FARMERS keep asking three questions about hogs: What is the best type and breed? How do parents pass their distinct features on to their offspring? How can we improve production? Another question was added a few years ago when it became plain that the usual kind of pig had too much lard, which, because of the growing competition of fats of plant origin, depressed the price of live hogs. Swine breeders and workers in agricultural experiment stations agreed that if the hog business were to stay profitable, they would have to develop a leaner animal—one that would grow well on the available feed and under American production methods.

One sign that the questions are being answered is the record made during the war. In 1943, for example, more than 121 million pigs were raised, more than ever before, and 66.4 percent above the average in the decade before that.

Research before the war indicated that an intermediate type suited the needs of the American producer and consumer better than extremes, particularly in the Corn Belt—a hog that could be finished at 200 to 240 pounds or, on farms with plenty of feed, at 300 pounds or more. This kind promises to be adaptable to a wide range of production and marketing conditions.

To develop this meat type the Department, in cooperation with the Iowa Agricultural Experiment Station, imported 23 head of Landrace hogs from Denmark in 1934 for use in experiments in breeding and feeding. The Danish Landrace had been bred under testing-station methods for many years, and was producing carcasses that were favored by the London bacon market.

Some of the Landrace were crossed with domestic breeds to determine
whether we could improve the meat of domestic stock and perhaps reduce lard yields. Several strains were started from the various crosses. From them, strains similar in type to the Landrace are being produced. They are a little longer of body and shorter of leg than the domestic breeds that were used in the crosses, and the carcasses compare favorably with those of the domestic breeds.

We believe that some of the strains may ultimately aid in improving domestic stock through systematic crossing. Cross-breeding has been practiced generally by many hog producers for years, because of the hybrid vigor usually obtained. These and other studies should ultimately point a way for obtaining the maximum in hybrid vigor from systematic crossing and perhaps eventually get better carcasses than are now had.

At the Regional Swine Breeding Laboratory at Ames, Iowa, an institution established in 1937 by agricultural experiment stations in the Corn Belt and the Department, experiments are in progress to explore possibilities for using inbred lines to improve the seed-stock value of pure breeds, and improve the performance and the carcasses of hogs produced for market. Methods of selection also are being investigated. Progress is being made. Some day inbred lines may be used not only to improve pure breeds, but also, when used systematically, may yield more pork per litter than the established practices.

The methods being tested in the various experiments have demonstrated that inbred lines can be produced within any of the pure breeds, and that the very best of the lines may have a place in future hog production. Likewise, useful lines can be formed from crosses of breeds. There is some evidence that lines from crossbred foundations may give more hybrid vigor in crosses than lines formed within breeds.

Today, swine breeders emphasize performance records as a means of improving the herd. The usefulness of such records in the dairy and poultry industries has been demonstrated by years of testing and proving superior stock.

Performance records for sows require earmarking of pigs and weights of pigs at weaning time. More thought is being given to final selection of boars and gilts for the breeding herd and how they can be used to increase feedlot efficiency and yield high quality carcasses.

**Feeding Hogs**

The American farmer did a first-rate job of feeding hogs during the war. Feed takes 70 to 85 percent of the cost of production and it was necessary to get as much efficiency as possible out of the feed on hand in order to meet the need for the large increase in numbers of hogs. Farmers realized that protein feeds saved corn or cereal grains in the swine ration, and could speed up gains so that hogs would be ready for market earlier.
A combination of feeds of both animal and plant origin are more efficient supplements to grain than either one used alone as a supplement. On the other hand, a protein feed of animal origin should be part of the ration of sows during the gestation and suckling periods and for the young pig until it reaches at least 75 pounds. Consequently, when the supply of animal protein feeds, like tankage and fishmeal, is limited, they should be fed to the animals that need it most for proper development.

For growing and fattening pigs, over 75 pounds in weight, feeds of plant origin, like meals of soybean, linseed, cottonseed, peanuts, and alfalfa, used in various combinations to supplement the grain ration, will produce satisfactory results if the supply of protein feeds from animal sources is low or lacking. During this period, however, hogs receiving some animal protein in the supplement will gain faster than those on an all-vegetable supplement.

Wartime shortages of protein feeds of animal origin led to a series of tests at Beltsville on the value of plant proteins. We found that a good all-vegetable protein supplement can be used during the gestation period, but that a ration containing some animal protein is necessary to increase growth rate in growing and fattening pigs. In the tests, the sows and litters were handled under conditions similar to those found on many hog farms. Pasture crops were fed during the gestation and suckling periods. Considerable corn and other grains were saved when high-protein supplements were used to provide a well-balanced diet.

We think a farmer will do well to grow his own protein supplements so that he need buy little extra feed. Skim milk is a valuable supplement of animal origin. Soybeans are good in small quantities, when combined with other supplements and minerals. The practice of exchanging whole soybeans for soybean meal, which can be used safely in large quantities, is often profitable. For fattening hogs over 100 pounds in dry lot, a mixture of three parts soybean meal and one part ground alfalfa hay may be self-fed in one compartment of a feeder with corn and a mineral mixture in separate compartments.

Legume hays and hay meals, like alfalfa, soybean, red clover, Ladino clover, and lespedeza, provide proteins, minerals, and vitamins of excellent quality. They may be fed separately, as hay, or ground and mixed with concentrates.

The hog's stomach is small and requires feed in concentrated form. The bulkiness and relatively high fiber content of hay and hay meals limit the amount that can be fed profitably. In general, 5 to 10 percent of good legume hay, either ground or unground, has been considered the most desirable level, although more may be fed with good results. A growing and fattening hog can tolerate as much as 8 percent fiber; that permits the use of as much as 20 percent of a hay of 30 percent fiber content in a mixture of corn, tankage, and linseed meal.
Tests at the Wisconsin Agricultural Experiment Station show that brood sows fed only 5 percent alfalfa in a ration made up largely of corn and soybean meal did not produce enough milk to suckle their litters satisfactorily. On the other hand, sows that received 15 percent alfalfa had strong litters. The addition of 15 percent of alfalfa hay was also favored in a ration containing tankage as well as those with only vegetable-source protein feeds. Rations containing 15 percent ground alfalfa hay also gave excellent results for growing and fattening pigs.

It is not necessary to use ground legume hays in rations where pigs have access to good pasture. If pigs are fed in dry lot or in fields where the pasture is poor, ground hays are valuable in the ration. The winter ration for fall-farrowed pigs should contain liberal amounts of good hay to promote general health and rapid and economical gains.

**Pastures for Pigs**

Green pastures furnish proteins, vitamins, and minerals, and when they are properly rotated are the basis of a good sanitation program and save as much as one-fourth of the grain ration and one-half of the protein supplement ordinarily fed to pigs.

Scientists at the University of Illinois, after experiments in which pigs were grazed on excellent alfalfa pasture, credited the pasturage with about 1,000 pounds of pork an acre, besides the gain credited to the corn that was fed.

At the same experiment station, rye pasture furnished excellent grazing for sows and March-farrowed pigs. An acre of good rye pasture carried 100 early pigs and their dams until alfalfa was ready to graze about May 1. In those tests, an acre of rye pasture saved almost 100 bushels of corn and 560 pounds of protein supplement. In another instance, sows and pigs fed only corn on rye pasture made more gain with less feed per 100 pounds gain than sows and litters fed corn and supplement in dry lot.

Winter oats is an excellent grazing crop for sows and early spring litters. An acre of winter oats pasture ordinarily furnishes pasture for four sows and their litters during the suckling period. In sections of the country where it can be planted early to get a good fall growth it is one of the best early spring pasture crops.

**Year-Round Grazing**

In the South, soil and climate make it possible to produce a variety of crops that can be hogged off almost the year round. Under such systems, litters can be farrowed so as to provide a more uniform supply of market hogs throughout the year.

The Georgia Coastal Plain Experiment Station began a series of tests
in 1936 to determine the value of different crops in a year-round grazing program. Only grain crops were used that could be harvested by the hogs. A sufficient acreage was planted so that each crop would carry a given number of hogs until the succeeding crop was ready. Over an 8-year period, data were obtained on the value of 14 feed and grain crops to determine their place in such a program.

The sequence of crops found best for the Coastal Plains area of Georgia was: Mature oats, to be hogged off in May and June; early dent corn to furnish feed in July, August, September, and October; either runner peanuts or sweetpotatoes for feed in November, December, and January; and field corn for February and March. Early dent corn, which returned $2.59 for each dollar of cost, was the most profitable of the crops tested. Only two crops, sweetpotatoes and sunflowers, failed to return enough pork per acre to cover expenses. The average amount of pork produced to the acre ranged from 542 pounds for corn and Spanish peanuts to 305 for corn and soybeans. On the average, it required approximately 0.4 of an acre of fattening crops to grow out and fatten a pig from weaning to market weight.

The year-round hogging-off program saves labor in harvesting the crop, increases soil fertility, distributes labor and income more evenly through the year, establishes good sanitation practices to control parasites, and uses soil-building crops that could not be harvested economically and fed to hogs.

Going to Market

What is the best weight at which to market hogs in relation to feed costs per unit of gain? At Beltsville we tried to determine the amount of feed required for each 50 pounds of gain between 75 and 375 pounds of live weight. Hogs of the intermediate type were self-fed, with these results:

<table>
<thead>
<tr>
<th>Pounds</th>
<th>Number of hogs on test</th>
<th>Average daily gain in pounds</th>
<th>Pounds of feed per 50 pounds of live-weight gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>75-124</td>
<td>42</td>
<td>1.62</td>
<td>167</td>
</tr>
<tr>
<td>125-174</td>
<td>42</td>
<td>1.75</td>
<td>190</td>
</tr>
<tr>
<td>175-224</td>
<td>34</td>
<td>1.71</td>
<td>206</td>
</tr>
<tr>
<td>225-274</td>
<td>26</td>
<td>1.65</td>
<td>223</td>
</tr>
<tr>
<td>275-324</td>
<td>18</td>
<td>1.46</td>
<td>252</td>
</tr>
<tr>
<td>325-374</td>
<td>9</td>
<td>1.31</td>
<td>276</td>
</tr>
</tbody>
</table>

We found that 275 pounds is about the limit to which the in-between hogs can be fed profitably under normal conditions. Beyond that, the rate of gain dropped significantly, and the feed needed for each succeeding 50 pounds of gain increased appreciably. Therefore, unless lard is needed, it is desirable from the standpoint of feed utilization to market
hogs at live weights of 200 to 225 pounds, because it requires less feed to produce lean meat than it does to produce fat.

The use of distillers' dried grains with solubles as a feed for swine grew out of war conditions. The shortage of protein feeds and the large quantities of distillers' dried grains resulting as a byproduct of alcohol production led to tests at Beltsville to determine the value of the product. Besides their high protein content, the products contain the B vitamins.

Dried distillers' grains with solubles were fed to pigs at different levels as protein supplements. The distillery product made up 9.4 to 12 percent and from 18 to 26 percent of a ration composed of corn, tankage, soybean meal, alfalfa meals, and minerals. The tests, in which the hogs were fed to market weights of approximately 225 pounds, showed that at the level of 9 to 12 percent of the ration, rate and economy of gains were comparable to those of pigs in the check lot without distillers' grains. However, when the dried grains with solubles were fed at the second level, the rate of gain was slowed up by about 30 percent while 40 percent more feed was required per 100 pounds of gain. It was apparent that the added high fiber content of the ration at higher levels hindered normal gains.

Tests conducted at the Kentucky Agricultural Experiment Station confirmed our results and indicated that the distillers' feed products do not contain all the essential amino acids at a level required to promote satisfactory growth. Further tests at Kentucky, and some at the Illinois Agricultural Experiment Station, show that when distillers' dried solubles were used as a supplement to certain basic rations, an improvement in quality was obtained, with an increase in rate and economy of gains. It seems likely that this improvement is due to vitamin factors contained in the distillers' solubles. Results to date indicate that growing pigs receiving distillers' products in the ration, nevertheless may be expected to produce more economical gains when given access to good pasture than when fed these products in dry lot.

Self-Feeding of Sows During Gestation

Self-feeding of sows and litters during the suckling period and of pigs during the growing and fattening periods is common in swine management. Bred sows fatten so easily that the practice of self-feeding grains and concentrates during the gestation period until recently was not considered advisable. Comparisons of self-feeding and hand feeding of bred gilts have been made at the Minnesota Agricultural Experiment Station. Preliminary results show that self-feeding during gestation is practical, but there should be enough bulk to the ration to keep the sows from getting too fat. A ration of 43 parts of ground corn, 25 parts of ground oats, 25 parts of alfalfa meal, and 7 parts of tankage, plus a mineral mixture, proved satisfactory.
An adequate ration for self-feeding can be made up largely of home-grown grains and good legume hay; only an animal protein supplement, if skim milk is not available on the farm, need then be bought. Other preliminary results show that the average number of pigs farrowed and weaned and the weights of pigs at both farrowing and weaning were practically the same for the self-fed and hand-fed groups. The milk production of the sows did not seem to be adversely affected by either method. The cost of feed per sow was slightly higher in the self-fed group. Self-feeding, however, lightens the work of morning and evening feeding.

Reducing Death Losses

The big economic loss in the swine industry is due to the failure to raise and market a higher percentage of pigs farrowed. An average of 35 to 40 percent of the total pigs farrowed never reach market. It is estimated that approximately a seventh of all hog feed is fed to pigs that never get to market.

Where electric current is available, the use of electric heat in the farrowing pens pays well. An ordinary 150- or 200-watt electric lamp is enough. The cost of installation of hover and light will pay for itself the first season in pigs saved. At Beltsville we saved approximately 5 percent more pigs in the spring of 1940 by using home-made electric hovers than we did without them. The comparison was made in a heated central farrowing house. Similar experience was had at the Purdue Agricultural Experiment Station. The sows in a group with supplemental heat saved 82.8 percent of live pigs farrowed, compared to 65.7 percent in the group without heat. The death loss of pigs from chilling was reduced from 10 percent in the lot without heat to 2.2 percent in the lot with heat. The difference of 17.1 percent in pigs saved is of economic importance. If a similar saving could be had in a State or the whole country, it would mean greatly increased production with the same number of sows, or fewer sows would be needed to maintain a normal swine population.

Uremia in Young Pigs

A post mortem examination of young pigs that died during the suckling period in the herd at Beltsville revealed that most of the pigs lost in the first 2 weeks of life had uremia. The condition shows up in the excretory ducts of the kidneys, and is characterized by crystalline deposits, a marked increase in urea, uric acid, and other compounds in the blood, kidneys, and liver.

The condition apparently is not associated with the so-called baby pig disease, as the blood sugar content is within normal range. A similar condition was produced experimentally in young pigs by withholding
food, an indication that the cause may be the failure of the sow to come in milk normally after farrowing, faulty feeding or management, or failure of the pigs to suckle soon after birth. Proper attention to the diet of the sow before and after farrowing should be helpful, although the definite cause of the condition is not yet fully understood.

THE AUTHOR

John H. Zeller is from Franklin County, Pa. He is in charge of swine investigations at the Bureau of Animal Industry. Except for time out to serve in the naval aviation service during the war, he has been continuously active in swine research for the Department since 1917.

FOR FURTHER READING


Foster, G. H., and Vestal, C. M.: The Use of Electric Heat in the Farrowing Pens of Young Pigs, Purdue University Experiment Station Bulletin 494, 1944.


ALSO, IN THIS BOOK


Drugs to Control Parasites, by Benjamin Schwartz, page 71.
Under the traditional methods of feeding dairy calves, each one of them during its first 6 to 8 months of life drinks about 200 pounds of whole milk and 1,900 pounds of skim milk. Research to determine how early calves can be weaned from milk is reported by H. T. Converse on page 159. Of course as a calf's milk diet is reduced, it must be trained to eat more hay and grain. The following pages present some results of calf-feeding tests at Beltsville.
These Holstein steers are 6 months old; their average weight is 381 pounds. None had any whole milk except colostrum, nor any skim milk or other animal protein after 1 month of age. They had had an average of 234 pounds of milk at the time their pictures were taken.

These Jersey and Holstein heifers (above) are 9 months old and, reading from left to right, were normal weight at 8, 3, 6, and 7 months, respectively. None of them had any whole milk except colostrum and no skim milk or other animal protein after 2 months of age. They consumed an average of 461 pounds each.

Below, a Jersey heifer calf as she looked at monthly intervals from 2 to 6 months. She was weaned from skim milk at 2 months of age and never had any whole milk except colostrum. She consumed a total of 491 pounds of milk; weight normal at 3 months. The composite pictures were made by W. A. Stenhouse.
These four Holstein heifers were a year old when their pictures were taken. From left to right, they had no milk after 1, 2, 6, and 6 months, respectively. The first three had no whole milk except colostrum; the fourth had no skim milk, but at 6 months had drunk 2,377 pounds of whole milk. The skim milk consumed by the first three was 278, 427, and 2,590 pounds, respectively. The weight of each of the calves, in pounds, at different ages, was:

<table>
<thead>
<tr>
<th>Age</th>
<th>6 months</th>
<th>12 months</th>
<th>18 months</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>370</td>
<td>708</td>
<td>857</td>
</tr>
<tr>
<td></td>
<td>386</td>
<td>593</td>
<td>853</td>
</tr>
<tr>
<td></td>
<td>400</td>
<td>641</td>
<td>844</td>
</tr>
<tr>
<td></td>
<td>396</td>
<td>655</td>
<td>838</td>
</tr>
</tbody>
</table>

The first calf was under weight at 6 months, but exceeded the others at 12 and 18 months.

Tests at Beltsville indicate that vitamin D supplement is not absolutely necessary in a calf’s diet. This young bull had never been exposed to sunlight and had no vitamin D except what he got from sun-cured hay. At 6 months, when the picture was taken, he weighed 354 pounds.
With increasing competition from fats and oils of plant origin, swine breeders realize the need for a leaner hog that is adapted to American methods of production. In cooperation with several State experiment stations, good progress has been made, as illustrated in these pages. An article on swine breeding and management appears on page 201. Above, John Zeller inspects a group of pigs selected at random from a litter at weaning time. The purpose is to determine record of performance as to rate of gain and economy of feed per unit of gain.

In 1934 the Department, in cooperation with the Iowa Agricultural Experiment Station, imported some Landrace hogs (left, above) from Denmark for crossing with local stock. From this white breed there have been developed strains that are black or red in color. A result is the Landrace-Poland China inbred gilts (right), at 9 months of age. They are 75 percent Landrace and 25 percent Poland China and have longer bodies and shorter legs than U. S. breeds.
These older Landrace-Hampshire inbred sows (above) are of a black strain. They were bred at the U. S. Range Livestock Experiment Station at Miles City, Mont., in cooperation with the Montana Agricultural Experiment Station at Bozeman. They are 60 percent Landrace and 40 percent unbelted Hampshire. The 8½-month-old gilts (right, above) are from Landrace and Berkshire stock. They are 63 percent Landrace and 37 percent Berkshire, and were bred at Blakeford Farms, Queenstown, Md., in cooperation with the Maryland station.

The foundation stock of the 8½-month-old gilts (above) are Landrace from Denmark and Large Black from England. They are a black strain bred at Beltsville and are 75 percent Landrace and 25 percent Large Black. Some Landrace-Duroc, a red strain, are also being developed. The 9-month-old gilts (below) are about 75 percent Landrace and 25 percent Duroc.
The 8-month-old gilts (above, left) are red and are being developed from a three-breed cross. They are 77 percent Landrace, 15 percent Duroc, and 8 percent unbelted Hampshire. Those at the right, above, are of four breeds: 60 percent Yorkshire, 33 percent Duroc, 3 percent Landrace, and 3 percent unbelted Hampshire. They are a red strain at Beltsville, 8 1/2 months old.

PIG LOSSES CAN BE REDUCED where electric current is available to provide warmth in this type of home-made hover. This equipment has helped reduce pig losses at Beltsville. Attracted to the light and warmth of the hover (below) almost as soon as they are born, the little pigs are cozy and, under the protecting guard rail, are fairly safe from being trampled.
TYPICAL SHEEP COUNTRY is the setting for the headquarters of the U. S. Sheep Experiment Station, and Western Sheep Breeding Laboratory, at Dubois, Idaho. In these barns, corrals, and laboratories, and on the sagebrush range, research goes on to develop better breeding and feeding methods and thus better sheep. A general article on the subject begins on page 209.
Sheepmen usually breed their ewes at 18 months, but tests with purebred Hampshire sheep at the U. S. Belle Fourche Field Station, Newell, S. Dak., indicate that lambs born early in the spring, and with proper feeding and care, can be bred the following fall with no apparent bad effect on them. Both the lamb-bred and yearling-bred ewes are in the above flock.

The Columbia breed (above, left) is a product of the Dubois station and is considered by some sheepmen as the perfect sheep. This ram, a plump, square, rugged specimen, is a typical Columbia sheep. The Targhee ewe (above, right) is shown in every-day range condition. She carries a good half-blood fleece of medium fineness that is usually in strong demand by manufacturers of apparel fabrics. She has a square mutton form, open face, no skin folds.

Below, left, is a modern Rambouillet ram, and (right) one that not long ago was considered a prize-winning type of animal. The large folds at the neck and wool over the eyes are now considered as serious drawbacks by practical producers. The ideal modern ram has none of these bad features but produces a heavy yield of wool in high demand for fine dress goods.
A typical yearling Navajo ram (left, above), and a second-generation yearling crossbred ram produced at the Southwestern Range and Sheep Breeding Laboratory in New Mexico. Fleece from the crossbred ram (right) is a long staple quarter-blood type of wool good for either hand-weaving or commercial use. The Navajo ram produces a carpet-type wool of low value.

Lamb feeders send thousands of lambs to feed lots such as this (below) in Colorado, Wyoming, and Nebraska, where much good lamb-fattening feed like alfalfa, corn, oats, and barley is grown. Most of the feeder lambs from the western ranges are fattened in these open feed lots.
MILK, MOHAIR, AND CHEVON are produced by goats. Interest in raising them for these purposes is increasing in the United States. Research is under way to develop breeding and management methods that will give the goat raiser higher returns. Progress made in recent years is discussed on page 217. The above photo shows a common method of feeding young goats.

Selective breeding based on performance is one phase of efforts to obtain higher milk yields. An example of improved breeding is Supreme Security No. 44784 (left), a purebred Saanen buck, who has proved his ability to transmit high milk production. One of his daughters, U. S. D. A. 105 (right), gave 2,303.5 pounds of milk and 73.51 pounds of butterfat in 306 days.
Since does ordinarily breed only in the fall, a year-round supply of goat milk is somewhat of a problem. Partially offsetting this drawback is the fact that they usually give birth to two kids at a time, as the above Toggenburg doe No. 607; frequently they have three and even four.

Experiments indicate that it pays to add some grain to a milk goat's diet. This Toggenburg doe No. 971 gave 1,551.9 pounds of milk and 60.52 pounds of butterfat in 301 days on a ration of 1 pound of grain to each 4 pounds of milk. During subsequent lactations, without grain, she gave an average of only 886 pounds of milk and 28.03 pounds of butterfat in 231 days.

Angora goats are the only source of mohair, a 10-million-dollar industry in the Southwestern States. The best mohair comes from Angora does that carry a dense, fine-quality fleece that grows in ringlets rather than as straight hair. The specimen at right is a doe of high quality.

The platform and stanchion arrangement (below) is adapted to goats. It not only prevents the goat from wandering around, but is sanitary and brings the milker's work closer to him.
HIGHER QUALITY MEAT AND EGGS from poultry, and greater efficiency in feeding and taking care of domestic fowl, are some of the objectives of research by the Department in cooperation with several State experiment stations. On page 225 T. C. Byerly discusses the breeding of better poultry, and on page 231 he reports results of work on how to keep poultry healthy. The next few pages show how the work is done and some of the results.

The development of new strains to meet specific needs is a phase of poultry work at Beltsville. Here M. W. Olsen (left) and J. P. Quinn display a Rhode Island Red hen, a Sussex rooster, and a White Wyandotte hen, the three breeds crossed to get the Columbian poultry strain (below).

Fast-feathering chicks are better for table use because they have fewer pinfeathers when ready for market. Of the two same-aged chicks (left), a strain of the new Columbian chicken, the upper one has well-developed tail and wing feathers. This is done by selective breeding.
Also, as a result of selective breeding and testing, the Beltsville Small White turkey has become a well-established type. It is a relatively small bird with lots of white meat, and thus meets very well the needs of smaller families. A good egg has a strong nonporous shell, no blood spots, keeps well, and retains its weight in storage. Here eggs are being tested for shell strength and weight. Research continues to develop a hen that combines these qualities.

Department pathologists have found a faster way to determine whether or not a turkey has pullorum disease. A drop of blood taken from the turkey's wing is mixed with a drop of solution called antigen. If the antigen shows curdled spots, the turkey is afflicted; if it remains cloudy throughout, the turkey is free of the disease. The process takes about 3 minutes.
POULTRY FEEDING RESEARCH at Beltsville has proved that a concentrate of cow manure aids growth in chickens. Proof of this is shown by the two chicks being weighed by H. R. Bird. They are 6 weeks old; both were fed the same diet except that the chick at the left received 23 grams of cow-manure concentrate per 100 pounds of feed. Its effect on growth is due to an unknown dietary factor. An article on Feeding Poultry begins on page 235.

The diet of a hen, if she is to produce hatchable eggs and strong chicks, apparently must contain some animal protein. Of 100 fertile eggs laid by hens fed an adequate diet, except for animal proteins, 34 failed to hatch; chicks from 19 died during the first week of life. Of another 100 fertile eggs from hens fed an adequate diet but including fish-meal supplement (below), 15 eggs failed to hatch and only 4 chicks died before they were a week old.
AT LEAST A DOZEN STATES are carrying on research to develop horses that are better adapted to farm and general use. The U. S. Department of Agriculture, at its Morgan Horse Farm in Middlebury, Vt., and at its Range Livestock Experiment Station at Miles City, Mont., has made studies that indicate the need for improvement in breeding and management.

PRESENTING Mentor 8627, a 4-year-old Morgan stallion, used by the Department in its breeding program at the Morgan Horse Farm. He stands 15.1 hands high; weighs 1,040 pounds.

A series of tests has been devised for measuring the performance and endurance of a horse, one of which is a 11½-mile cross-country ride under saddle carrying 20 percent of its body weight. Another test is a 5-mile trot hitched to a cart. Walking and trotting speed and length of stride are recorded over a measured mile, the animal pulling 60 percent of its body weight.
For the 5-mile test, respiration and heart rates are taken before the test and 5, 10, and 15 minutes afterwards. Each horse is given a score for signs of fatigue and ease of gait for riding.

The Michigan station developed the handy-sized farm horses shown above. They are crossbred fillies sired by an Arabian stallion from a mare of Percheron x grade Clydesdale breeding.