It's No Longer "Just Chicken Feed"—Now a Product of Scientific Nutritional Research

C. R. Grau

It wasn't so very long ago that "chicken feed" meant something of little or no value, some feed that was given to chickens in the hope that eventually a chicken dinner might result. But when you pass off something as "just chicken feed" today, you may not mean what you say.

The tremendous business of producing and manufacturing feeds for poultry is now one of California's major industries, one that is based on the firm foundations of scientific investigation. As the feed and poultry industries developed, they recognized the role the Division of Poultry Husbandry could play in reinforcing a foundation on which the industry rested—the science of nutrition.

Many times pure research has uncovered facts that appeared to be of little practical importance at the time, but which later assumed great significance. Like other sciences, the science of nutrition can supply many examples of the value of basic research.

In the Poultry Division, for example, experiments were begun a few years ago on the effects of riboflavin (known then as vitamin G) on the hatchability of eggs from hens fed various diets. Soon it was found that riboflavin deficiency causes death of the embryos, and that certain characteristic changes in the kidneys and feathers were usually identifiable in the embryos.

It so happened that about this time a number of hatchery operators sought the help of the Division in order to determine the cause of the low hatchability which confronted them. Hereditary and managemental factors were ruled out as causes, and the suspicions were centered on the feed. Examination of dead embryos by staff members who were familiar with the symptoms of riboflavin deficiency indicated that these embryos died as a result of this deficiency. When rich sources of the vitamin were added to the hens diet, incubation produced normal, healthy chicks
Bunyi ad of deformed, dead embryos.
Flour C ng the last year, a continua-
and Or f these hatchability studies
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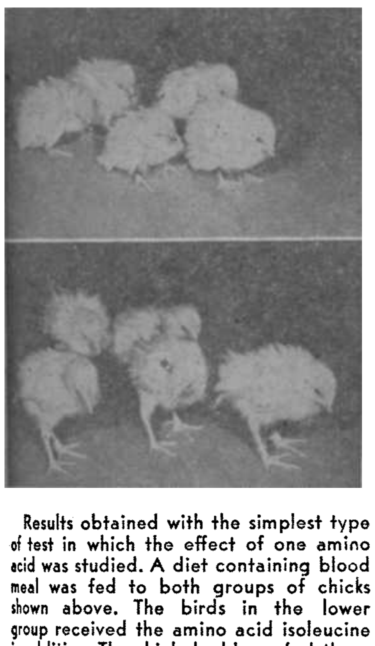

Results obtained with the simplest type of test in which the effect of one amino acid was studied. A diet containing blood meal was fed to both groups of chicks shown above. The birds in the lower group received the amino acid isoleucine in addition. The chicks had been fed these diets only 10 days when the picture was taken.

the deficiency, such as there were with lack of riboflavin.

Required Nutrients

Chicken feed contains a number of things besides vitamins, principally carbohydrates, fats, protein, and minerals. Now all these are important, but the proteins and minerals are most likely to give trouble in practical diets. During the war, there were plenty of occasions to use all our available information about proteins, because normal supplies were reduced or cut off, new ones became available, and every pound was precious.

When we talk of proteins we are really talking about the various amino acids which are combined in the form of proteins, and when we talk of protein needs we really mean amino acid needs. Not all proteins are alike in their amino acid contents, and not all amino acids are alike in what they do to the body. Just as a chick needs a number of vitamins, so it needs a number of amino acids—at least 11 different ones, and probably more for best growth. We now know which of these 11 are likely to be lacking in the usual chicken feeds, and how to combine proteins so that one can help out another.

Determining Deficiencies

The poultryman might ask, "How can I recognize amino acid deficiencies?" The answer is that, unlike vitamins, where such symptoms as rickets or curly-toe paralysis may result, the amino acids have only an effect on growth, and all deficiencies look alike. This simply means that the reasons for the poor growth must be figured out from the feeds being used. By chemical analyses, the amino acid contents of many feeds have been determined, and from these data and the requirements, the deficiencies in the protein were estimated. Feeding trials in which pure amino acids are added to the proteins confirmed these results in almost all instances.

Protein Concentrates Tested

Among the protein concentrates that have been studied, and the amino acid deficiencies that they exhibit, are soybean meal (methionine), sesame meal (lysine), milk (arginine and glycine), corn gluten meal (lysine, tryptophane, and arginine), cottonseed meal (lysine and methionine) and peanut meal (methionine and lysine). In the above list, the principal deficiencies are listed first.

Sardine meal and sunflower seed meal are good sources of all the amino acids for the chick, and, in addition, supply some of the amino acids—particularly methionine, lacking in other feeds. Sesame meal is an excellent methionine source, and even though it is deficient in lysine, it can be used efficiently by combining it with soybean meal, which is deficient in methionine, but carries an excess of lysine over the requirement.

The Poultry Division has confirmed reports from other areas that fish solubles, a by-product of fish meal production, supplement diets high in soybean meal and corn, and that this effect is not caused by the riboflavin or protein content of the solubles. However, when barley and fish meal replace some of the corn and soybean meal, fish solubles supplement the diet only to the extent that they furnish riboflavin to it.

Mineral Requirements

Studies of the mineral requirements of chicks have revealed that a deficiency of magnesium causes a lesion in the cerebellum (part of the brain) of chicks, which, in turn, causes incoordination during walking, convulsions, and even death. This particular brain condition is not observable with the naked eye as is that of vitamin E deficiency. When vitamin E is lacking, similar symptoms are observed but the fundamental causes of the symptoms are quite different.

These and other nutritional studies are being continued and expanded as facilities and personnel permit. Much of the work that needs to be done lies in the application of present knowledge to commercial conditions; of equal importance, however, is the study of the fundamentals of nutrition, since only thus can some of the poultry industry's very practical problems be solved.

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The Division of Animal Husbandry is making a series of digestion trial studies on a wide variety of new feeds for livestock.

Avocado Tree Decline Report Shows Progress

Condensed from a report by Robert W. Hodgson, Assistant Dean of the College of Agriculture, covering a two-year study of Avocado Tree Decline conducted cooperatively by the divisions of Irrigation and Soils, Horticulture, Plant Pathology, Soils and Plant Nutrition and Orchard Management of the College of Agriculture, Los Angeles and Riverside campuses.

In many cases the primary cause of the spread of avocado tree decline is the progressive extension of a condition of waterlogging from a center where it first developed to surrounding areas which in turn become waterlogged and develop tree decline.

Tree decline has been confined largely to fullbearing orchards and not infrequently has seemed to follow a period of heavy production.

In some orchards the development and spread of the decline seems to have been promoted by the installation and careless use of sprinkler irrigation, which resulted in waterlogging the soil in areas formerly unreached by furrow irrigation.

Excessive Water

A close correlation has been found between unfavorable moisture conditions in the root zone and the occurrence of tree decline. In most cases it occurs on shallow soils with poor underdrainage, though it has been found on heavy soils where water penetration is slow. Excess water in the root zone invariably is associated with the trouble.

Surface paper coverings applied in three orchards to prevent excessive wetting from rainfall have stimulated healthy root development near the soil surface but the trees have not improved.

It is indicated that irrigations must be light and frequent enough on the shallow soils where the trouble is prevalent to maintain available moisture in the root zone and at the same time prevent its accumulation above the impermeable subsoil layers.

Fungus Usually Present

The fungus, **Phytopthora cinnamomi,** was recovered from the roots of aproximately 80 per cent of the declined trees examined in an intensive field survey, and about 20 per cent from nearby trees presumably healthy.

There is little doubt that the fungus plays an important role in avocado tree decline. When the fungus is present decline is both more certain and more rapid.

The possibility exists that this fungus has been, and is being, spread through the medium of the soil in the balls surrounding the roots of nursery trees.

Rootstocks Studied

No relationship has been found between rootstock and the occurrence of decline.

Much of the greater part of the commercial acreage is on Mexican race rootstock seedlings but the work done to date has failed to reveal evidence of differences in resistance within this horticultural race. New plantings on Mexican rootstocks, on Guatemalan, and on a West Indian race rootstock have failed consistently in decline areas.

Avocados and Citrus

In limited pot-culture trials in waterlogged soils, the avocado was much more sensitive to injury than citrus seedlings. In soils taken from decline areas, avocado seedlings have not responded to applications of various fertilizers.

Fairly extensive replanting trials indicate that good replants occupy spaces where lemon trees, rather than declined avocado trees, had been. There is little doubt that citrus trees generally succeed as replants in areas where avocado trees have declined, and vice versa.

Negative Findings

Field trials with soil nutrients, disinfectants, absorbents and amendments have failed to cause improvement in affected trees.

Injections, both in the trees and soil about their roots, with hormones and vitamins, have been without effect.

No permanent benefit is likely to result from pruning affected trees.

No authentic cases of complete recovery from decline have been observed.

Recommendations

Avocado trees should not be planted on soils which have poor or very slow drainage, or are too shallow for economical or effective drainage.

It may be possible to delay or prevent the occurrence of decline by the installation of intercepting drains and by special care with reference to soil management practices.

The use of other tree fruits or crops is recommended for areas where avocado trees have declined. Replanting decline areas with avocado trees has not been successful.

New Methods Developed For Fruit Dehydration Make Superior Product

Steam-blanching of pears prior to sulfuring makes possible a dehydrated product superior to the sun-dried fruit.

Grading of the fruit for size and maturity before cutting is the only change in the usual procedure until after the pears are trayed. Such grading will avoid uneven drying in the dehydrater.

Pre-sulfuring

The freshly trayed pear halves go directly from the cutting shed to the sulfur house for a 20 to 30 minute exposure to dense sulfur smoke. This short pre-sulfuring sets the color of the fruit and aids in retaining the desired translucency in the finished product.

Boiler to supply steam for cabinet blancher.

Steam-Blanching

The cabinet type of blancher is preferred for pears, which require from 20 to 30 minutes of blanching, depending upon the size and maturity of the fruit.

The rate of heating in the blancher and the rate of cooling on the trays after they are removed, are influencing factors governed by plant conditions and equipment and must be learned and taken into account by the operator.

After the trays are removed from the blancher, the surface temperature of the fruit drops rapidly if the heat can escape easily. If the stack is confined so that the heat cannot escape readily, the fruit cools slowly and tends to overblanch.

The fruit must be allowed to cool to a lukewarm temperature before entering the sulfur house. Otherwise, the absorption of sulfur dioxide is very poor and the keeping quality of the pears will suffer.

Sulfuring

The sulfur house must be tight against the loss of sulfur dioxide. It may hold one or more stacks, but it must provide space for the sulfur buckets and circulation channels for the fumes to move freely about each tray.

A successful practice is to use four stacked cars in a five-car house. By centering the four cars, sufficient space—about two feet—is left at each end of the house for the sulfur buckets. For convenience in replacing the empty buckets, a door approximately 32"x34" may be hung in the house ends, particularly in the rear. Ventilation for the burning sulfur may be supplied by holes bored in the doors.

The construction of the sulfur house may be of concrete, brick, plywood, or matched lumber sheathing with asphalt building paper on a wood frame to make it air tight.

Sulfur is used at the rate of 12½ pounds in each bucket for a five-hour burn. A four stack house will require two buckets every five hours. Therefore, the usual overnight, or 10 hour sulfuring will burn 50 pounds of sulfur.

Each stack of trays should be sulfured for 10 or 12 hours instead of the 36 to 48 hours required for unblanched pears.

Only the best grade of flowers of sulfur can be used successfully. Spray or dusting sulfurs are not suitable. Impurities will rise to the surface of the molten sulfur to form a slag which will suffocate the burning.

Ashes of sacking, grass or other materials used to ignite the sulfur and left to burn with it will accumulate to form a suffocating slag. New buckets should be washed with soap and water to remove any oil clinging to the surfaces. Buckets in use should be emptied and cleaned every few days.

Dehydrating

Freshly sulfured fruit loses sulfur dioxide rapidly while standing in the open air. It is essential that the trays move from the sulfur house to the dehydrater without loss of time.

In the dehydrater two fundamental changes in the fruit take place; the evaporation of water and of sulfur dioxide. The ideal is to remove the moisture from the fruit tissue as quickly as possible and to make the loss of sulfur dioxide as slow as possible. The shorter the drying time for pears, the better the sulfur dioxide retention.

The principal factors contributing to a short drying time are a high air flow and a moderate humidity on the cool end of the dehydrater tunnel. The difference between the dry and the wet-bulb temperatures at the cool end should never be smaller than 15 deg. F.

Another important factor is to stagger cars over various tunnels with sufficient spacing of time. Blanched fruit yields its moisture quickly and there is a fast build-up of humidity in the tunnels if the cars are moved in too frequently.

The cars should be pulled from the dehydrater at a fruit moisture content of 30 to 35 per cent. When the fruit has cooled and the desired moisture content reached, it should be scraped from the trays and packaged immediately or stored in clean wooden boxes. The rate of drying in storage is reduced if the boxes are stacked close together in a cool place.

Single-car cabinet blancher. Steam distribution pipes are at back of cabinet and on door.

The new procedures in cut fruit dehydration described briefly herein were applied successfully to part of the 1946 pear crop under the cooperative direction of E. M. Mrak, H. J. Phaff, Associate Professors of Food Technology, Berkeley, and R. L. Perry, Associate Professor of Agricultural Engineering, Davis. Prior research establishing the basic procedures later adapted to pears was done with D. L. Marsh, Gordon MacKinney, Associate Professors of Food Technology, Berkeley, and A. S. Crafts, Professor of Botany, Davis.

A continuing study is under way by the Division of Soils and Plant Nutrition to determine the net fixation of nitrogen from legumes and nonlegumes under irrigation agriculture, leaching losses of nitrogen, actual crop removal, and net unaccounted-for losses of nitrogen.