

this stagnation of the air over the central and eastern United States led to its being all but equally warm from the Gulf to the Lakes, and even into Canada, and, therefore, to the removal of such interchange as was occurring in North America between cold and warm air, and the rains that accompany such interchange, to unusually high latitudes.

Also, and presumably owing to this same alteration of the general routes of warm and cold air, moderately high atmospheric pressure often extended from the Atlantic Ocean far out onto the continent in the latitude of the Carolinas, thus effectually shutting off from the areas covered, and also those to their immediate north, all access of humidity from the Gulf of Mexico, its chief source for the regions in question.

Finally, after the soil had become dry over this great territory, and vegetation withered, local showers, which depend for their moisture mainly upon inland evaporation, necessarily were relatively infrequent and feeble. Thus any drought when well established, as the one of 1930 certainly was, tends to perpetuate itself partly by maintenance of the same paths of warm and cold air interchange and partly by deficiency of surface evaporation.

Of course all this quasi-stable condition of drought, or of excessive rain, may be completely upset at any time by some unusual storm, such as a suitably timed and located hurricane, by the onset of cold weather or otherwise.

We know something of what causes droughts and how they tend to perpetuate themselves, but we can not yet predict their coming nor their going nor how severe they will be.

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**E**GG Hatchability Is Only about two-thirds of the fertile eggs Influenced by the incubated in the United States each year Nutrition of Embryo hatch. The developing chicks in the remaining third die at various stages before they are ready to leave the shell. Inherited weaknesses, improper conditions of incubation, and faulty diet of the breeding flocks are the principal causes of death.

Much of this loss could be prevented if poultry breeders would use only eggs from vigorous stock and incubate these eggs at a proper temperature with the correct degree of ventilation and moisture. Many fertile eggs would still fail to hatch, however, unless the breeding flocks received rations containing enough of the right quality of nutrients for the chick embryo from the time it begins to develop until it leaves the shell.

Except for the oxygen, which is obtained through the shell from the air, the food supply of the chick embryo is contained in the egg. The proteins, water, and minerals, assisted by the pigments and vitamins, form most of the structure; the carbohydrates, some protein, and fat supply energy.

Some proteins lack or contain too little of certain components needed by the developing embryo. Many hens, when fed only vegetable proteins, for instance, produce eggs which, although fertile, fail to hatch as well as when an animal protein is added to the ration.

### Animal Protein in Feed Results in Best Hatches

At the United States Animal Husbandry Experiment Farm, Beltsville, Md., 120 Rhode Island Red pullets, equally divided in three pens, received an all-vegetable basal ration, a mineral mixture, cod-liver oil, and some form of protein. As sources of protein, cottonseed meal was fed to the pullets in one pen, soybean-oil meal to those in another, and mixed animal protein to those in the third pen. The eggs from the three pens were incubated and 58, 64.5, and 77 per cent, respectively, hatched. The results showed the superiority of the animal-protein supplement in producing eggs of high hatchability.

During the second week of incubation, when the embryo absorbs most of the egg white, a much higher percentage of the embryo deaths occurred in the eggs of the pullets receiving cottonseed and soybean-oil meals than from those receiving animal protein. Many of the dead embryos in the eggs from the pullets receiving vegetable protein were swollen because of liquid accumulating beneath the skin. This condition is known as edema, and may result from affected kidneys.

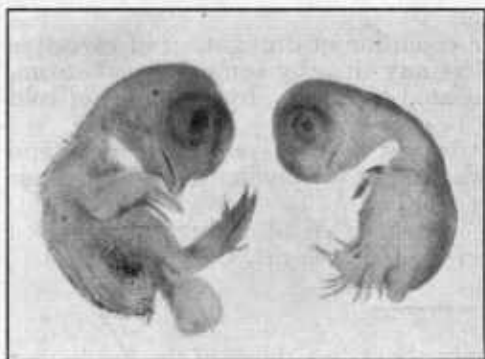


FIGURE 48.—On the left is a normal embryo after 11 days' incubation; on the right is one showing parrot beak and backwardly curved legs, caused in part by improper nutrition

The dead embryos in which edema was very noticeable also had extremely short and backwardly curved legs and parrotlike beaks, as shown in Figure 48. This condition is known as chondrodystrophy, signifying lack of normal formation of cartilage because of poor nourishment. Most embryos so affected die before the fifteenth day of incubation, though a few live until hatching time but rarely, if ever, hatch.

Any ration lacking animal protein may result in this trouble. Less than 0.1 per cent of the fertile eggs (12 out of 15,000) from the department's breeding flock, which received a mixed ration and was allowed on range, showed this trouble. Many of these hens were of the same breeding as the hens used in the experiment mentioned.

Further poultry-nutrition studies showed that a supplement of yeast, though not so good as animal protein, gave fairly satisfactory hatchability results, when fed to pullets receiving an all-vegetable basal ration. A 20 per cent supplement of a dry-yeast preparation when fed to 40 pullets on such a ration resulted in the hatching of 74.5 per cent of the fertile eggs. When an all-vegetable basal ration and a supplement of mixed animal proteins were fed to another lot of 40 pullets, 77 per cent of the eggs hatched; and when an all-vegetable basal ration alone was fed to 40 pullets, 69.2 per cent hatched. These differences in hatchability are no greater than may be expected from the inherent variability of the hens used. The yeast supplement, however, is far too expensive to be practical.

### Nutrition Effects Vary

Although in general hatchability of the eggs is lowered by the feeding of cottonseed and soybean-oil meals, all hens are not affected to

the same extent and many apparently not at all; and since these feeds are cheaper than animal proteins, high in food value, and easy to obtain, there is a tendency for poultrymen to feed more of them. When they are to be used as protein supplements, it is advisable to carry on pedigree hatching, examine dead embryos in the eggs for the condition shown in the illustration, and cull the hens that have produced such eggs. However, until a vegetable-protein ration is found which results in as high a per cent of hatchability as does the use of animal proteins, it is best to include some of the latter in the ration of breeding hens.

Lime and vitamin D in the ration are also necessary for satisfactory hatchability as well as for bone formation. Cod-liver oil is the best-known source of this vitamin. However, if the hens receive an abundance of direct sunshine, no other source of vitamin D is necessary. Still another requirement for large hatches is a reasonable quantity of pigment in the ration. This term signifies the natural coloring matter in various feeds.

Although successive generations of chickens have been reared on rations containing little or no pigment, eggs from hens receiving these rations hatch poorly. Only 25 per cent of the eggs from experimental hens fed on such rations hatched, as compared with 77 per cent from hens on normal rations. The yellow pigment which colors the normal egg yolk is obtained by the hen directly from the feeds, especially green feed and yellow corn.

Briefly, it is recommended that poultry breeders feed a ration containing adequate quantities of protein, both vegetable and animal; lime; cod-liver oil unless an abundance of direct sunlight is received; and a source of pigment, such as yellow corn or green feed.

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**E**LECTRICAL Machines Aid Department's Scientists in Compiling Statistics From Maine to California there is probably no State that does not utilize electricity in some way to lighten the burden of the farmer or the farmer's wife. Help is rendered in the form of power to work a pump jack, to run a corn sheller, to milk, or to turn a cream separator, or perhaps to operate a cordwood saw. Few farmers, however, realize the extent to which electricity is utilized in the daily tasks of agricultural workers in Washington. They might even regard tasks such as compiling statistics as easy enough without electrical help, but in this modern age, a task does not necessarily require muscular effort to become laborious.

A great deal of the clerical work incidental to the research studies undertaken by scientific workers of the Department of Agriculture is done with the aid of electrical machines. Some of this work is simple enough in itself but the large volume makes the use of machines a necessity. Other phases of the work are so complex that it is hardly conceivable that they could be undertaken at all without the aid of machinery. In this latter class of work comes the minute analytical studies which involve the use of elaborate questionnaires to get the many facts concerning a given subject. A very remarkable method has been developed for work of this kind, its great advantage being in the successive reclassifying of the same material.