STATUS OF THE POULTRY INDUSTRY AND POSSIBLE PROGRAMS FOR IMPROVEMENT

General Considerations

Poultry have received inadequate attention in many American countries in relation to their value as a source of animal protein. This seems to be the case particularly in those countries where the average intake of animal protein per person, per day, is estimated to be below 30 g. Data were included in the report of the Baurú meeting (Phillips, 1953) on the intake of animal protein per person, per day, and of the 12 countries for which data were available in the Western Hemsphere, Argentina, Uruguay, the United States of America and Canada had an intake higher than 30 g., while Brazil, Chile, Colombia, Cuba, El Salvador, Honduras, Mexico and Peru have average intakes below this. The Second Inter-American Meeting on Livestock Production in Baurú, therefore, recommended that governments should study the adequacy of existing programs and give increased emphasis to intensive programs for poultry improvement wherever this proves to be desirable.

The wide differences which exist in the state of development of the poultry industry in the various countries may be illustrated by tables recently prepared by the Statistics Branch of the Economics Division of FAO showing that average egg production per hen, per year, is estimated to vary from about 38 to 175 eggs in American countries (*see* Table 17). The data for Argentina and Brazil are official estimates, while the figure for Mexico is unofficial. There is also a great variation in the average consumption of eggs per person, per year, in the different countries; 4.4 to 15.4 lb. in Latin America, and 37.4 to 46.2 lb. in Canada and the United States of America. Similar variation exists in the consumption of poultry meat, which is highest in the United States.

The importance of poultry husbandry is often underestimated although it offers great possibilites for providing, rapidly and economically, protein of high quality, essential vitamins, and of improving the farmers' income. The efficiency of poultry production mainly depends upon the level of production of each individual, whereas the actual number of birds is of minor importance. The fact is often overlooked that fast growing birds and good layers are far more efficient than birds with a low level of production. The utilization of nutrients by laying hens is a typical and striking

TABLE 17 – AVERAGE EGG PRODUCTION OF HENS IN VARIOUS AMERICAN COUNTRIES

Region and Country	Period	Number of Eggs
North America		
Alaska	1952/53	140
Bermuda	1948	120
Canada	1948–53	164
Hawaii	1948–53	160
United States	1948–53	175
Latin America		
Argentina	1952/53	71
Brazil	1952/53	76
British Guiana	1952/53	38
British Honduras	1950	90
British West Indies:		
Jamaica	1948–51	65
Trinidad and Tobago	1948	100
Windward Islands:		
Dominica	1952/53	80
Chile	1948	112
Colombia	1950	120
Guadeloupe	1951/52	80
Martinique	1951/52	50
Mexico	1953	80
Netherlands Antilles	1948–51	118
Panama	1953	86
Peru	1950–53	44
Puerto Rico	1949/50–1951/52	126
Surinam	1952	100
Uruguay	1952	87
Virgin Islands (U.S.A.)	1950	151

example. When the percentage of egg production is related to the respective consumption of " total digestible nutrients " (1 g. " total digestible nutrients " corresponds to 4.1 digestible calories) required for the production of 100 g. of eggs, variants similar to those shown in Table 18 occur (Engler, 1936).

The outstanding point of practical importance in this is that the hen which lays only 40 eggs per year may need up to 850 g. of grain and other dry feed to produce 1 normal sized egg. If a hen lays 120 eggs per year, then the total feedingstuffs required for 1 egg decreases to about 300 g. With an annual production of 240 eggs, only 180 g. of grains and layers mash are needed. Byerly (1954), based on his former experimental work, stated that a hen of 4 lb. body weight required about 60 lb. of feed for maintenance per year. For each dozen eggs produced it would require an additional 1½ lb. of feed. Thus, such

TABLE 18 – VARIATIONS IN EFFICIENCY OF EGG PRODUCTION IN RELATION TO LAYING CAPACITY

Percentage Egg Production 100% laying capacity = 365 eggs weighing each 58 g. (about 2 oz.)	Average maintenance and production requirement expressed as total digestible nutrients needed to produce 0.22 lb. of eggs by birds from about $4^1/_4$ lb. liveweight	Improvement of Utilization Index
10	1 000	—
20	550	450
30	375	175
40	300	75
50	250	50
60	210	40
70	180	30
80	160	20
90	150	10

a hen requires about 75 lb. of feed if it lays 10 dozen eggs in a year, or 90 lb. if it lays 20 dozen eggs. In the first instance each dozen eggs costs 7.5 lb. of feed (290 g. per egg), in the second only 4.5 lb. (170 g. per egg). In actual practice, of course, these figures would be subject to some variation on account of the body weight, the inherited laying capacity and phenotypical conditions of birds, the contents of nutrients of the ration, and the possibly available quantities of feedingstuffs found in the runs or field which will differ regionally and seasonally.

In many cases where scavenging birds pick up their feed wherever they can, these nutrients would otherwise be entirely lost or even detrimental, e.g., weed seeds and insects, if there were no birds. Although under certain conditions even low production may temporarily be justified, the fact should always be kept in mind that low level of production means an unfavorable feed conversion rate.

Since production level and efficiency of poultry production are influenced by many factors, some of which are of a personal nature such as interest of the farmer in the birds, sense of order and perseverance, the following points are of particular importance:

(1) Besides adequate housing and management, frequent culling of unthrifty birds is recognized as an efficient step towards reducing wastage of feeds and reducing the output and income per bird. On small farms and in backyards in particular, birds are frequently kept until they are too old for normal egg production. This, moreover, leads to a progressive decline in meat quality and renders disease control more difficult. Therefore, training courses for culling experts are recommended.

(2) The fight against poultry diseases needs to be reinforced on a national scale in many countries by diagnosis, advice, treatment and sanitary regulations. Veterinarians with special training in poultry pathology, including some practical work in poultry husbandry, are essential in the development of work in this field.

(3) In order to improve production capacity of utility birds and to increase the number of poultry keepers possessing healthy and efficient birds, accredited breeding stations are most useful as has been proved, e.g., in the United States of America, where a " National Poultry Improvement Plan " has been operating since 1935. Its objectives are to improve the breeding and production qualities of poultry and to reduce losses from hatchery disseminated diseases. This is being accomplished by:

(*a*) the development of more effective state poultry improvement programs;

(*b*) the identification of the quality of breeding stock (e.g., random sample tests), hatching eggs and chicks by authorized terms that are uniform and applicable in all parts of the country, and

(*c*) the establishment of an effective co-operative program through which newer knowledge and practical experience can be applied to the improvement of poultry and poultry products.

Progress in the production of efficient layers and quick growing table birds (broilers) may also be achieved by selection of inbred lines and their crossing. In principle, it is necessary not only to increase average egg and meat production capacity, but also natural resistance to certain diseases. The work of utility breeders' associations should be financially encouraged by governments.

(4) The rearing of healthy birds as well as an increase in egg and meat production also depends largely upon feeding. Though in many cases it would be possible and desirable to utilize more locally produced feedingstuffs for poultry, it is, however, indispensable to eliminate feeding deficiencies resulting from the biased use of certain products like grains and other carbohydrate feedingstuffs. Even a small amount of mash, rich in protein, minerals and vitamins may often help to overcome some nutritional deficiencies. This will result in an improved feed conversion rate, better health and thus considerably increased output and revenue. Hence,

special attention to the optimal use of indigenous feedingstuffs is desirable. This involves the collection of information on the possibilities and status of poultry feeding in the various countries and experimental and extension work. Well balanced commercial compound feeds are recognized as an efficient means of increasing output rapidly and reducing losses considerably. The increased use of antibiotics and other medicants as parts of compound feedingstuffs for poultry has brought along with its gains, additional responsibilities to the industry (Levine, 1954). The nature of the medication and its innate toxicity, particularly its safety factor, should be kept in mind.

(5) Further impetus should be given to research work, particularly in breeding, feeding and disease control. Careful planning and co-ordination of experimental work as well as the use of statistical methods in the interpretation of results are becoming more and more indispensable. This involves the necessity for adequate scientific and practical training of capable specialists and reliable personnel as well as the establishment of well equipped and sufficiently financed experiment stations.

(6) In all countries where the poultry industry is well advanced, such as Canada, Denmark, Israel, the Netherlands, the United Kingdom and the United States of America, extension services exist through which poultry keepers and breeders are assisted in putting into practice improved technical methods adapted to the existing conditions. Advisers should be well trained and as independent as possible. Their work should be supported by the distribution of good and inexpensive leaflets and other material for demonstration, such as plans and models of suitable and cheap poultry houses and waste-reducing feeding troughs, etc.

Governments, co-operative organizations and private firms, should pay particular attention to the level of quality and prices of poultry products, collection and marketing of eggs and table birds in countries where the industry is not highly developed. In many cases, attempts might be successful to interest the public in higher consumption of eggs and poultry meat.

Statistics and estimates on poultry numbers and production are often out-of-date, incomplete and unreliable. Also, owing to the diverse methods employed by different countries, it is extremely difficult to compare these figures. Therefore, such statistics need to be standardized and revised at regular intervals in order to complete the basic data for food balance sheets and facilitate economic and technical planning.

Current Situation and Recent Technical Developments in Various Countries

Information regarding the present status of the poultry industry and possible programs for improvement in American countries, is summarized in the following paragraphs.

In *Argentina*, poultry husbandry is usually carried out subsidiary to other agricultural activities. Out of a total of approximately 50,000,000 birds, about 60 percent are kept on peasant farms. Argentina offers favorable conditions for poultry production almost throughout the whole country. The main production period is July to November, with peaks in August, September and October; in this period, about 70 percent of the production is obtained, and 30 percent during the period from December to July. A notable increase in poultry production took place during recent years, and particularly near the big cities there are several specialized poultry establishments in which breeding stock, table birds (broilers) and eggs are produced. Originally, most of the imported birds were White Leghorns, especially bred for egg production, but more recently a tendency towards dual-purpose breeds became apparent, and other breeds, like Rhode Island Reds, Wyandottes, Sussex and New Hampshires were imported. The State supports the poultry breeders' activities by assisting in distributing improved breeds, particularly to farmers. Housing, feeding and management have also been considerably improved during the last few years. There are 30 accredited feed manufacturers in the country. According to a decree which the Government made in 1951, commercial mash-formulas must be officially approved.

Poultry diseases are reported to be efficiently controlled; this relates particularly to specialized establishments for egg and poultry meat production on a large scale, and to the 1,500 accredited breeding stations which are included in the state herdbook. The herdbook is open to the offspring of registered birds, to duly certified imported birds and to the offspring of non-registered hens with a minimum production of 180 eggs in the first year, mated with registered cocks which have to comply with standards. Special attention is given to the eradication of pullorum disease, and its control is extended also to poultry exhibitions. All birds showing a positive test reaction have to be eliminated. The direct control activities are complemented by extension campaigns, through meetings, publications and demonstrations.

In the main poultry zones, which coincide with the cereal zones of Argentina, the Provinces of Buenos Aires, Entre Ríos, Santa Fé and parts of the provinces of Córdoba and La

Pampa and where about 80 percent of the birds are located, buildings and other installations are usually of sufficient quality. In the north and central parts of the country, the open-front-house is most frequently adopted, whereas in the south, according to the environmental conditions, closed structures are preferred. Small incubators with a capacity of about 200 eggs are frequently used. On the large breeding establishments, incubators up to 60,000 egg capacity are available.

There are no specialized poultry experimental stations or schools in Argentina, but some general experimental stations, as well as certain agricultural schools and animal breeding stations have established poultry sections and are also dealing with advisory work in the poultry field. No important poultry co-operatives exist; however, the State has taken a very active interest in the establishment of co-operatives for all branches of animal husbandry and many of the agricultural co-operatives have poultry sections. The Government is at present carrying out a plan for the development of the poultry industry which covers extension work by means of meetings, publications, demonstrations, courses, exhibitions, direct advisory service, experimental work, disease control and marketing.

In *Canada*, 95 percent of the stock are purebreds or crosses of the following breeds: Single Comb White Leghorns, Barred Plymouth Rocks, Light Sussex, Rhode Island Reds, New Hampshires, White Rocks, Columbian Rocks and White Wyandottes. About 90 percent of poultry raised on farms, or in specialized commercial poultry establishments, are fed balanced mashes. It is estimated that approximately 60 percent of the birds are fed commercial mashes, and that an additional 25 percent get mashes made of home produced feedstuffs mixed with a high protein supplement manufactured and distributed by feed companies. The poultry are kept in houses varying from those made of straw bales in the prairie provinces to the industrial type with a capacity up to 15,000 birds in one unit; however, the one-storey, gable roof house with southern exposure and constructed of wood is the most popular type being used. The present tendency is to make this house deeper. Houses being constructed at present are about 40 ft. deep. The walls and ceiling are usually insulated and the floor is covered with deep litter. In large pen units, electric lights are frequently used. Automatic watering and feeding are used to a lesser extent.

A program for the eradication of pullorum disease in poultry has been in progress for 20 years. Under this program the incidence of positive pullorum reaction has been reduced to 0.12 percent. Virus and other contagious diseases of poultry are reportable under the Animal Diseases Act, and a control program

by vaccination is in progress. The manufacture and distribution of vaccines are controlled by permit. The experimental farms of the Canadian Department of Agriculture carry out extensive research work in poultry at the experimental farm, Ottawa, and on 23 branch stations spread throughout the country. Egg laying contests were operated in Canada from 1911 until the beginning of the last war. Since they were given up, the breeding of poultry has been stimulated by the "National Poultry Breeding Policy." It provides advice for the mating, pedigreeing and testing of families on the breeder's own farm. This work has now grown to proportions where it has become necessary to establish a central testing station. Accomodation is under construction for bringing samples of hatching eggs from the breeders' farms to a central place where the eggs will be hatched and the birds reared under uniform conditions which will allow comparisons of the efficiency of the various strains.

Breeder organizations have been established in each province in Canada. The poultry hatching industry has developed to a point where each province also has a hatchery association as well as a poultry products committee, made up of representatives of the breeding industry, hatching industry, feed industry, producers organizations, etc. There has also been organized a poultry products center which is financially supported by the industry for the purpose of popularizing eggs and other poultry products. There exist also feed manufacturers' associations. In addition to the organizations maintained by the industry, each provincial department of agriculture and the Canadian Department of Agriculture maintain poultry divisions staffed with qualified poultry personnel. Besides the educational and extension work done by provincial and federal departments of agriculture, there are seven universities with poultry departments, staffed by qualified specialists. There are also several agricultural schools where poultry instruction can be obtained. Numerous publications on poultry production in all its aspects have been issued. The industry is well served by several co-operative sales organizations. A large volume of the production in Alberta, Saskatchewan, Manitoba, Ontario and Quebec is marketed through producer-owned and operated co-operative organizations.

In *Colombia*, poultry production is usually carried out on a small scale. In most cases, the flocks which belong to farmers, have from 10 to 100 birds, mostly chickens and some turkeys and ducks. As a rule, poultry have to find their own feed, but sometimes this feeding is supplemented by small quantities of maize or inferior wheat. Few special poultry houses exist. The native birds produce about 60 eggs per year on the average, this low production being due to bad feeding and poor selection.

Nevertheless, poultry production occupies fifth place in economic importance in agricultural and livestock production in Colombia, coming after coffee, milk, beef and maize. Imports in 1954 were: chickens for breeding, 1,672,293 head; eggs for breeding, 240,000 units; eggs for consumption, 19,790,000 units; and chickens for consumption, 105,204 lb. Three years ago, after the appearance of Newcastle disease, imports of eggs and chickens, which had not formerly taken place, became necessary. Colombia has good possibilities for poultry development but it is necessary to instruct farmers on the improvement of installations, selection and feeding methods and to control diseases.

In *Ecuador*, the New Hampshire, Plymouth Rock, Rhode Island Reds, Jersey Black Giant and Orpington appear to be the best adapted improved breeds for the country. They have also been used for crossing with native birds. About 80 percent of the poultry in the country are scavengers. In some establishments, the construction of special types of buildings has been started; however, for the greater proportion of poultry, no special houses or equipment are available. Some preventive vaccination is carried out against the most important diseases, such as fowl cholera, Newcastle disease; and ecto- and endoparasites are controlled to some extent. There are no poultry co-operatives in the country.

In *El Salvador*, poultry raising has always been an important sideline with rural families. However, in the last five years the industry has made a very unusual growth. In the principal cities (San Miguel, Santa Ana and San Salvador) there are 40,000 laying hens under official supervision. When the poultry program was initiated, nothing was known of the performance of the leading breeds in the tropical climate of El Salvador. Therefore, eight different breeds were introduced and placed under test for three years (1949-51) at the experiment station of the National Center of Agronomy at San Andreas. The New Hampshires and Leghorns proved best. Recently it was shown that Leghorns produce more eggs than New Hampshires and since the price of eggs is high in relation to meat, the Leghorns are rated highest under present conditions. The supervised flocks are fed exclusively on balanced diets, while the flocks commonly kept by farmers depend entirely on grain and the insects they may obtain. Feed constitutes about 70 percent of the total costs in egg production. Three firms supply feeds. Two of these prepare balanced mashes with home products, using the minimum of imported concentrates. The third imports concentrates of high protein value, to be mixed with local feeds.

Poor nutrition and disease are the chief factors limiting production generally, and there is no national program of disease control. There are two poultry specialists working with 19 extension agents

to advise and assist the poultry breeders. There is only one publication devoted to this industry, but generally two articles per month on poultry keeping appear in the local press.

In *Jamaica*, there is an increasing number of farmers rearing poultry intensively. Most of the farmers use purebreds or crossbreds. During 1953, approximately 1,100 tons of feed were mixed and sold locally as compared with 2,000 tons imported. This gap can be expected to become narrower. Housing for poultry varies considerably. Deep litter is becoming increasingly popular for laying birds, and most of the broilers are now raised on wire. Only a few peasants provide proper housing for their birds, but there is no doubt that fairly cheap housing could be produced from local materials. Housing, in turn, implies intensive feeding and rearing and is thus unpopular with most of the small scale poultry farmers who prefer their birds to forage for part, at least, of their livelihood.

The presence of Newcastle disease, infectious bronchitis and chronic respiratory disease have recently been confirmed. Vaccination of all birds against Newcastle disease and fowl pox is recommended to farmers and is carried out on all chicks sold from the government hatchery. No program backed by legislation is in force, and, in view of the sporadic losses attributed to these diseases, it seems doubtful whether an expensive, comprehensive scheme is justifiable.

There are one major station and three minor stations where a limited amount of demonstration and research work on poultry is carried out. An accredited poultry scheme has recently been prepared in conjunction with efforts to make the island self-supporting for day-old chicks, and it is hoped that the scheme will be accepted and implemented in the coming year. The Department of Agriculture has one full-time poultry officer with two assistants. In addition, the 13 Livestock Extension Officers in the field are competent to give advice on elementary poultry husbandry. Extension circulars have been issued on "Starting in the Poultry Business," "Housing and Feeding Poultry" and "Common Diseases of Poultry." These are written in simple terms but deal with the subjects to a reasonably advanced level. There is a small co-operative which markets eggs and, to a limited extent, poultry meats. Other marketing is at present haphazard, but the Government is considering the promotion of an expansion of the present co-operative. There are two poultry keepers' organizations, but neither is firmly established or representative of the industry. An official accredited poultry scheme is soon to be launched.

In *Panama*, the most common improved breeds are Single Comb White Leghorns, Plymouth Rocks, New Hampshires and

Rhode Island Reds. The results obtained with heavy breeds have not always been satisfactory, whereas White Leghorns have proved to be more successful, but only where due attention was given to adequate feeding and protection against endoparasites. Leghorns have been less successful in ordinary small holdings, where the most adaptable breeds have been Rhode Island Reds and New Hampshires and, to a lesser degree, Plymouth Rocks. The New Hampshire is now the most common breed, both for egg and meat production, but particularly for the latter. Very little balanced feeding is done at present, and the majority of birds depend on waste grains and table refuse. However, a certain number of producers have already started to use balanced mashes, based on locally produced feedstuffs and, to a certain extent, on imported high protein concentrates. The production of compound feedstuffs is comparatively small, and is not supervised by the Government. It is supposed that the use of commercial mashes could be considerably increased if manufacturing would be standardized and officially supervised.

In poultry husbandry, little experimental work is carried out in Panama at present, but the National Institute of Agriculture keeps a flock of birds for teaching and experimental purposes.

In *Paraguay*, the poultry industry has not been developed to any significant extent for a number of reasons, among which the most important are: little official support, lack of adequate technical knowledge on the part of the farmers, the almost exclusive use of native breeds, several diseases which cause heavy losses, deficient feeding and inadequate housing and equipment, low quality of locally produced poultry meat and eggs, marketing difficulties, inadequate transport facilities, particularly for areas located at considerable distance from the consumption centers.

The native type of hen on the average produces not more than 60 eggs per year and is not precocious; however, its replacement by imported breeds or by adequate crosses is very slow, because the farmers believe that native birds are more resistant to the environmental conditions and diseases. The first significant imports of improved breeds were made in 1951, when some Rhode Island Reds came into the country, and appeared to be satisfactorily adaptable. An official breeding farm was established, which now has approximately 3,500 birds, the eggs of which are distributed for incubation. The official credit agency of the Government distributes breeding stock from this station on credit. The Rhode Island breed has certain disadvantages, however, mainly a certain susceptibility to diseases. Furthermore, low hatchability often occurs. The recently improved Leghorn breed has proved to be very adaptable to the existing conditions in the country; however, it is less satisfactory than the Rhode Island Red, which is a dual

purpose type. Recently also Sussex and New Hampshires have been imported.

Since there is little balanced feeding in Paraguay, poultry depend practically entirely on grains and pasture. Just recently, an attempt was made to produce poultry mashes from locally produced feedstuffs and imported meat meal. There are several diseases of considerable importance, such as fowl cholera, pullorum and fowl pox, but so far Paraguay is free of Newcastle disease, and precautions are taken by the Government to prevent its introduction.

In *Trinidad* and *Tobago*, Rhode Island Reds, White Leghorns and New Hampshires are being used to a considerable extent in broiler production. A large part of the poultry in the Colony is owned by peasants and the birds are allowed mostly free range. However, there is a noticeable trend towards the purchase of improved locally produced feeds. On the other hand, the large broiler producers feed, almost exclusively, imported feeds. There is one local firm manufacturing feed and the Marketing Division of the Department of Agriculture also sells poultry feeds.

No standard types of poultry houses are used. Peasant-owned birds roost in trees. Certain poultry raisers have their own plans for houses. Batteries are used for broiler production, but one raiser runs a series of broiler houses. A few are adopting the deep litter system. In view of the diversity of ownership and management, the possibility and need of standard housing is questionable. Specific regulations deal with the control of Newcastle disease. Regulations also cover the importation of live and dressed poultry. Vaccination against Newcastle disease, fowl pox and infectious bronchitis is practised. Two stations within the Department of Agriculture also give attention to poultry problems. Laying tests have not yet been carried out, and no poultry experts at present are included in the extension service. The Department of Agriculture has published bulletins on " A Few Practical Suggestions on Poultry Keeping in Trinidad and Tobago, " and " Observations on Simultaneous Vaccination in the Control of Fowl and Newcastle Disease. " There is a local poultry association which has a beneficial influence on the industry. Co-operative societies do not exist.

In the *United States of America*, poultry production provides approximately 10 percent of the gross farm income. There are highly specialized production establishments where many thousands of birds are produced on one " farm, " and chickens are raised on 78 percent of all farms. The principal grain producing states are also the leading states in volume of poultry and eggs produced, yet most poultry are fed manufactured feeds. Of all laying hens 31 percent are in flocks of less than 100 birds, 25 per-

cent in flocks of 100 to 200 birds and less than 10 percent in flocks of over 1,600 birds.

The great majority of chickens produced in the United States of America come from five breeds: New Hampshire, White Leghorn, White Rock, Barred Rock and Rhode Island Reds, in that order. In recent years a significant number of birds have come from cross-matings. It is estimated that approximately 20 percent of current chick production is from cross-mated parent stock. Five years ago this percentage was probably no greater than 12.

There are only a relatively small number of primary breeders and there is a tendency for the number to decrease and the size of operation to increase. Perhaps the most significant recent development is that many primary breeders are now employing highly trained geneticists to conduct their breeding programs. This trend has increased the rate at which research information from experiment stations and the U.S. Department of Agriculture is put into practice. In addition, the geneticists employed by commercial breeders are contributing to the general fund of knowledge on poultry genetics and breeding methods.

There are many poultry breeders' organizations. The oldest is the American Poultry Association which was organized for the purpose of standardizing varieties.

The U.S. Record of Performance Federation is strictly a breeders' organization comprising the Record of Performance (R.O.P.) breeders participating in the National Poultry Improvement Plan. In most states there is an organization of the breeders and hatcheries participating in the National Poultry Improvement Plan. The members have a voice in determining the provisions of the Plan on a national basis, and in the establishment of state-operating rules.

Breeders and hatcherymen are represented in two national trade organizations: the American Poultry and Hatchery Federation, and the National Turkey Federation. There are state affiliates to these organizations, and numerous other state and regional organizations in which poultry breeders are an integral part.

State and area poultry breeders' schools have been an important stimulus to poultry breeding in the United States of America. The Massachusetts Poultry Breeders School, one of the first, has been held annually since 1927. Two of the well established regional schools held annually are the Midwest Poultry Breeders Conference and the Pacific Poultry Breeders Round Table. The National Poultry Breeders Round Table, sponsored by a group of large private breeders, is another well established breeders organization.

There has been no substantial trend toward breeders co-operatives. The breeding is handled almost exclusively by private breeders, many of which are large corporate organizations. Of

the estimated 8,000 baby chick hatcheries, only a little over 100 are co-operative hatcheries.

Standard egg-laying tests, comprising 13 selected pullets per entry, have demonstrated the possibilities of high egg production, and thus contributed to the development of the poultry industry in the United States. The first tests were established at Storrs, Connecticut, and Mountain Grove, Missouri, 1911. Within the next 20 years, more than 40 tests were opened, but the number declined to 15 in 1950 and 8 at present. Results in the standard laying tests, which were based on highly selected samples of birds, did not accurately reflect the average production of the entrant's stock. Random sample tests were started with an objective of overcoming this weakness. The entries in such tests are a random sample of hatching eggs or chicks, taken by a disinterested party, of the grade of stock to be tested. There is no culling and the tests are usually continued for 500 days from the date of hatch. The first random sample egg production tests were conducted at Pomona, California, in 1947/48 and 1948/49. The acceptance of such tests is indicated by the fact that there were in operation 6 tests of this type, and 2 additional tests have been announced for 1955.

Consistent with the interest in commercial broiler production in the United States, 8 meat production tests have been established. There is a growing interest in random sample turkey production tests. One such test was conducted in Texas in 1954, and at least 1 additional test was being planned for 1955.

The National Poultry Improvement Plan, a federal/state program initiated in 1935, has been a major factor in the development of the poultry industry. Approximately two-thirds of the nation's hatching egg flocks and hatcheries voluntarily participate in the Plan. The program provides for the classification of flocks, hatching eggs, chicks and poults with respect to disease control (Pullorum and typhoid) and breeding improvement. Four of the breeding improvement classifications are based on Record of Performance. The R.O.P. program includes supervised trap-nesting and pedigree breeding on the breeder's farm and performance records in random sample tests.

Approximately 61 percent of the estimated 1,680 million chickens raised in the United States of America in 1954 were broilers reared in confinement on commercially mixed food. The other 39 percent, comprising 621 million chickens, which include 414 million laying hens and pullets, were raised on farms. These chickens consumed an estimated 21.8 million tons of feed. Mixed feed supplied about 13 million tons, leaving 8.8 million tons to be supplied by grain grown on the farm, home-made mashes and pastures. It is reasonable to believe that the smaller farm flocks

and backyard flocks (under 50 layers) obtained some feed as table scrap, bugs and insects. However, in the over-all production of meat and eggs, the quantity of food the chicken obtains by scavenging is negligible. In the smaller farm flocks, the value of good pastures as a feed supply should not be overlooked. Although the proportion of grass that the chicken can effectively utilize is small, it is of economic importance because it is estimated to save 10 percent of the grain requirements and supply vitamin A and riboflavin. However, feed from a carefully prepared and planted pasture cannot be considered scavenger material.

The great majority of turkeys are raised under commercial systems, and do not have access to any food other than the mashes and grains fed them.

An estimate of the poultry population and of the total food consumed when compared with the estimated production of formula feeds indicates that at least 60 percent of the feed consumed by poultry is supplied by commercially mixed feed.

Owing to the varied climates encountered in the United States of America, poultry houses are not limited to one or two types. Factors, such as kind of operation, and size of flock, also enter into the planning of poultry houses. Building design differs somewhat for broiler production from that for egg production. A noteworthy shift in recent years is to keep hens confined in individual cages. For farm flocks, poultry houses are relatively small one-storey structures; for many of the larger flocks the houses are multiple storey. Light construction has been used for many years, but considerable loss has been suffered in those structures during the past few years owing to storms. This experience seems to be resulting in more substantial design for poultry houses, effectively tied from roof to foundation.

In the southern part of the United States of America, individual cages are placed under comparatively simple shades. Sidewalls and floors are not used. The nests and supports are so arranged that removal of droppings may be done easily. Poultry houses in the colder parts of the country are enclosed and frequently well insulated, but most of these houses are equipped with windows on at least two sides. These are opened for cross-ventilation during summer months. In some of the northern states, houses are designed to keep the chickens occupied most of the time over utility pits. Feeders, waterers and perches are located so that waste and droppings fall into the pits. These pits may be cleaned either manually or mechanically.

Although poultry houses design has been linked closely with the protection of birds from cold, there is accumulating evidence that protection from excessive heat is fully as necessary. Extremely hot weather (above body temperatures) often kills large

numbers of birds. Protection sometimes is provided by spraying the roofs with water during the heat of the day. A plan exchange service is maintained whereby plans for poultry houses developed in any part of the country are catalogued so that interested poultrymen may select a design most suitable to the particular climate. The catalogs are held in country agricultural agents' offices and plans considered suitable for a given state are available through the Agricultural Extension Service of that state.

National disease control programs developed by the U.S. Department of Agriculture for the prevention of poultry diseases are the pullorum disease and fowl typhoid eradication programs, which are a part of the national poultry and turkey improvement plans, and are conducted under the auspices of the Animal and Poultry Husbandry Research Branch of the Agricultural Research Service, U.S. Department of Agriculture, the co-ordinating agency for the entire program. They are conducted within 47 of the states on a voluntary basis. The Department also sponsors research for the control of such other diseases as infectious bronchitis, chronic respiratory disease, tuberculosis, and avian leucosis on a co-operative basis with some of the states; however, the organization for such control is limited to the states. Basically, the control of all poultry diseases is a problem left to the individual states and is only done on a national basis, as in the case of pullorum disease and fowl typhoid, when it is mutually agreed upon, except in the case of imports of fowl of all kinds. Department regulations designed to prevent the introduction and dissemination of poultry diseases of foreign origin include:

(1) for poultry intended for importation from any part of the world (except Canada), the importer is required to obtain a permit before such poultry are shipped from the point of origin;
(2) all poultry offered for importation must be accompanied by a certificate from a salaried veterinary officer of the national government of the country of origin, showing freedom from certain diseases and exposure thereto for 60 days before shipment;
(3) veterinary inspection at a designated port of entry;
(4) quarantine (except for poultry from Canada) for not less than 15 days at the first port of entry in the United States of America.

Statutory authority is available, to eradicate certain diseases, should they gain entrance to the United States and threaten the poultry industry. In 1924, an outbreak of fowl plague (European fowl pest) was eradicated through strict quarantine measures, and

in 1950, an outbreak of Asiatic Newcastle disease was quickly eradicated through quarantine and slaughter of diseased and exposed birds, with indemnities to owners of such birds.

Regarding recent advances in poultry research, the following summary of information is indicative of some of the major developments in the United States of America.

The united attack of the state agricultural experiment stations in each of the four regions of the country — North Central, Southern, Western and Northeastern — in close co-operation with the U.S. Department of Agriculture appears to be the logical way to reach a sound and more rapid solution of poultry breeding problems too hard to solve by individual breeders and institutions. In two of the regions, testing stations have been established for evaluating, under uniform conditions, the inbred lines of chickens developed in the various states, as to combining ability to form hybrids with high economic qualities. In two regions the co-ordinated research is on chickens exclusively; in another turkeys only, and in the fourth region, both chickens and turkeys.

A short cut in the breeding procedure is now being studied at the Indiana Station by research workers of the U.S. Department of Agriculture and Purdue University. Using the very prolific fruit fly as a test animal, instead of the chicken, the relative effectiveness of various systems of breeding according to egg size and production is being determined.

Normally, in prolonged breeding programs the qualities for which selections are made increase up to a point, after which, in many instances, the rate of improvement levels off. In order to break through the leveling-off period and to obtain additional gains, X-ray treatments are administered to produce mutations in the chromosomes. These treatments will be given through five generations, and the genes and chromosomes of different individuals, unified and recombined.

A non-broody line of Rhode Island Red chickens has been developed by the Massachusetts Station, which has shown complete freedom from the broody instinct through several generations. The Maryland Station is breeding flightless chickens that have wings, but lose the long pinion feathers permanently at the time of first molt. New breeds of chickens that thrive well at high altitudes are being developed at the Wyoming Station.

The recent use of radio-active isotopes in poultry has been found advantageous by the Florida and Tennessee stations and the U.S. Department of Agriculture in studies on problems involved in growth, development and reproduction. When S35-labeled sodium sulphate was injected into newly hatched chicks, about 32 percent of the sulphur was still present in the chick six days later. The sulphur was divided between two fractions: about 10 percent

has taurine and about 22 percent associated with connective tissue. No radio-active cystine was detected. When 0.5 percent sodium sulphate was fed to chicks on a sulphur deficient diet, a growth stimulation was obtained. The results obtained by U.S. Department of Agriculture workers shed some light on nutritional metabolism in the chick which is at present very poorly understood.

A vast amount of new knowledge about growth factors and antibiotics has opened up a wide horizon of research activities that are bound to bring great changes in poultry production. According to the New York (Cornell) and Washington stations, the growth promoting factor, B_{12}, seems to exist in several forms. A number of other factors, most of them important for growth of birds, are still unidentified. Four such unidentified growth factors have been found in a liver preparation. In addition, a " whey " factor and an " alfalfa " factor are known to exist. Also chicks have a dietary requirement for either specific fatty acids, or for an unknown vitamin or vitamins present in vegetable oils, or both. A biological assay was developed by the U.S. Department of Agriculture workers for determining the presence of an unidentified chick growth factor in feeds. Using this method, a factor(s) in condensed fish solubles was found. Efforts to isolate the factor(s) have resulted in a concentrate which, at 0.009 percent of the diet, gives a growth response equal to 4 percent fish solubles (a 250 to 300 fold concentration). Progeny performance trials showed that the unidentified factor is transferred from the hen to the chick when the breeder diet contained fish solubles. Further work is in progress to concentrate the fish solubles factor and possibly establish its identity.

Although, according to the Illinois, Maryland and Washington stations, the value of " surface active agents " in stimulating growth is still doubtful, that of antibiotics is well established, as shown by research at the California, Pennsylvania, Texas and other stations. Antibiotics apparently do not serve as nutrients but improve the microflora of the digestive tract, thus encouraging synthesis of nutrients or permitting more complete utilization of those in the diet. Research at the Maryland and Texas stations, and at the U.S. Department of Agriculture shows that the feeding of antibiotics does not appreciably improve the growth of chicks reared in a very clean environment, whereas it causes a marked response in a normal environment.

The Storrs, Connecticut, Maryland, Utah stations and the U.S. Department of Agriculture have shown that a significant increase in growth rate, improvement in feathering, and increase in efficiency of feed utilization can be obtained by supplementing certain diets with additional methionine, one of the essential amino acids.

The growth depression of alfalfa meal seemingly is due to saponine, which can be counteracted largely by cholestrol or removed by extraction of the meal with hot water, as indicated by research at the California Station. The U.S. Department of Agriculture has shown that the growth-inhibiting properties of alfalfa vary widely with location of production, variety and cutting.

Successful growth and reproduction of chickens has been obtained on a diet of only ladino clover (as range), ground corn, and minerals, according to the Ohio Station. That grassland economizes on feed is concluded from research by the Michigan, Pennsylvania and Vermont stations.

At the Storrs, Connecticut station, a high incidence of encephalomacia has been produced in chicks, hatched from hens deficient in Vitamin E and raised on a low Vitamin E diet containing 2 percent "Vitamin A and D feeding oil," but a remarkable protection is obtained by feeding an antioxidant (diphenyl-paraphenyl-enediamine) used to protect carotene in feeds.

The Wisconsin Station has found that a wood waste product from the paper industry, torula yeast, when replacing part of the soybean oil meal in a chicken diet, will produce good growth. Wood sugar molasses, corn molasses, and low grade sugar, will replace a part of a cereal grain in hen and chicken rations successfully, according to the Arkansas, Hawaii and Oregon stations. Vegetable wastes, such as discarded broccoli, kale, rhubarb, spinach and carrots, when converted into measl or a homogenized fermented mixture, have been found by the Delaware and Maryland stations to substitute well for alfalfa meal. Chicken scrap has compared favorably with other protein concentrates in a chick diet at the Iowa, Nebraska and Wisconsin stations.

According to the Hawaii Station, brackish water containing as high as 400 grains of salt (NaCl) per gallon, given to chickens in addition to a diet having 0.5 percent salt, had no adverse effect on feed consumption, body weight, or survival. Thus, it will be possible for poultry to be raised on land in Hawaii where the salinity of the water is high (up to 100 grains of salt per gallon of water).

Regarding physiology, there are four different families of blood group characters in chickens that reflect hereditary biochemical differences in the protein structure of their blood cells. By comparing the performance of chickens with these different blood types, the Texas Station has found it possible to determine whether the blood group genes also affect characters of economic importance.

Hens whose eggs show low fertility, usually are able to maintain live spermatozoa in their reproductive tracts only about one day, whereas those with high fertility can maintain spermatozoa for 14

days or more. The New York (Cornell) Station discovered that, by pretesting the females, it is possible to eliminate those in which duration of fertility is low.

The Puerto Rico Station also found that time of hatching has an important bearing on sexual maturity and egg production of pullets, regardless of the relatively uniform climatic conditions on the Island which has no seasonal extremes. Female chicks hatched in February, for example, had earlier sexual maturity than those hatched in March. The poultry breeder in Puerto Rico, therefore, must consider a correction or allowance for date of hatch when breeding for early sexual maturity.

The reticulo-endothelial system is concerned with blood-cell formation, bile formation, straining off fatty materials, phagocytic destruction of blood cells, and the metabolism of iron and pigment. On the theory that this system can filter congo red particles from the blood stream in very much the same manner as disease-producing viruses, the Alabama Station has compared the ability of different breeds of chickens to filter out such particles. The evidence thus far indicates that disease resistance may be associated with the reticulo-endothelial system.

It has been demonstrated by the U.S. Department of Agriculture that the ruptured follicle plays an important role in controlling time of lay of the egg (or ovum) which it previously contained. Following removal of the ruptured follicle, the egg was retained in the uterus far beyond the time of normal lay. It has been shown recently that removal of a part (approximately half) of the ruptured follicle results in a contrary effect, the egg being laid prematurely by 12 to 17 hours before the hour of expected lay. These findings afford additional evidence that the ruptured follicle normally participates in the control of oviposition. Work is being continued to ascertain the manner in which the ruptured follicle exercises its regulatory function.

Management problems are also receiving full attention. According to the Pennsylvania Station, the replacement of small, scattered laying pens with larger units in a more orderly compact arrangement; the removal of partitions between pens; the grouping of nests near the pen doors or the addition of nesting rooms; the installation of floor feed-boxes with overhead chutes, or, in large units, of a mechanical mash feeder; and the use of feed carrier trucks and frost-protected automatic waterers — all have proved to be valuable as labor and time savers. A utility unit consisting of an automatic feeder and waterer installed between the roosting perches so that the chickens eat, drink and roost over a droppings pit, together with a mechanical cleaner for removal of droppings, has been designed.

The Ohio Station has found that the long-time use of compost

litter for chickens under proper conditions causes no " build-up " of diseases or parasites. Actually, less difficulty is experienced from coccidiosis with compost litter than with bi-weekly replacements. Also, compost litter apparently is a source of special nutritional factors for confined birds. For turkeys, however, compost litter is dangerous, so fresh litter should be used and changed frequently.

A number of the diseases that formerly plagued the poultrymen of the United States of America are now being successfully combatted. Roup, aspergillosis, tuberculosis, pox, pullorum and coccidiosis are no longer considered major problems. Rickets, perosis, gout and other nutritional disorders also cause little concern. Nevertheless, losses appear to mount and new diseases are being recognized. Lymphomatosis or leucosis has been a cause of loss among adult chickens. U.S. Department of Agriculture researchers have recently found a test to detect visceral lymphomatosis (big liver disease) in live chickens. Respiratory disease and air-sac infection (chronic respiratory disease) are important. The U.S. Department of Agriculture and the states have extensive cooperative research programs on these diseases.

In *Uruguay*, probably more than 75 percent of the total amount of poultry and eggs produced comes from general farms on which the poultry enterprise is only a side-line business. Chickens are kept in complete liberty, usually in flocks between 50 to 200 birds, scattered around the barns and being almost entirely dependent upon loose grains or any other feed they can pick up in the field; supplementary rations are given in some cases and during certain seasons.

There is a common belief among farmers that " criollos " (indigenous) hens are hardier and even more productive than purebreds. The introduction of valuable production breeds like New Hampshires, Rhode Island Reds and Single Comb White Leghorns, also appears to be hampered by the diffusion of fancy birds. Since 1951, the Bureau of Animal Industries prohibits the importation of hatching eggs or chickens from all countries that are not officially declared free from Newcastle disease.

There is a close relationship between the corn crop and its price and the number of chickens kept on general farms during the same year. Farmers seldom buy any feed for their chickens. There are no specialized commercial poultry feed manufacturers, but some firms, as a side-line, supply customers with ready-to-use feed for their birds. Commercial poultry farms depend almost entirely on a subsidized ration sold by the Government at different price levels and limited to those who have been operating poultry farms for several years.

Corn is the main grain for poultry followed by oats, barley,

sorghum, and wheat milling by-products. Owing to the relative abundance of animal proteins (meat scraps, tankage, liver meal, bone meal, fish meal), there is little use of plant protein foods, of which sunflower and linseed oil meals are mainly available. Brewer's dried yeast and dried whey are also produced in the country.

On general farms, neither special poultry houses nor equipment are used, whereas specialized poultry farms make comparatively large investments in buildings and equipment. In view of the favorable climate, there is no need for closed poultry houses, except brooder houses, which must protect the chicks against heavy rainfall and strong winds that occur from time to time.

The Bureau of Animal Industries has set up a laboratory in which, among other work, poultry diagnostics are performed and vaccines and pullorum antigen prepared. Disease diagnostics are also made by the College of Veterinary Medicine in Montevideo.

The Government of Uruguay has also established within the Department of Agriculture a poultry service, which is operating a poultry plant on one of the state-owned farms. This station sells limited numbers of hatching eggs, baby chicks and breeding stock at low prices. It is also in charge of the R.O.P. program. Laying contests are organized each year. There is not yet any organized extension service on poultry in the country. Efforts are being made to issue leaflets and other publications relating to poultry. There are three main poultry organizations in the country. Poultry co-operatives have not been successful so far, and none exists at present.

Experimental work has been carried out on the increase of weight and feed conversion rate of New Hampshire chickens and their crosses from 8 to 14 weeks of age. Four hundred and thirty-seven chickens, New Hampshire, Plymouth Rock/New Hampshire and White Leghorn/New Hampshire, in two groups, both coming from the same stock and bred in the same form, were controlled periodically in their weights from the amount of feed consumed and finishing after 14 weeks (Achenbach, 1954). Up to 14 weeks, the feed conversion rate was 4.67 and 4.78, respectively, for both lots. To the 12th week, this relation was more favorable and below 4. In the partial period from the 12th to the 14th week, it increased to almost 10 in one case and to more than 11 in the other. This would indicate the advisability of initiating the marketing of the chickens at about 12 weeks, if the market conditions were favorable. The average weight after 14 weeks was 4 lb., with a maximum of 5 lb. for the first lot and 3½ lb. for the second. The average weight of the pure New Hampshire chickens was higher than the crosses in the first lot, but lower in the second, in which the crosses exceeded the purebreds by more than

10½ oz. each. The finishing of the pure New Hampshire was inferior to the crosses, especially in lot No. 1. The best chickens resulted from the crosses between a White Leghorn cock and a New Hampshire hen.

In *Venezuela*, specialized poultry production is relatively new, since the establishment of well equipped poultry farms was started only about ten years ago. Earlier, poultry production was of a purely domestic type and complementary to other agricultural activities. Since 1946, however, the demand for eggs and meat has considerably increased, and large amounts had to be imported. Hence, the Government decided to support the import of baby chicks, which were then reared in the country. At the same time, the Government allocated credits for the establishment of poultry farms for meat and egg production. These measures resulted in a reduction of imports, first of frozen poultry meat, and then of baby chicks; and since 1949, it has no longer been necessary to import table birds; however, chicks are still imported. The most common, improved breeds are New Hampshires, Plymouth Rocks and Rhode Island Reds, but there is still a large stock of native breeds in the country. Balanced feed rations are used in industrial establishments, but they are not yet applied on domestic farms. At present, there are six plants, for the production of compound feeds.

The Government of Venezuela takes an active interest in the the control of diseases through its veterinary services. Furthermore, certain vaccines, particularly against Newcastle disease, are available, and there is a laboratory which carries out some research work in poultry diseases. However, there is no specific poultry experimental station in Venezuela. Experiments are carried out at the Faculty of Agronomy of the Central University of Venezuela, and at the Agricultural School at Maracay. At present, work is in progress on a cross between Leghorn and "Piroca blanca" which is a native breed. Favorable results have been obtained in the fifth generation, i.e., a monthly average of 21 eggs, sufficient body weight, resistance to certain diseases and, in general, a good adaptability to the environmental conditions.

The most efficient support of the poultry industry has been of an economic nature, i.e., credits for the establishment of poultry plants, and import duties. Furthermore, the Ministry of Agriculture organizes a certain number of poultry courses throughout the country, and livestock shows usually include a poultry section. Most of the poultry producers of the country are members of one of the following associations: Co-operativa Nacional de Granjeros (Caracas), Asociación Venezolana de Agricultura (Caracas), Asociación de Granjeros de Miranda (Estado de Miranda) and Asociación de Granjeros de Zula (Estado de Zula).

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