AGRICULTURE

Research Yields Billions

Besides its most important result in saving lives, agricultural research has given back to the nation about $100 for every dollar invested in it.

By Dr. W. V. LAMBERT

Director of the Agricultural Research Administration

In a radio talk on "Adventures in Science" over the Columbia Broadcasting System.

➤ BENEFITS to the whole nation totaling thousands of lives and billions of dollars started down on the farm with scientific research.

Developed by research, most of the corn grown now is hybrid corn. It is produced by crossing in-bred strains of corn. It not only gives higher yields but has more resistance to disease and drought than the corn that used to be grown. It has what is called hybrid vigor. The special seed stocks are grown by farmers or companies skilled in their production.

To make present-day hybrid corn possible, the Department of Agriculture estimates that it took about $10,000,000 worth of research, covering 30 years. That includes work done at the state agricultural experiment stations, as well as in the Department of Agriculture.

In the one year 1946 the dividend from the research on hybrid corn was three-quarters of a billion dollars.

At least one-fifth of the 1946 3,000,000,000-bushel crop can be traced directly to the use of hybrids.

Cereal Grains

Over the last quarter of a century, plant breeders at the agricultural experiment stations, as well as at the Department of Agriculture, have developed dozens of disease-resistant varieties of wheat, oats, barley, rye, and other grains. Based on records of damage caused by stem rust and other diseases, Agriculture scientists are pretty sure that these new varieties have added at least half a billion dollars to the farmers' pockets each year. And the same kind of progress has been made with sugar crops. But while geneticists are working to hybridize new varieties of grains, nature is busy hybridizing new strains of rust and smut to attack the grains.

The research on dairy cattle has paid tremendous dividends. The first cow-testing association in the United States was started about 40 years ago. The farmers kept records of each cow's production, and they could quickly see which cows were paying for their board and which were not. These associations proved to be ideal places to put into practice what was learned from research. There are now over 1,000 of these Dairy Herd Improvement Associations. Last year the average production, as compared with 40 years ago, was almost 125 pounds more butterfat per cow. Over a million cows are in these associations.

But that's not all. Other farmers have applied these practices to their own herds. During the past 40 years there's been a gain of almost 50 pounds, in the average production of butterfat, for the 25,000,000 dairy cows outside the associations. And this means another billion pounds of butterfat a year.

DDT Development

As for DDT, the greatest value of DDT can't be measured in dollars and cents. In DDT we have the most powerful weapon ever possessed by man for the destruction of flies, mosquitoes, lice, and other insects that transmit human diseases. During the war without the use of DDT, there were many places in the world where our men could not have survived. And of course since the war, we've been using DDT against insects the farmer has to fight.

One of the most striking uses we've found for DDT on the farm is control of hornflies, stable flies, and the other flies that swarm around cattle in the summer time, such as the flies that used to make the old cow switch her tail and get it in the milk pail.

In order to find out how much the farmer really benefits by controlling flies on range cattle, the Department of Agriculture cooperated in a large-scale test with the State people in Kansas. A similar test was made in Florida on dairy cattle.

They found that in the range herd where the flies were controlled with DDT, the weight gain during the summer averaged 50 pounds more, per animal, than in a similar herd where no spraying was done to control the flies. In the Florida experiment, with the *dairy* cows, we found that the cows gave 10% to 15% more milk when the flies were controlled.

About $50,000 was spent in these experiments on DDT. There's already a profit of $10,000,000, with a possibility of reaching at least $100,000,000 every year.

The swine sanitation system is a simple practice now in use by most farmers who raise hogs. The pigs are farrowed on land that has not been used for hog pastures for at least a year. This keeps the little pigs from being infested with roundworms, and gets them off to a good start early in life.

About $25,000 was spent on this research, but it's worth $25,000,000 a year.

Parasite Control

Now there is a drug, phenothiazine, the most widely used of any drug for controlling internal parasites of livestock. This research cost us about $10,000, and every year farmers are getting back $10,000,000—in the form of thriftier animals that grow faster.

During the war, this drug treatment for sheep helped us over a critical shortage of surgical thread, made from sheep casings. But the casings from domestic sheep were so badly damaged by worms they couldn't be used—until the farmers began using phenothiazine. Agricultural research benefits not just the farmer, but the whole country, either directly or indirectly.

The best example probably is penicillin, but there's also the research on human nutrition—vitamins, minerals, proteins, and so on. The Department of Agriculture spent about $100,000 on that penicillin research.

They found out how to produce penicillin on a large scale, through mold fermentations. But they couldn't have done it in such a short time if Agriculture chemists hadn't already known a great deal about mold fermentations.

It is one of the best examples to illustrate the need for continuity in carrying out research. If the work on molds had been stopped a few years previous to 1940, we might never have been able to help the English doctors who came over that summer asking for help in producing this great disease fighter. And the world might still be waiting for penicillin. That adds thousands of human lives to the dividends from farm research, lives that can't be measured in dollars and cents.

The annual added farm income due to just these examples of agricultural research is over $2,000,000,000 each and every year. All this resulted from research investments that totaled over several decades only a few tens of millions of dollars at the most. And don't forget the human lives saved and the more contented fly-free cows.

Science News Letter, April 12, 1947

BIOCHEMISTRY

Protein Synthesis Seen

Traced with radioactive sulfur, protein synthesis was carried out in the laboratory. Methionine was used with living tissue to synthesize proteins.

➤ THE FIRST direct observation of protein synthesis outside the animal body has been achieved through the tools of atomic science.

Two University of California scientists reported this pioneering step in the application of radioactive substances to the study of growth, cancer and other biological processes associated with the building up of organic compounds in living systems.

Surprisingly, the advance was made with radioactive sulfur, which has been available to researchers on the Berkeley campus for a number of years. The technique of study will have its widest application with radioactive carbon 14, which was only recently released to scientists by the Manhattan District.

The two researchers, Drs. Harold Tarver and Jacklyn Melchior, placed living animal tissue slices in a solution together with methionine labeled with radioactive sulfur. Methionine is one of about 25 amino acids, which are sometimes called the building blocks of all life.

The liver slices were slowly dying, with a breaking down of protein into amino acids. But so long as they lived they were building up some new protein, using the discarded amino acids. This process was demonstrated by the finding of labeled methionine incorporated into the protein of the tissue slices.

Proteins are formed by the linking together in chains of various amino acids. Drs. Tarver and Melchior found that the radioactive methionine was incorporated into the protein by the formation of peptide bonds, which are the typical linkage between the amino acid molecules in all proteins. In this linkage a carbon atom of one molecule is linked to the nitrogen atom of another molecule.

The scientists succeeded in their experiments after failure to demonstrate true protein synthesis using radioactive cysteine, another sulfur-bearing amino acid.

Dr. Tarver, reporting to the *Archives of Biochemistry,* expressed the opinion that the study, applied with radioactive carbon, provides an unexcelled technique for the study of the formation of the all-important peptide bond. For the first time biochemists are able to come to direct grips with the problem of protein synthesis.

The technique will also enable Dr. Tarver and other scientists to study the differences between protein formation in different tissues, for example between normal and cancer tissue.

Its use with sulfur will be limited, since only methionine and cysteine, of the amino acids, contain sulfur. However, all the amino acids have carbon atoms.

Science News Letter, April 12, 1947

RADAR

Aluminum Kite Reflector Is Used for Radar Target

➤ AN INGENIOUS target for radar reflection is being employed in connection with work perfecting automatic equipment to direct gun-fire against aircraft with greater accuracy than used during the war. Westinghouse scientists are responsible.

The target is a box-kite radar reflector built of light balsa wood and aluminum foil. It is held aloft some 600 feet above the earth by an anchored five-foot helium-filled balloon. Aluminum is employed because it is an unusually good reflector of the ultra-short waves used in radar. This is one of the reasons that tiny V-shaped strips of this metal were scattered in the sky by American bombers to blind the aircraft from enemy radar eyes. This so-called "radar counter-measure" was known as "window."

The great advantage of a high-suspended target in the development work is that its field is clear of all obstructions. Radar reflections from targets near the earth are subject to interference from ground-reflections or others from tall buildings, trees and hills. When the gun-aiming device is more nearly perfected, airplanes will be used for targets.

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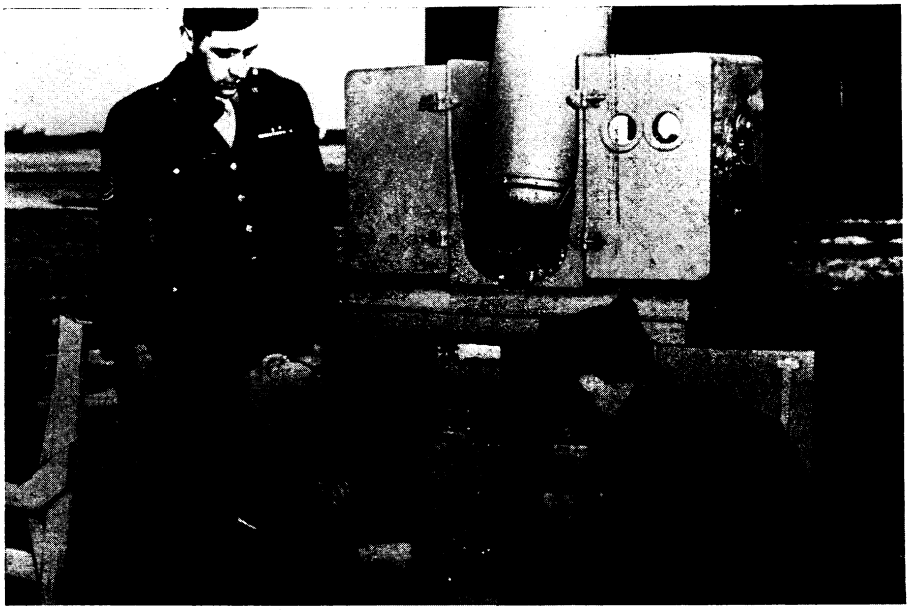

CEILOMETER—Army Air Forces instrument measures the height of clouds by throwing up a ray of ultraviolet light which is scanned by a photo-electric cell unit. When a cloud breaks the beam, a "trace" registers on the recording instrument. The ceilometer accurately gauges cloud heights up to 10,000 feet.