

could be given to chickens of any age; and the virus did not spread from vaccinated to susceptible pen mates.

In spite of the desirable characteristics of the vaccine against most strains of Newcastle disease virus, studies demonstrated that none of the vaccines can be relied upon to completely prevent infection and the spread of the exotic disease strains of the virus (VVND).

Most recent investigations, however, showed that Newcastle disease virus induces a cellular immune response and that the degree of immunity differed with the strains of the virus and was influenced by the route of their administration.

Of greatest importance among solutions being investigated is the development of a means to protect birds during the first 3 to 5 weeks of age, when they are immunologically incompetent and cannot respond to any vaccine. This period of vulnerability to diseases emphasizes the need for improving our immunization programs for preventing and controlling diseases to maintain healthy and profitable poultry flocks.

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## Alternative feedstuffs

Food production in California creates a variety of by-products that have potential as poultry feedstuffs. To make the best use of these by-products, we are analyzing their value as poultry feed and are developing ways to overcome any limitations they may have.

**Rice bran.** In areas where considerable rice is milled, rice bran is readily available for animal feeding. It differs considerably from wheat bran and usually has approximately 12 percent protein, 12 percent fiber, and 12 percent or more fat. When it is used as a substitute for cereals in a feed for chickens, it has been found to depress growth by approximately 30 percent when fed as 60 percent of the feed. This adverse effect cannot be noted at the 10 to 15 percent level.

Such growth depression can be prevented by steam-treating the bran. This treatment destroys both trypsin inhibitor and lipase activity in the raw rice bran; but there is evidence that neither of these is responsible for its growth depression. The metabolizable energy of the rice bran is approximately equivalent to that of wheat and is not altered by the steam treatment. To date, no simple method has been found to treat rice bran to improve growth. Without treatment it can be used satisfactorily in both starting and laying rations at the 10 to 15 percent level. Since the fat in rice bran is very unsaturated, the bran should be used promptly to prevent rancidity. Bran from parboiled rice is of better feeding value than raw paddy rice because the fat is stable and the growth inhibitor has been destroyed by parboiling.

The amino acid composition of rice bran protein is more favorable nutritionally than that of most other cereal proteins. This could simplify the need to supplement rations containing rice bran with other protein sources. The rice seed itself also has better quality protein than most other cereals and one would expect that a by-product based upon rice, such as dried brewer's grains, would have nutritive value superior to similar products derived from other cereals.

**Cottonseed meal.** Cottonseed meal has had limited use in poultry rations because of the presence of gossypol, which has an adverse effect on egg quality. While its effect can be reduced by using a strain of cotton with low gossypol content or by using a prepress treatment before solvent

extraction to remove the oil, these methods have not entirely removed the possible dangers in using this meal in laying rations. Work is in progress testing a new solvent for its potential in producing a meal with lowered gossypol content and possibly reduced aflatoxin content as well.

**Triticales.** Triticales are newly developed cereals from crosses between wheat and rye. We are evaluating nutritive values of triticales and other cereals. Triticales can replace corn, wheat, and milo in all plant protein diets of growing coturnix. Layer diets for coturnix containing 90 percent triticale can be formulated if the protein content of the triticale sample is about 16 percent. The egg production of birds on such diets is comparable to that of birds on conventional diets.

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Harris Hawks at the UC Davis Raptor Research Center.

## Raptor research

Raptors, or birds of prey, include such familiar forms as hawks, eagles, and owls. Many species of raptors are valuable to agriculture as biological control agents, feeding on rats, mice, and birds such as starlings. Reductions in the populations of some species due to pesticide poisoning has focused attention on these birds, and new knowledge of the basic biology of raptors is essential to any management program.

Our raptor program involves the following major projects: (1) the effects of rodenticides on raptors; (2) development of artificial diets for captive raptors; (3) studies of the seasonal variations in energy requirements and metabolism of owls; (4) development of endocrinological methods to be used in an assessment of the reproductive status of the wild population of California condors; and (5) breeding of Harris' Hawks in captivity.

These studies are in the preliminary stage, and few conclusions are available. However, the rodenticide research indicates that some species of raptors are much more susceptible to the poisons than are others. The work with diets for captive raptors shows that appearance and texture are important in food acceptability by Red-tailed Hawks. Disguising foods by covering them with animal skins resulted in visual acceptance of prepared foods, but acceptable textures of purified diets are yet to be obtained.

*-W. W. Weathers*