

Study also must be made of the interrelationships between nutrition and susceptibility to illness and mortality from tuberculosis, measles, and other specific infections.

If people the world over are to benefit from research and understanding of the principles of nutrition, the results must be interpreted to answer the practical problems faced by family food managers, consumers, teachers, physicians, and public leaders and Government agencies that formulate national and international food programs. Many different combinations of foods can meet the nutritional requirements of normal, healthy persons.

Research also is needed to lead to better understanding of why food choices are made and how food habits can be modified. Dependent on such knowledge is success of programs of nutrition education and food distribution, as well as all efforts to influence people to use new or different foods.

Thus, further scientific research is needed to define the zones of intake of essential nutrients that will free people from obvious ill health and will undergird the highest possible level of physical and mental vigor throughout the life cycle and through successive generations.

Research must then translate the information into food practices and dietary patterns which are practical in view of economic, cultural, and agricultural potentialities of populations living in different parts of the world.

HAZEL K. STIEBELING was Deputy Administrator, Agricultural Research Service, when she retired in 1963. She joined the Department in 1930 and was named in 1942 to supervise the Department's research program in human nutrition and home economics.

RUTH M. LEVERTON, Assistant Administrator, Agricultural Research Service, joined the Department of Agriculture in 1957. She has special responsibility for the program in Nutrition and Consumer-Use Research, including human nutrition.

Problems in Animal Husbandry

by RALPH E. HODGSON and
NED D. BAYLEY

WE ALL AGREE on the need to improve the diets of people in many countries.

We agree also that sources of animal protein must be expanded in order to accomplish that. While some of this protein food may come from local sources of fish, the larger part must come from farm livestock and poultry.

The problem then is to increase the producing ability of livestock and poultry—of which many countries have large numbers—by creating conditions of feeding and management that permit satisfactory performance and by controlling and eliminating diseases and parasites that cause staggering losses of animals and that contribute to low production.

Through long investigation and experience, we have found that greatest returns from animal production, whether it is milk, beef, swine, sheep and wool, eggs, or poultry meat, come when high animal performance is attained.

WE HAVE FOUND that 10 conditions are needed to achieve successful livestock and poultry enterprises.

The individual farmers should have the interest and ability and potential resources to engage in the enterprise with the prospect of success.

The enterprise should be adapted to the locality, the land, and the climate.

In establishing livestock or poultry enterprises, adequate information should be available to the individual.

Access to a market for the product produced should be assured. The existence of such markets and their availability to the producer have been critical to the incentives for improving the care and breeding of animals.

The livestock and poultry should be adapted to the existing environment. The ability of indigenous animals to reproduce and to produce efficiently and economically should be thoroughly tested and their abilities utilized.

Exogenous types with particularly adapted qualities should be introduced when conditions indicate.

Breeding programs, national, regional, and within herd, should be developed to improve steadily the producing ability of animals. Record-of-performance programs should be developed and applied to measure productivity, to guide management practices, and to identify superior breeding stock. Breeding service by artificial insemination should be developed and employed to use superior germ plasm to improve performance.

An adequate year-round feed supply, based on local farm-produced forage and grain supplemented with concentrate mixes to avoid nutritional deficiencies, is needed.

An effective program of disease and parasite control and eradication should include an adequate, qualified veterinary service. A livestock industry cannot flourish and meet a country's needs for animal foods under conditions of unabated diseases that terminate in death of animals or produce continuous ill health and low production.

An appropriate sanitary service should be available to supervise the production, processing, and marketing of animal products. The development and maintenance of good markets require that the foods be wholesome and produced in clean conditions.

A strong research and development effort is needed to improve husbandry and disease control practices.

An active extension program is required to take the latest research findings from the laboratory to the farmer and aid him in applying this new knowledge to his production problems.

IN REGIONS where livestock enterprises have prospered, research is directed toward making further improvement in an already efficient industry.

For example, research on nutrition and breeding have resulted in a broiler industry that can produce birds of 3.5 pounds for market in 65 days, compared to the 91 days needed before the research findings were applied.

Research investigators have turned their attention to increasing feed efficiency further by studying the interrelationships of minerals, proteins, and other nutrients.

Geneticists also have undertaken to increase feed efficiency by selecting for that trait directly; selection previously emphasized increased rate of growth of the animals or an increase in production of milk, eggs, and wool per animal.

Except for broiler chickens, little progress has been made on improving the efficiency with which animals convert feed to animal products. This problem must be attacked if the livestock industry is to advance as it should. Success in the broiler industry indicates the potential gains to be made with other farm animals.

Studies with all classes of livestock have been started on fat metabolism, deposition of fat in the body, and the secretion of fat in milk. Efforts to produce lean, meat-type hogs through breeding have been successful.

Nutritionists and physiologists are probing the basic phenomena that make hogs different in their use of body fat and its composition. They are looking for means of controlling fat content of the meat by altering rations or by other practices. In beef cattle, dairy cattle, sheep, and poultry, similar problems are being studied.

Animal geneticists are asking themselves if the highly developed breeds

and strains of livestock can be improved further. They are studying the possibility that plateaus in breeding may prevent or slow further progress. They are looking for new breeding methods that may be used to remove the plateaus or raise them higher.

To learn the basic principles underlying these problems, researchers have turned to pilot experiments with small laboratory animals, such as mice, and flour beetles and fruit flies. The scientists have been delving deep into the inheritance of biochemical and physiological processes that affect economic factors in the production of meat, eggs, milk, wool, and fur.

Physiologists have put renewed effort into studies on the ability of livestock to withstand stress—hot and cold climates, sudden changes in temperatures, natural resistance to diseases and parasites, and even the stress of high levels of performance.

Losses connected with reproduction remain a serious barrier to greater efficiency. In the United States, the reproductive losses in beef and dairy cattle, sheep, swine, and poultry are estimated to be 1.3 billion dollars each year. Many of these losses are hidden.

Techniques of artificial insemination and procedures in storing semen have been successful with cattle but have been less successful with swine, sheep, and poultry. The preservation of ova and sperm and tissue culture methods of growing animal embryos are research fields of great potential value and deserve greatly increased effort.

With dairy cattle, about 25 percent of the cows are replaced each year, 20 percent of which left herds because of reproductive problems. Reasons for replacement were sterility, calving difficulties, and embryonic mortality.

In poultry, it is common to experience that only 75 percent of the eggs set actually hatch.

Actual lamb production is only 95 lambs per 100 ewes, whereas the potential production is around 170 lambs.

It takes 13 million sows to produce the annual pig crop; under ideal con-

ditions it should take only 9 million.

It is generally true that the reproductive insufficiency in livestock and poultry is even more of a problem in developing countries. Thus, research to improve the reproductive rate of farm animals is a fertile field of inquiry.

PROGRESS has been made in the control and eradication of animal diseases in many countries, but losses from infectious and metabolic disorders remain serious. Specialists have estimated that as much as one-tenth of the animal population in the United States is lost each year from diseases. Losses from all causes due to disease have been estimated to amount to at least 2 billion annually.

In cattle, mastitis is a major, serious, unsolved problem, particularly in the dairy industry. Among other costly diseases that call for more research are vibriosis, anaplasmosis, leptospirosis, leukosis, and chronic respiratory ailments of poultry.

Of all the diseases of domestic animals, those of swine have been most neglected. Hog cholera, atrophic rhinitis, enteritis, and erysipelas are plagues still. Swine flu, virus pneumonia, and pleuropneumonia-like infections demand study.

Control of parasites has always been recognized as critical to successful animal husbandry in the Tropics and subtropics. Its importance has been underestimated in the temperate regions; however, except in regard to a few of the more aggressive species.

Successful research on insect control has made a great contribution to the efficiency—or, indeed, the existence—of livestock production.

Research also is being continued to determine the levels of residues in animal tissues left by insecticidal treatments, how long they persist, and how they may be lessened or avoided.

Advances in areas where the livestock industry is highly developed involve further improvement by way of greater knowledge of the principles of animal biology, but the problems

in developing countries require concentration on developing and applying the discoveries already made.

Worldwide, foot-and-mouth disease is probably the most prevalent infectious disease of animals. North America and Australia are the only large livestock areas that are free from it. It occurs in all parts of Africa, in most of Asia, and in most of South America.

Rinderpest, which destroys more cattle than any other disease, continues to be widespread in many districts of Africa and Asia. Contagious pleuropneumonia of cattle is still a problem in parts of Africa, Asia, and Australia.

African horse sickness and swine fever are destructive in Africa and have invaded some of the Mediterranean countries of Europe. Anthrax, a deadly killer that the United States is not always able to keep out, exists throughout the world; little is done in many regions to control it.

These and other diseases threaten the developing countries. Their uncontrolled existence in one country threatens livestock industries in all.

LIVESTOCK PRODUCTION cannot be improved if feed supplies are inadequate or unbalanced, as they are apt to be in developing countries because of low crop yields and unregulated numbers of animals.

Soil scientists, agronomists, entomologists, animal husbandmen, and biologists are among the scientists who have undertaken studies that pertain to supplies and use of feed: Analyses of plants to identify the nutrients in them; local sources of protein; the use of fish, seed, and vegetable byproducts for livestock feed; the nature of feed deficiencies; the need for new crops; the possibilities of using low-cost supplements, such as urea; the addition of relatively cheap synthetic vitamins to feeds; and more.

The mineral requirements of livestock have been studied for many years, and supplementation to overcome local deficiencies has been successfully practiced in some countries,

but deficiencies are being discovered in some developing countries. The need there is to identify these and define the type and amount of supplementation. To do that in places that lack good laboratories, simple methods suitable for making field analyses need to be developed.

THE CREATION of progressive livestock industries in developing countries depends on a progressive total agricultural industry that makes the most of the resources available to it to produce crops and animal products in quantity, quality, and variety. Of the resources that go into such enterprises, the human resource—the man and his managerial ability—is by far the most important. He must be supported by a constant flow of new information on production, processing, and marketing.

This information comes to him from several sources—from his own experience, from dealers in agricultural equipment, and from research stations and educational institutions. All this is available to farmers in some countries but not in many developing countries, where a gulf separates the laboratory and the farm.

Therefore one of the first requirements in developing an advanced livestock industry should be the training of technicians who can develop the knowledge the livestock and poultry raisers need and who can help them put the information to work.

RALPH E. HODGSON became Director, Animal Husbandry Research Division, Agricultural Research Service, in 1957. Previously he was Chief, Dairy Cattle Research Branch, and Assistant Chief, Bureau of Dairy Industry. Dr. Hodgson joined the Bureau of Dairy Industry as an assistant dairy husbandman in 1930.

NED D. BAYLEY became Assistant Director, Animal Husbandry Research Division, Agricultural Research Service, in 1961. Previously, he was Investigations Leader in Dairy Cattle Breeding and Management, Dairy Cattle Research Branch, in 1956-1961.