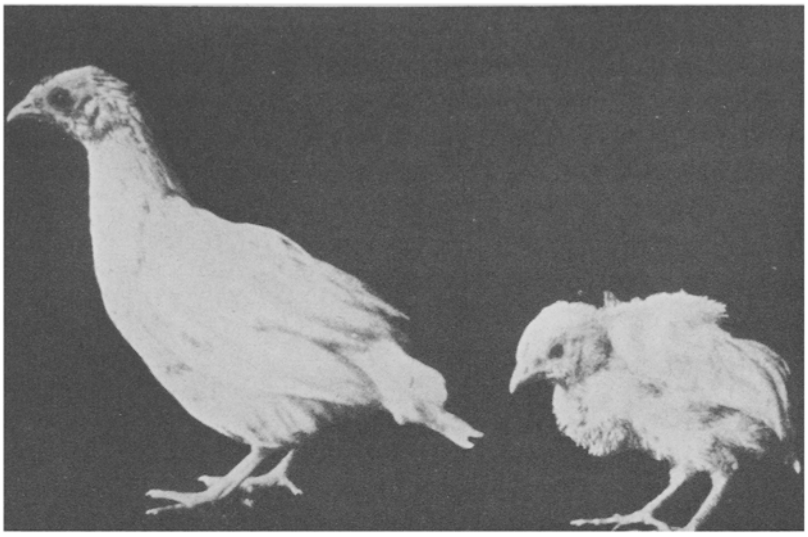

These chicks are both only six weeks of age—both had exactly the same diet—except that the larger had an adequate supply of Vitamin D

Recent Developments in State Control of Feeding Stuffs

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University of Minnesota

IN this address I shall talk for a few minutes about the laws regulating the manufacture and sale of feeds in the United States and the machinery set up by the States and the Federal Government for the enforcement of these statutes. I shall also mention some of our accomplishments and discuss one or two new phases of this work.

The labeling and marketing of commercial feeds is controlled from two sources, namely, Federal and State. The Federal Government receives its authority for policing the feed trade from the United States Food and Drug Act, commonly called the Pure Food Law. Briefly stated this act defines the word "Food" to include all articles used for food, drink, confectionery or condiment, whether simple, mixed or compound, by man or other animal. Since feeds or commercial feeds are foods used by domestic animals, all such products come within the purview of the Pure Food Law. In one respect the Federal Act is more comprehensive than the state law because it does not exempt from regulation the grains or meals made from single grains as do many of the state feed laws. On the other hand the Federal law does not have the force of the state laws because it does not require the labeling of feeds with their guaranteed analysis and ingredients. Under the Federal law a shipper need show only the net weight of the package. If, however, any guaranties are made regarding the character or value of the contents of the package, all the provisions of the Federal law can be applied and invoked whenever such statements are false or misleading in any particular.

Contrasting the application of the Federal and state laws to shipments of feed, it may be interesting to see how these laws supplement each other. Shipments of products made entirely within the boundaries of one state are not subject to the provisions of the Food and Drug Act but come entirely under the regulations provided in the state laws. Shipments made from one state into another or shipments in interstate commerce are under the control of the Federal Act.

*Before Fall Meeting, American Oil Chemists' Society, Chicago, October, 1931.

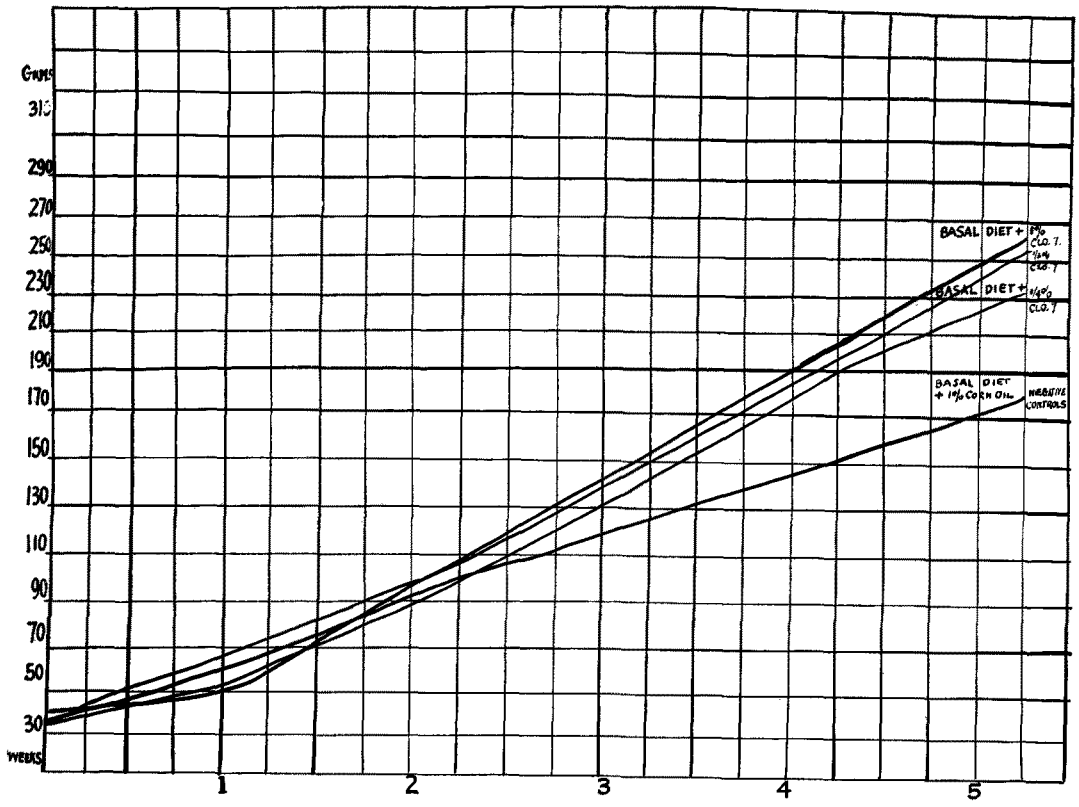
In many instances state control officials find on sale by dealers, goods which have been shipped from some point outside of the state. The shipper may have violated the provisions of the state law but being outside the jurisdiction of the state courts, he cannot be compelled to answer for his offence unless he or his agent comes into the state for service. However, most of the state feed control officials are commissioned by the Secretary of Agriculture of the United States as collaborating chemists or officials authorized to assist in the enforcement of the Food and Drug Act. They are permitted to present evidence directly to the United States attorneys in their respective territories for appropriate action. Most state officials are therefore clothed with the necessary authority to handle violations of both state and Federal feed laws.

As illustrating the co-operation that can be effected between the Federal Government and the states, I recall a program of work in the examination of linseed oil meal several years ago. The official definition for linseed meal or oil meal says that this product is the ground cake resulting from the pressing of properly cleaned flaxseed in the manufacture of linseed oil. It provides further that the final product shall not contain more than 6 per cent of weed seeds or other foreign material, none of which shall be deliberately added. Confronting the chemist was the task of determining whether or not a sample of oil meal submitted for examination conformed to this definition. It was evident that the presence of considerably more than 6 per cent of screenings in an oil meal was not noticeable in its effects on the ordinary determinations made in the examination of feeds, such as protein, fat, fiber and total ash. This was true because the natural variations in the flax cake and in the weed seeds were apt to be greater than variations due to different percentages in mixtures, within reasonable limits.

As a result of studies made of linseed meals of known purity and the foreign material and weed seeds commonly present in adulterated or improperly cleaned products, the Wisconsin State Feed Laboratory discovered that the amount of insoluble ash or silica was an indication of the amount of foreign material present. Following this discovery an investigation of the whole oil meal situation was conducted by factory inspections and otherwise, in the states of Minnesota and Wisconsin by the state departments in co-operation with the Federal authorities. A large number of samples of linseed meals on sale in Minnesota were examined for insoluble ash. The results ranged from 0.08 per cent to 2.71 per cent. The average silica or sand content of all the samples was found to be, during the first year of the investigation, a little over 0.90 per cent. This conservatively represented the average sand content in all the oil meals sold in the state. Our investigation proved all oil meals testing in excess of 0.50 per cent were either adulterated by the addition of screenings or were made from improperly cleaned flax. After bringing the condition forcibly to the attention of the manufacturers, there was a marked but gradual improvement in the quality of the oil meal sold and manufactured in Minnesota. Within three years the average silica content of our oil meal was reduced from 0.90 per cent to 0.21 per cent. In other words there had been a reduction in the average insoluble ash content of oil meal of 0.69 per cent. This may seem at first glance like a small improvement but when it is pointed out that nearly three-quarters of one per cent of all the oil meal sold was sand, the financial loss to the purchasers can be imagined when applied to the thousands of tons distributed and used by feed manufacturers in this country. Besides this, the presence of the sand proves the presence of a much greater percentage of screenings or prohibited material, the amount of which it is impossible to estimate.

Attempts have been made in a number of states during the past ten years to pass legislation requiring manufacturers of feed to show percentages of the ingredients used. This amounts to legislation requiring the disclosure of the manufacturer's formula. Opponents of this kind of legislation call it unconstitutional, because, they say, it amounts to depriving a person or his property (or formula) without compensation or due process of law. Proponents of such laws claim the disclosure of percentages of ingredients of commercial feeds on the label is necessary to protect the purchaser against fraud and misrepresentation. Feed control officials have generally not favored this

MINNESOTA DEPARTMENT OF AGRICULTURE DAIRY AND FOOD.
DIVISION OF FEED AND FERTILIZER CONTROL.



BASAL RACHITIC DIET, FREE FROM VITAMIN D. CONSISTED OF YELLOW CORN MEAL 59%, CRUDE DOMESTIC CASEIN 12%, WHEAT FLOUR MIDDLINGS 25%, TRI-CALCIUM PHOSPHATE 1%, CALCIUM CARBONATE 1%, SALT 1%, DRIED BAKERS YEAST, 1%.

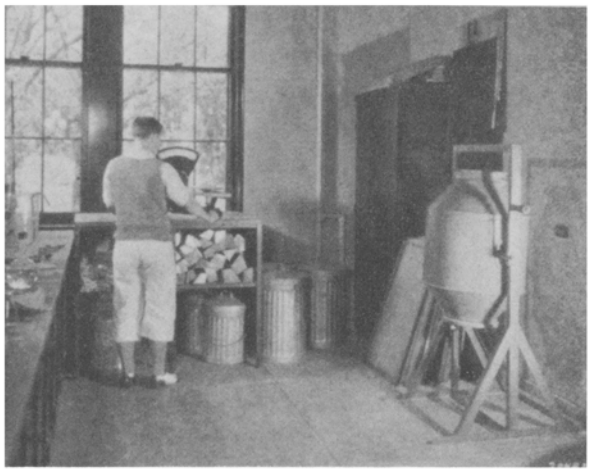
PERCENTAGES OF BONE ASH PRESENT IN LEG BONES OF CHICKENS AFTER FEEDING TESTS.

PER CENT OF OIL IN RATION	NEGATIVE CONTROL- CORN OIL	PERCENTAGES OF BONE ASH No. 1	No. 2	No. 3
1/4%		47.20%	43.95%	47.25%
1/2%		47.63%	48.39%	47.95%
1%	33.19%	48.64%	47.58%	48.62%

legislation, not on the ground of its unconstitutionality, but rather because suitable and dependable methods are not available for enforcing such acts. So far as I am aware no state has yet enacted laws requiring the percentages of *all* ingredients in compounded feeds. A few however, do require the percentages of some ingredients under certain circumstances. Some manufacturers have voluntarily shown on their labels, the formulas or the percentages of ingredients. Such feeds are called open formula feeds.

The provisions of some state laws, the introduction of open formula feeds, and the requirements of certain definitions and standards already adopted have placed upon the feed control chemist the obligation of devising methods for the detection of minute amounts and the estimation of percentages of ingredients. During the past few years some progress has been made. A referee of the Association of Official Agricultural Chemists has conducted, in collaboration with other chemists, studies of methods for the determination of grit, hoof meal, oat hulls, dried buttermilk and other substances. In these tests the chemists often resorts to the

use of sieves for the purpose of concentrating in one fraction the substance he desires to identify or determine the percentage of. The



Vitamin testing laboratory showing weighing of chicks, feed mixer and feed storage room

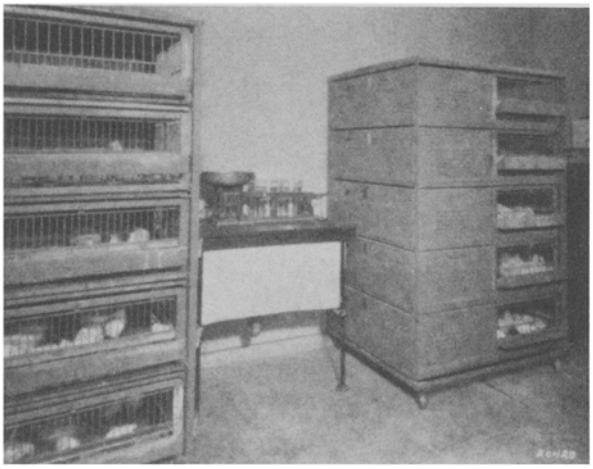
use of liquids of different densities has been a valuable aid in making separations of certain substances from the bulk of a mixture. The use of stains such as methylene blue and gentian violet are also valuable both for identification and estimation of certain ingredients.

The Sterling method for the determination of hoof-meal and horn, which are prohibited by definition in animal by-product feeds, has received considerable study. While the results reported by this method show wide variation, it is expected that results will improve when analysis have had more experience with it. This method for determination of hoof meal depends upon the separation, by use of chloroform, of the meaty portions of the product from the bone portion and the enzymatic digestion of the matter that floats.

H. E. Gensler, the referee referred to, reports that he has examined specimens of hoof-meal both raw and treated with the Hanovia ultra-violet quartz lamp and has found that the fluorescence given off by this material was so definite and characteristic that when various quantities of hoof were added to meat scraps it was possible to detect as little as 1 per cent. He also made similar studies with dried buttermilk and found it possible to detect even traces of this substance.

Perhaps the most interesting as well as the most important development from the standpoint of nutrition is the widespread and popular attention recently given to vitamins. Research work done in nutrition laboratories throughout this and other countries has stimulated the interest of the public in the vitamin values of both human and animal foods. Manufacturers of products consumed by animals have been quick to take advantage of this interest. Products are prepared and placed on the market with labels making claims for the presence of all the vitamins from "A" to "G." To determine the propriety of making such claims on labels is a task for which the average feed control chemist is hardly equipped, either by training or experience, to perform.

Fortunately, there is only one vitamin commonly lacking in the rations used in animal feeding. This is vitamin "D," the absence of which will cause rickets in growing animals or poultry. A feed which is deficient in calcium, phosphorus and vitamin "D" is called a rachitic ration because it does not have the property of preventing rickets in growing chicks and young animals. If a substance rich in vitamin "D" is added, even in small amounts, to a rachitic ration, it enables the growing animal to assimilate the calcium and phosphorus properly. The ration is then said to be anti-rachitic because birds and animals to which it is fed develop strong healthy bones with the proper amount of calcification. Since good cod liver



Electrically heated brooder cages and scales for weighing the feed

oil is rich in vitamin "D," it is that material which has been most commonly added to rations for growing chicks. Cod liver oils from differ-

(*Continued on page* 48)

RECENT DEVELOPMENTS IN STATE CONTROL OF FEEDSTUFFS

(*Continued from page 42*)

ent sources and produced under good and bad conditions of manufacture are apt to vary in vitamin "D" value. Substitutes for cod liver oil also have appeared on the market recently. The testing, therefore, of cod liver oils, their substitutes and allied products, becomes an important matter in the protection of farmers, feeders, and other purchasers.

No dependable quantitative chemical tests have been devised for determining the comparative value of products having vitamin "D" potency. The only approved method of assay is the experiment involving the actual feeding of rats or chicks under the most carefully controlled conditions. Since, from an inspection standpoint, practically no previous work had been done, it became necessary to establish a procedure of testing peculiarly fitted to the needs of feed control work. This matter was considered at the last two meetings of the American Association of Feed Control Officials. In October, 1930, the association adopted a tentative definition for cod liver oil. This definition reads: "Cod liver oil is the product obtained by extraction of part of the oil from cod livers. It shall be labeled vitamin 'D' substandard cod liver oil if its vitamin potency, when measured by the Association of Official Agricultural Chemists' tests, fails to produce the minimum calcification as accepted." The A. O. A. C. was then asked to appoint a referee whose duty it would be to conduct, in collaboragations of methods and procedures for vitamin tion with chemists of the various states, investitesting. This appointment was made and a report of the referee will undoubtedly be presented to the next convention of the A. O. A. C.

The Wisconsin Feed Control Laboratory was the first state inspection laboratory to undertake the testing of cod liver oils for vitamin potency. In September, 1930, the Minnesota Feed Control Division entered into a co-operative agreement with the Division of Agricultural Biochemistry of the University of Minnesota, whereby a vitamin testing laboratory was established at University Farm. Prof. L. S. Palmer consented to supervise the scientific work and to act in an advisory capacity. The actual testing and the experiments were performed by L. L. Lachat, a graduate of Pennsylvania State College, who was employed by the Department for this purpose. So far as known, the Wisconsin and the Minnesota laboratories are the only state control departments attempting to regulate the labeling and sale of products claiming vitamin potency by routine testing.

After several months of preparation and after the installation of equipment in this laboratory, work on the problem of finding a suitable basal rachitic ration and developing a standard method of procedure was undertaken. Much difficulty was encountered before a satisfactory dry basal ration was found. Such a ration had to meet the requirements of producing severe rickets in young chicks after five or six weeks of feeding and still not cause too many deaths, while giving a reasonable amount of growth. After nine months of careful investigational work on a large number of rations, our laboratory, in co-operation with the Wisconsin laboratory, selected what was considered the most satisfactory basal ration and agreed on a uniform method of procedure. This ration and method of procedure will undoubtedly form the basis for testing products for vitamin "D" in the state feed control laboratories in this country.

The basal rachitic ration now used is one of several suggested for this purpose by Prof. E. B. Hart of the University of Wisconsin. An article by Hart, Kline and Keenan, published in *"Science"* of June 26, 1931, discusses, in some detail, the requirements of a good basal ration and outlines their technique for a feeding test.

The ration contains the following ingredients and percentages:

	Per cent
Yellow corn	59
Wheat flour middlings	25
Crude domestic casein	12
Dried baker's yeast	1
Sodium chloride	1
Calcium carbonate	1
Calcium phosphate (tribasic)	1

In preparing this ration, the ingredients needed for it are carefully cleaned and ground

to pass at least a 16 mesh sieve. Extreme care is taken in weighing and mixing so as to insure that each bird shall receive the proper proportion of each ingredient. The cod liver oil or other oil is not allowed to stand mixed with the ration but is added immediately before feeding.

A brief outline of the method of procedure may be of interest. Day old white leghorn chicks were decided on as more satisfactory for the test than white rats. The chicks are divided into groups of ten to fifteen each. Each group is weighed collectively on the day the experiment is begun. Thereafter, at weekly intervals for five weeks the chicks are weighed individually and records kept of the weights. At the end of the first week each chick is identified by a metal tag attached to its wing. The number of groups used on the test will depend upon the number of levels at which it is desired to test the oil or other vitamin bearing product. In our laboratory, for each product tested, we generally use three groups of chicks in addition to the negative control group. One control group may serve for several products being tested at the same time. The control group is fed the rachitic ration without any addition except that 1 per cent corn oil, which contains no vitamin "D," is added. The other three groups receive the same rachitic ration with the addition of ¼ per cent, ½ per cent, and 1 percent cod liver oil or other product being tested. Corn oil, in an amount to make the total oil 1 per cent, is added to the rations in which less than 1 per cent cod liver oil is used. Each group of chicks receives daily a supply of fresh iodized distilled water. The feeding troughs are filled with feed as soon as they are emptied and careful records kept of the feed consumed by each group.

At the end of the feeding period the birds are killed and the left tibia or lower leg bone of each is removed and dried. Each tibia, after drying, is placed in a filter paper container, crushed in a vise and extracted with hot alcohol for 20 hours in a specially prepared continuous extraction outfit. The bones are then extracted with ether for 20 hours. After drying they are weighed and ashed in an electric furnace. The percentage of ash is determined on the individual tibiae, each representing one bird. The results are calculated on the basis of the extracted and dried bone. Comparison of the average percentage of bone ash in the control group with the average percentage in each other group, shows the effect of the addition of each quantity of vitamin-bearing oil or other substance. In our experiments the spread in the bone ash content between the control group and groups receiving the basal ration plus ¼ per cent to 1 per cent good cod liver oil has been about 15 per cent. The average bone ash from the group of chicks fed the rachitic ration has been approximately 33 per cent. This has been increased to about 48 per cent in groups fed the same ration with the addition of ¼ to 1 per cent good cod liver oil.

One of the objects of our preliminary experimental work was to reduce, as much as possible, the length of time required to complete a test. In some of our earlier experiments we fed the chicks for seven or eight weeks. As can be imagined, a great objection to this biological method of testing is the expense involved, not only because of the time requirement, but also because of the amount of equipment and supplies needed. Therefore, any improvement such as the shortening of the period of feeding is of great importance. Very satisfactory tests are now being made with five weeks of feeding. It is likely that further work will improve and shorten the method of testing still more; which improvement should hasten more general adoption of vitamin testing in control laboratories.

Government Bids Opened

On February 15th the Purchasing Department of Panama Railroad Company, 24 State street, New York City, opened bids for large quantities of miscellaneus supplies for use in the Canal Zone, including fifteen cases of yellow naphtha laundry soap each containing one hundred 10 ounce cakes, ten barrels of sal soda, five cases each containing twenty sets of six candles per set, sixty-five cases washing powder containing 100 8-ounce cartons each, fifteen cases washing powder containing 24 3½-pound cartons each, one hundred seventy-five cases brown or white wrapped laundry soap containing 100 9-ounce cakes each, twelve hundred cases brown or white unwrapped laundry soap containing 60 16-ounce cakes each, thirty-five cases powdered lye of 48 No. 1 tins each.