teijiro Yabuta and Yusuke Sumiki (both have worked with gibberellins for over 15 years, and are responsible for much of the present day interest) have found that gibberellins stimulate the germination of barley, wheat, and rice grains. Also, add the Japanese, there is an increase in the amount of amylase—the substance that helps hydrolyze starches to sugars—in the germinated barley and wheat grains treated with gibberellins.

British and USDA workers add that gibberellic acid increases the fresh and dry weight of many plants. Ash, nitrogen, and phosphorus, as well as carbohydrate content, increase.

Speculation says that there may be an increase in both cell multiplication and elongation from gibberellic acid treatment. This possibility can be tied in with observed physical phenomena —plant stems elongate at a relatively rapid rate. Treated leaves become somewhat lighter in color than those of untreated plants. Large doses of acid tend to make long thin stems and small leaves. Sometimes more lateral branches develop on treated plants.

The observable effects of gibberellic acid activity suggest the material may be an auxin, according to some workers. Others point out the new compound can outdo present day regulators such as indoleacetic acid—itself considered an auxin. On the other hand, gibberellins are apparently different in their action from IAA, so it is difficult to predict that the new compounds can replace anything at this time.

Although gibberellic acid can be applied to plants as a lanolin paste or directly to the seed as a dry seed dressing, spraying appears the best method of application. The raw chemical is not too soluble in water so it must first be dissolved in alcohol. Then with the aid of a detergent it is mixed with many volumes of water until the desired concentration—anywhere from one to 50 or more p.p.m.—is reached.

Shortage of Material for Research Purposes

Big stumbling block to unraveling the mysteries of gibberellic acid activity has been lack of material. Up until a few months ago only F. H. Stodola of Northern Utilization Research Branch, USDA, Peoria, Ill., and the British workers could supply samples. Stodola, working with aid from the Army Chemical Corps, had developed a fermentation method for making gibberellins back in 1951. The process is similar to that for penicillin production. Now both Eli Lilly and Merck are making and distributing gibberellic acid, without cost, to interested research parties. Both companies have also done considerable testing on their own; their results have generally confirmed those of other workers.

Commercial Use?

Whether or when gibberellic acid will be available as a marketable product is anyone's guess. Most research people point out that any of a number of factors could conceivably rule out commercial use of this new growth regulator. Many state agriculture experiment stations are getting samples for study. Others have started test programs. The gibberellins development looks like a solid contribution for agriculture, but farmers and others concerned must await the collection of more research data before they know just how great a gain has been made.

THE COTTON INDUSTRY is just beginning to cash in on its great potential for lowering costs through yield increases.

"Cotton yields on today's modern farms are evidence of a new kind of technological progress—one that has scarcely begun to express itself yet in crop statistics," says Charles R. Sayre, president of Delta & Pine Land Co.

But increased farm power and use of labor-saving machines do not tell the whole story. Since the end of World War II, Sayre says, this country has seen a two-thirds increase in the effective amount of chemical fertilizer applied to cotton, an eight-fold increase in insecticides, and "tentative" acceptance of chemical harvest aids and of herbicides in many parts of the cotton belt.

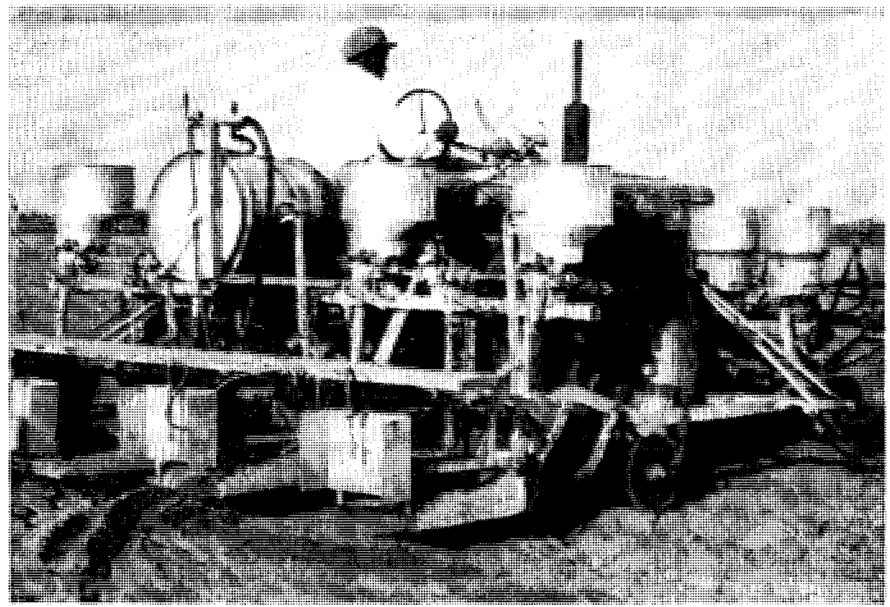
In those states touching the Mississippi River, and states further eastward, a vigorous upward trend in yields has occurred, especially in the past five or six years. The same trend is apparent in Texas and Oklahoma. In California, Arizona, and New Mexico, the upward trend has been taking place for 12 or 13 years.

Average yield in the western states climbed from 600 pounds in 1939 to more than 800 pounds per acre in 1955. Mississippi, Louisiana, and Arkansas yields rose from 300 pounds to more than 400 pounds per acre. Texas and Louisiana, too, have boosted average yields—from 175 pounds per acre to more than 200.

20,000 Cotton Pickers

One-fourth of last year's cotton crop was havested with machines, says Cecil Collerette, chairman of the National Cotton Council's production and marketing committee. Only 6% was harvested this way in 1949.

Today there are 20,000 cotton pickers and 25,000 strippers available for harvesting. In 1952, only 3000 pickers and less than 7000 strippers were in use.



Rig used on the Chalk Level Plantation near Shreveport, La., to seed cotton, fertilize, and apply pre-emergence weedkillers in one sweep. Fertilizer hoppers are on front, sleds flatten seed beds, and shields keep wind from blowing spray

Collerette estimates that there are 1.5 million tractors operating today on Cotton Belt farms—compared with 300,000 in 1939. Man hours required to produce a bale of cotton have been cut in half by machines, from 200 to 100.

And modern farm practices are becoming more closely correlated with mechanization. For example, it is now recommended that cotton be planted in flat rows wherever possible, if mechanical harvesting is used, so that pickers can move easily in the field and work efficiently.

Another example of this correlation is defoliation—practiced on a wide scale in many parts of the belt. Harvesting is facilitated when chemicals are applied to make plants shed their leaves prematurely. Weed control is tied in closely with mechanization, too, as well as insect control by airplane and ground sprays.

Problem Child: Weeds

In order to reap fully the benefits which mechanization offers cotton farmers, growers must be aware that all segments of production are interrelated. Without planning to coordinate farming practices, cotton production becomes a "jumble of parts rather than a smooth machine." Land leveling, deep tillage, bedding, and weed control are all related to over-all production efficiency.

Weed control is the last and hardest gap to bridge before complete cotton mechanization can be achieved, says Chester G. McWhorter, agronomist at the Delta Branch Experiment Station. Not only is weed control by hand labor expensive, but failure to remove weeds results in lower yields, lower grades, and reduced cash per acre.

A two-year study at Stoneville, he says, shows that 60% of pre-harvest labor requirements are tied up in weed control when several chemical and cultural practices are combined. But a combination of cultivation and hoe labor consumes 80 to 90% of the preharvest work.

Chemicals and additional seed required for cross plowing make this type of weed control more expensive than hand hoeing. On the other hand, full mechanization, including mechanical harvesting, reduces production costs about $38 an acre and increases returns by more than $25 per acre.

"Hand methods of weed control take an average of 18 hours of hoe labor per acre," says William E. Giles, superintendent of the Delta Branch Experiment Station. "But a combination of chemicals and cross plowing takes only 3.4 hours." Weed control can be performed by a small resident labor force with this labor-saving method, an example of the interrelationship of two seemingly disassociated practices (weed control and harvesting).

Cotton growers can look forward to substantial progress in the near future, says E. Lee Langsford, USDA agricultural economist. Mechanical and chemical techniques may eventually replace 50% of the labor now consumed in weed control. And these methods are potentially applicable to 85% of the nation's crop.

Langsford also sees in the near future fairly complete mechanization of about 50% of the nation's crop—contrasted with today's 25%. In the past 25 years, changes in Cotton Belt agricultural practices have released 18 billion acres of cropland for other uses with an annual saving of 2.3 billion man hours.

"Research on cotton production management should be concentrated on obtaining better stands, equipment for control of weeds and diseases, defoliation, irrigation, soil characteristics, and environmental factors," says A. W. Snell at Clemson College.

Present application equipment for early and midseason insect control must be improved, he says. There is also need for better techniques for late-season control.

With increasing amounts of fertilization, more irrigation, and development of higher yielding cotton, the problem of more foliage and larger stalk is bound to come. "We need to study high clearance sprayers and other application equipment for this rank cotton," Snell says.

Late-Season Boll Weevils

If we knew more about late-season boll weevil control, allowing us to extend the fruiting season, we could substantially improve yields, he indicates. And a better defoliant, or better techniques for applying present chemicals under hundreds of different field conditions encountered, is certainly desirable.

Mechanization, in the long run, will pull costs down further, says H. F. Miller of USDA's Agricultural Research Service. All the good effects of complete mechanization lower production costs by about $30 a bale. But under average conditions adverse effects on quality lower the selling price $10; the farmer's net gain is $20 per bale. However, if proved research results were fully used on all machine-picked cotton, the $10-per-bale quality loss could be cut in half.

Food Supplies After A-Blast

Food recovered intact a mile or more from ground zero will be safe for human consumption

Food supplies in the aftermath of an atomic attack could become as critical a problem as that of medical supplies—at least that was the feeling of many civil defense people. To find how critical, the Federal Civil Defense Administration called on the Food and Drug Administration to supervise an experiment with foods for AEC's blast in Nevada in May, 1955.

As a result of these tests, FDA now knows that:

- All foods recovered intact one mile or further from the target are safe for immediate consumption
- All foods and their containers exposed within a quarter of a mile of ground zero are subjected to radioactivity from gamma rays and neutrons
- Consumption of foods from the close-in area within two to seven days after exposure can only be tolerated for short periods
- Use of the radioactive foods should be restricted to disaster situations
- All foods containing phosphorus or sodium chloride become permanently radioactive

E. P. Laug, reporting FDA's findings to the annual meeting of the Association of Official Agricultural Chemists in Washington, said there is little doubt that phosphorus contributes the most serious radioactivity. The Bureau of Standards Handbook No. 52 sets the permissible phosphorus radiation level at 2×10^{-4} microcuries per gram of water intake. FDA, assuming the same tolerance in foods, found that 15 days after exposure in the 0.25-mile radius, 23 of the 28 bulk and retail foods tested exceeded this limit. Milk powder, cheese, oatmeal, navy beans, and baking powder headed the list. Of the 54 canned foods tested, activity was excessive in all but eight, with seafoods showing the highest counts.

Even in an emergency situation, foods containing radioactive phosphorus in these amounts could obviously not be eaten for long. However, concludes Laug, "in the face of possible mass starvation, consumption of such radioactive foods would certainly constitute the preferable risk."

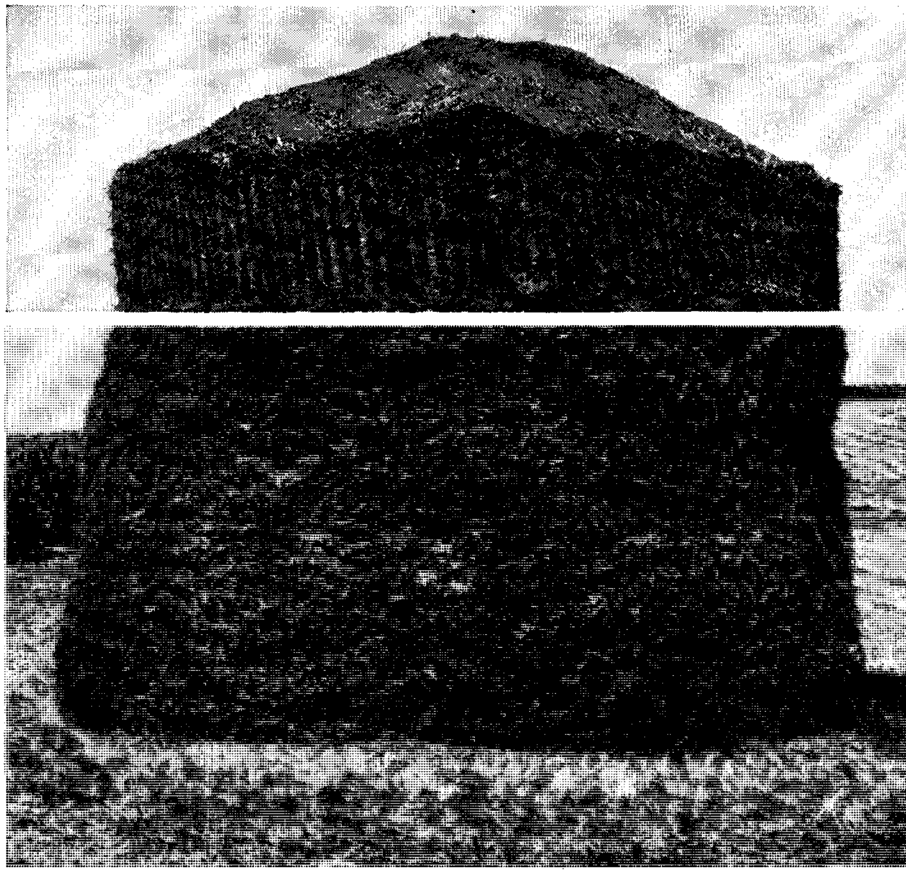
Conversion of stable chlorine-35 to the long-lived radioactive chlorine-36 is also of interest chemically. Because of this action, all exposed foods containing sodium chloride will show a slight but permanent trace of radioactivity. Table salt, for example, maintains measurable activity even after a year.

The Food and Drug Administration tested 100 different types of commodities—about 1500 tons. Included were heat-processed foods packed in cans and glass; frozen foods; beverages; semiperishable fruits and vegetables; fresh and processed foods; and bulk staples.

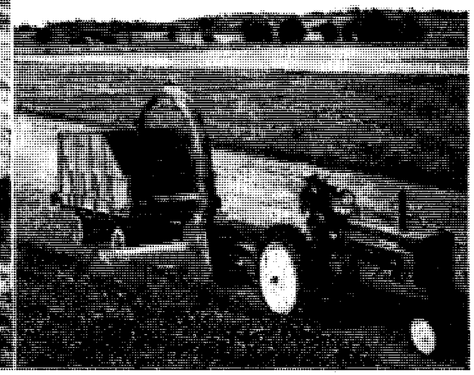
In one series of tests, FDA stored foods in on-the-site homes, store-type structures, and industrial buildings one to three miles from ground zero. Here damages were physical and similar to those caused by other disasters—heavy explosions and hurricanes. Shelving attached to walls at right angles to the blast lost their contents by drumhead action of the walls. Shelves on walls in line with the blast suffered less displacement. Food stored in basements was not moved, and any missile damage occurred on shelving in a direct line with windows or doors.

The second test series was set up in the quarter-mile area closest to the blast. In this radius, buildings were not available for test storage, so FDA stored the test foods in shallow trenches and covered them with a layer of dirt, one to two inches deep. These foods received maximum irradiation and maximum force of pressure waves, but were shielded from burning in the heat flash. Induced radiation at this distance is of the order 10^{12} neutrons per square centimeter. Samples from this area furnished the significant findings on irradiation effects.

Pressure waves caused some physical damage to foods in the trenches. Glass breakage and splitting of wooden panels were extensive, and losses from crushing and distortion of cans amounted to 5%. Semiperishables



In experimental farm studies conducted in Washington State, the yield of alfalfa was increased nearly 40% by adding Moly to molybdenum-deficient soil. The fodder below the white line in the stack at the left indicates yield on moly-deficient soil. Volume above the line indicates increase produced by addition of Moly to soil. Photos courtesy of John Deere, Moline, Illinois.



How alfalfa yield has been stepped up nearly 40% by adding MOLYBDENUM to some acid Washington soils

Application of Sodium Molybdate to Moly-deficient soil, tests show, will result in sizeable yield increases

Scientific tests conducted by Dr. H. M. Reisenauer in Spokane County, Washington, have resulted in greatly increased yields of alfalfa. Investigations that began in 1952 have shown that poor forage yields were caused by Moly deficiency. Correction was made by adding one pound of sodium molybdate per acre. The applications were made in water solution, using a weed spraying outfit.

Other marked advantages result from the use of Moly

When alfalfa is grown in a Moly-deficient soil the plants tend to be stunted and pale green in color. Spots develop between the leaf veins, often spreading to affect the entire leaf. Such leaves finally die and fall off. When other conditions are favorable, these deficiency symptoms are corrected by the addition of available Moly to the soil, resulting in greater yields and more vigorous growth.

Tests here and abroad show that all crops need Moly

Thorough tests, made over the last 15 years, both in this country and in many foreign areas, have shown conclusively that all crops need Moly in a form which can be assimilated readily by the plant. If available Moly is not present in the soil in sufficient quantities, then it should be added either alone or combined with fertilizers.

Help offered for spotting and correcting Moly-deficiency

Specific experiments with dozens of different crops, ranging from citrus to sugar beets, proved that Moly deficiency exists in soils in many areas in the United States. In order to help you diagnose Moly Soil deficiencies in your territory, we will be glad to send you test samples of Sodium Molybdate. Write for MOLY TEST SAMPLES. Address Climax Molybdenum Company, Department 44, 500 Fifth Avenue, New York 36, N. Y.

MOLY CAN BE ADDED TO ANY FERTILIZER BLEND

In recommending fertilizer blends you can always specify that certain quantities of Sodium Molybdate be included as an additive.

CLIMAX MOLYBDENUM

were badly crushed and bruised. As might be expected,

On recovery of the food samples two days after the blast, all glass containers were discolored (clouded) and highly radioactive. However, this irradiation was never extended to the contents of the containers, and after five days, less than 1% of the activity due to sodium-24 remained. Plastic packaging films except polyethylene showed some activity (attributed to mineral plasticizers), but this decayed rapidly.

Metal cans also became moderately radioactive, but this activity, primarily from coatings, lasted much longer than that in glass. There is evidence that some of the activity is due to tin—a particular isotope having a half life of approximately 100 days. Can liners themselves were radioactive, especially "C" enamels used to prevent discoloration by black iron sulfide. Since liners contain zinc, activity was also traced to zinc-64 with 250-day half life and to food-derived sulfur that combined with the zinc.

There was no sign of toxic by-products being formed in any of the foods, and nutritional values remained good after the test. Considering the normal variations in vitamin content of foods, these losses were relatively unimportant. Vitamin losses from vitamin-rich foods were insignificant; foods considered poor sources showed largest losses.

Chemical analyses, as evidence for changes, were conducted only if samples showed organoleptic or physical effects. One of the most striking chemical changes was the yellowing of table salt, originally believed to be due to liberation of free iodine. Analysis, though, did not support this belief, nor did it provide any other clue to the reaction.

Foods from the quarter-mile area were made into diets for rats. No deviation from normal growth and development was noted even after one year.

Laug stressed the fact that these test conclusions apply only for fission-type explosions. He and the FDA believe, however, that some of the findings may be related qualitatively to larger explosions of the thermonuclear type tested in the Pacific.

Effects of Irradiation on Foods Placed 1/4 Mile from Target

	Radioactivity	Taste and Odor	Other Effects
Dry milk solids	Excessive P^{32} after 15 days	Distinct off-flavors on reconstruction with water	American cheese and skimmed milk showed excessive P^{32} activity after 13 days.
Butter and Margarine	Excessive P^{32} after 13 days	Butter was "cheesy" or "oxidized"; margarine, "stale"	Deterioration similar to aging under poor storage conditions
Meats:			
Fresh	Low	Meats were dry and coarse after cooking; flavor and odor unacceptable	Cooked beef was "medicinal" or "liverish"; lamb darkened
Cured and processed	Higher than fresh meats; lunch meats and frankfurters, excessive P^{32} after 10 days	No detectable taste defects	Frankfurters were bulged and curled; dried beef decreased in riboflavin after storage
Canned Foods:			
Soups, vegetables, fruits, juices	Lowest of all canned foods	Only apple juice was inferior in taste	Catchup with 3% salt was more active than salt-free tomato juice
Seafoods	Excessive P^{32} after 15 days		
Baby foods	Excessive P^{32} after 10 days		
Pork and beans[a]	Excessive P^{32} after 10 days		
Semiperishable fruits and vegetables	Low	No detectable effects	Raisins showed excessive P^{32} after 13 days
Frozen Foods	Low, except cod fillets	No change in flavor, odor, or taste	Frozen foods had added protection of insulated containers
Flours[b]			
Without additives	Low	Some deterioration of flour in small packages	
With baking powder, salt, etc.	Higher due to P^{32} and sodium chloride	Cornmeal had bitter taste when baked	Cornmeal deterioration due to accelerated aging effect
Cereals	Low	Only rolled oats developed "burnt" flavor and poor aroma	Oats showed no loss of thiamin, riboflavin, or niacin after storage
Beverages	Low, except beer with salt content	Slight loss of sweetness in soft drinks; coffee and tea flavors unaffected	Should be potable at any time

[a] Navy beans showed excessive P^{32} activity after 15 days
[b] Macaroni showed excessive P^{32} activity after 13 days