Poultry Husbandry Report, 1949

progress report of advances in poultry research conducted during 1949 by the staff of the division

The following report was prepared by the staff members of the Division of Poultry Husbandry under the direction of Professor L. W. Taylor, Chairman of the Division of Poultry Husbandry, and Poultry Husbandman in the Experiment Station, Berkeley.

Amino acid studies with chicks indicated that a protein source that is slightly deficient in lysine, or in total methionine plus cystine, will be unsatisfactory when fed at levels to provide a 20% protein diet, yet may be satisfactory when fed to provide a 30% protein diet. Amino acid requirements increase as the protein level is raised, but the requirements do not increase as rapidly as does the protein level. This effect is observed only with a borderline deficiency at a low protein level. A severe deficiency will not be overcome by increasing the protein even to very high levels.

When some amino acids are fed in amounts greater than are required by the chick, growth is depressed. The growth-depressing effect of excess methionine has been found to be overcome by increasing the level of total protein. All of this work emphasizes the importance of an existing balance between amino acid levels and total protein levels.

During the studies on the amino acid requirements of laying hens, it was observed that hens fed purified diets often fail to lay their eggs at the normal time, and may hold them in the uterus from a few extra hours to as long as a month. The cause for this failure remains unknown. In these studies, a number of malformed eggs were observed, because the first egg held in the uterus was pushed against a second egg coming into the uterus. When these two eggs are laid, the first is found to have a sandy shell, while the second is found to have a smooth, malformed shell.

A deficiency of lysine in a ration for turkey poults resulted in pigmentation failure causing a white bar to develop in the flight and tail feathers. The amount of lysine required to prevent the white bar increased as the protein level of the ration was raised. D-Lysine was found inactive for promoting growth or for the prevention of the white bar. No pigmentation failure was noted when high levels of molybdenum were fed, although this element causes pigmentation failure in other animals.

Growth Inhibitors

Studies are continuing on the mechanism of the action of the growth inhibitors in raw soybeans. Chicks with artificial anuses were prepared so that feces could be studied separately from urine. It was found that more methionine passed through the gastrointestinal tract unabsorbed in the chicks fed raw soybeans than in those fed the heated beans.

Alfalfa meal as ordinarily used in chick rations—5% or less—does not cause retarded growth in chicks. As the level of alfalfa meal in the ration is increased above 5% of the chick ration an increasing degree of growth depression is obtained.

An inhibitory substance was obtained from alfalfa meal by extraction with hot water. Fractionation of the water extract showed that the inhibitor was soluble in 50% and 80% ethyl alcohol and could be precipitated from an aqueous alcohol solution by the addition of acetone. The properties of the inhibitory fractions suggested that the growth depression might be caused by the presence of one or more saponins. When cholesterol was fed in a ration containing 20% alfalfa meal, the growth depressing effect was largely counteracted. If the absorption of cholesterol was increased by including cottonseed oil in an alfalfa-cholesterol diet, there was no growth depression by alfalfa meal.

Feeding Trials

A number of chick-feeding trials have indicated that yeast culture, a product containing a small amount of live yeast, has a growth-promoting action in cockerel chicks when fed at 2% of the diet. Although this observation has been made a number of times, the reason for it is unknown. There is no apparent effect on pullet chicks. The effect on the growth of cockerels is rather small—only about 5% faster with diets containing yeast culture than with diets containing no yeast culture.

Dried raw potatoes caused a reduction in growth and lowered feed efficiency in both chicks and poults when fed at 20% or 40% of the ration. Dried cooked potatoes fed at 40% of the ration caused only a slight depression in growth and probably a somewhat lower level could be used satisfactorily in poultry rations.

Studies were made on the quality of soybean oil meals on the market. Two samples were picked up in the eastern United States and six on the Pacific Coast. Five samples were prepared by the solvent process and three by the expeller process. They were assayed for antitrypsin and fed to chicks in practical chick rations. No important difference could be detected in their quality.

Chick rations are also being formulated to utilize whole soybeans instead of soybean meal. Preliminary studies indicate that whole soybeans, properly processed, may be used in considerable amounts in chick rations.

Breeding Methods

The question of how much attention should be paid to the family average relative to that paid to the individual record has always been of importance to the breeder. Results of experimental study in 1949 confirmed the theory worked out by investigators in the field of population genetics that the relative weight to be given to family averages depends on the degree of heritability of the trait under selection. When heritability is low—for instance, 5% for hen-housed egg production—the family should be given considerably more weight than the individual performance. Thus for the example given as a guide in selection, a full-sister family average with eight birds to the family is worth 6½ times the record of any individual in it. A smaller family may be of relatively less value. Thus the hen-housed average of four sisters is only 3½ times as valuable as an individual record.

With characters of high heritability, the optimum family weighting is much lower. For instance, in egg weight—where heritability may be tentatively estimated at 50%—a family average based on as many as eight daughters is only 1½ times as valuable as an individual record.

Inheritance in Chickens

Still further advances over last year can be reported in the selection for the tendency to produce blood spots. Of the eggs laid by the birds in the selected line, 22.80% contained blood spots, as compared to 1.35% in the production-bred line. The latter line has also shown an

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increase in the hen-housed average egg production, reaching the figure of 224.7 eggs. This represents an increase of about 100 eggs per bird over the foundation stock. Continued selection for shank length in yet another line failed to show progress in the last year. The possible reasons for this are being investigated.

The hereditary nature of crooked toes in the University flock of S.C.W. Leghorns has been established. Incidence of crooked toes in the selected crooked-toe line was 97% in 1948 and 94% in 1949 while that in the production line was 5.6% and 1.7%. Numerous matings within and between crooked-toe and production-bred lines have been made to determine the manner of inheritance of the defect. Further studies on the inheritance of shell thickness demonstrated beyond doubt the existence of a significant maternal effect. The shell thickness of eggs produced by a bird thus depends not only on its own genetic constitution but also on the properties of her dam transmitted in a manner other than through her chromosomes.

Inbreeding of eight lines of chickens selected in different manners has been continued. The average coefficients of inbreeding in them now range between 32% and 52%. A study on the reproductive behavior of the inbred lines was completed, indicating that the major effect of inbreeding on reproduction was in relation to reduced hatchability, while other characters such as egg production in the hatching season, fertility and early mortality varied in their response from line to line. In general, however, birds with higher coefficients of inbreeding within a given line tended to have fewer offspring than those relatively less inbred.

Turkeys

The growth data for different strains of Bronze turkeys show that the difference in rate of growth between faster growing and slower growing birds occurs during the first two or three months, with normally little, if any, difference in rate of growth thereafter. The inheritance is more or less characteristic of quantitative characters and shows every indication of being readily modified by selection.

In crosses between a fast and a slow growing strain of Bronze turkeys, the offspring grew at about the same rate as the faster growing parent. On the other hand, in crosses of the fast growing Bronze strain with the Beltsville Small White turkeys, the crossbreds were intermediate, which agrees with published information from the United States Department of Agriculture.

One hundred Bronze and Bronze-red males were handled in a Regional Turkey Breeding Project and the sperm production estimated quantitatively once a week, starting in the fall of 1948. These were handled through the entire first year and the 84 survivors continued into the second year. Six of these males are being used to start a breeding test. The factors considered in selecting these breeding males were: *1*, maturity; *2*, pausing; and *3*, persistency.

Maturity indicates the age at which sperm were first produced. Pausing means that the bird produced semen for several months, then ceased to produce semen for one or more weeks, after which semen production was resumed. Persistency refers to the major fall—and summer—period of sperm production. Some males produced semen continuously, others stopped producing semen before August first and remained nonproductive for several months—with some still not in production by January.

While the statistical analysis of the data has not been completed, it is apparent that there are differences in maturity, pausing, and persistency; also probably in amount of semen produced.

Most of the males of one strain of Bronze turkeys proved refractory—yielded only negligible amounts of semen. The progeny of a cross of fertile turkeys of this line with a nonrefractory strain were all nonrefractory so far as tested this year.

Artificial Light for Hens

Analysis of the records obtained during the last several years indicates that while hens started on all-night lights come into egg production a little earlier than those given a 14- or 15-hour day, the average egg production up to the end of May is not significantly affected by length of day, provided the birds are given 13 or more hours. All-night lights have, however, increased the percentage of waste eggs as compared with birds given a 13-, 14-, or 15-hour day. The difference is mainly in broken and thin-shelled eggs that are not suitable for hatching. Birds on all-night lights lay somewhat more eggs before the end of March, and significantly fewer eggs after that time, than birds on about a 14-hour day. One small pen started on all-night lights and then changed to a 14-hour day when all were laying showed about the same pattern of egg production as birds on a 14-hour day, including fewer waste eggs.

Egg Washing Trials

In a program of egg washing in two different field trials, approximately 79,000 eggs were treated in different ways, broken and examined. From these studies, the conclusion is inescapable that the washing of eggs is a risky business. The only safe eggs for storage were clean unwashed eggs. Unwashed light dirties were almost as safe. Results with washed eggs were completely unpredictable, but practically all eggs that spoiled in storage had been washed.

Environmental Studies

Poultry environmental studies were made in the climatic chamber. The effect of humidity was not noticeable at 70° F and 85° F, but high humidity had an adverse effect when the temperature was 100° F. The reaction of hens and pullets to high temperature was also studied. The difference between them was not great.

The body temperature of laying hens was shown to be influenced by fasting. A variation of body temperature with different times of the day and night was noted in birds kept under constant temperature conditions for the first few days; afterwards under continuous lights the diurnal rhythm disappeared.

When birds were kept constantly at 90° F, cooling the drinking water increased water consumption and lowered body temperature. When water was withheld for 24 hours, only a short interruption of egg production was observed. When water was withheld 48 hours, some of the pullets returned to production only after a partial molt. Withholding water reduced feed consumption drastically.

The temperature inside chick boxes was studied at different room temperatures. The main purpose of removing plugs from chick boxes is to remove the excess heat produced. The use of larger chick boxes and replacing sections cut out of the lid with muslin gave best results in hot weather.

Chicken Flavor

The flavor of chicken has been separated from soup stock and fractionated into several components. Attempts have been made to characterize the important constituents.

From a study of the characteristics of the flavoring compounds it would appear that maximum evolution of odor occurs at pH 5.0–6.0—pH means the measurable acidity and alkalinity. Alkaline stock has very little odor and slight flavor.

Antemortem treatment appears to influence the flavor of the stock. Meat from poultry killed after a long fast tends to be slightly alkaline and, in turn, inferior for flavor. Full-fed birds produce a higher quality flavor.

The Regional Turkey Breeding Project was conducted with the co-operation of the United States Department of Agriculture.

In the February 1950 issue the article Soybean Meals as Poultry Feed *by Dudley C. Ambrose refered to the preparation of soy bean meals by the expeller and the solvent methods. In the solvent process of manufacturing soybean oil meal, hexanes—fat solvents—are used to remove the oil. Acids can not be used in this process.*