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Feed Flavoring for Poultry[1]

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Do you believe that adding a flavoring agent to your broiler or layer feed will improve performance? Your answer is probably no, or that you really hadn't thought about it. The early history of feed flavoring and taste research for poultry reads much the same way. Initially, poultry producers and some researchers felt that chickens had no real sense of taste and that flavor was of no consequence in poultry feeding. However, an examination of the literature, while not yielding a unanimous result on the effects of flavor, is conclusive that the bird has well defined taste mechanisms.

A literature review by Lindenmaier and Kare (1959) reveals that in the infancy of poultry research (1880) Merkel stated that no taste buds were found in Aves, and this feeling was echoed as late as 1954 in a report by Calhoun. In contrast, Bath (1906) differentiated between 30 and 70 buds in chickens. Lindenmaier and Kare (1959) reduced those numbers to approximately 8 in the day-old chick and 24 for a 3-month old cockerel. These taste buds were found only on the base of the tongue and floor of the pharynx, and the authors expressed some doubts concerning whether they were the only taste receptors in chickens because their taste mechanisms had been shown to be more than basic. The chicken's taste buds were found to be morphologically similar to, but not identical to, those of mammals. Certainly, the difference between the two dozen taste organs identified in the chicken and a count of 9,000 for humans or 25,000 for a cow (El Boushy and Kennedy, 1987) has cast some doubt on poultry's tasting ability.

Defining Taste

The word “taste” is defined in the dictionary as the special sense that perceives and distinguishes the sweet, sour, bitter or salty quality of a dissolved substance and is mediated by taste buds on the tongue. On the other hand, “flavor” is described as the blend of taste and smell sensations evoked by a substance in the mouth. Work by a number of researchers has established that a chicken's definition of taste would not correlate well with the dictionary definition. The bitter, sweet, sour or salty classifications have not been found to be valid, and chickens actually avoid saccharine and sweet flavors such as honey and strawberry (Ewing, 1963). Sucrose and the butter-type flavors have been the only ones for which any preference has been shown (Englemann, 1934; Jacobs and Scott, 1957). Another key factor is found in the term “dissolved substance.” The low moisture content of poultry feed coupled with its brief residence time in the mouth certainly would not seem to favor

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solublization of flavoring agents, and this has been another reason given for doubts of poultry's taste acuity. Concerning the interaction of odor with the tasting mechanism, Lindenmaier and Kare (1959) stated that, although several investigators had tried, none had been able to show that the sense of smell was a determining factor in taste sensation by poultry.

A Mixed Bag of Research

Most poultry flavor research has been conducted in drinking water rather than feed because flavor perception is much more acute from solutions. It was negative, rather than positive, results from the addition of a number of flavors to drinking water that caused Kare et al. (1957) to conclude that “the presence of a sense of taste in the fowl is emphatically established by the negative response to some flavors.” The birds detected these compounds consistently and consistently preferred unflavored water. Their reaction could not be correlated with any physical or chemical characteristics of the compounds. Solutions rejected had concentrations as low as one part in twenty-five thousand and were barely noticeable to people, indicating that the sense was one of taste and not a “common chemical sense” (Lindenmaier and Kare, 1959). Kare and Pick (1960) continued to work with offensive flavors and noted that the ability to chemically regulate feed or fluid intake with them opened a number of interesting possibilities for commercial poultry production. They suggested that restricted feeding of growing birds, molting initiation in layers and postponement of started pullet egg production might be accomplished through this method of feed restriction. Florida research with weed seed such as crotalaria (Damron, et al., 1986) has also indicated that much of its reported “toxicity” appeared to be the result of reduced feed intake from a bitter alkaloid taste.

According to the literature, the era of flavor research ended about 1960 with the group at Cornell having been the primary contributor. The results documented during that time were a “mixed bag” with some studies supporting flavoring effects and others not. Kare et al. (1957) offered some insight into possible reasons for this variability of result in their statement: “The authors are of the opinion that it is possible to so manipulate the design of the experiments as to produce almost any type of result with any of the flavors.” They were not implying scientific dishonesty, but rather making a valid comment concerning the many variables that must be considered and controlled when bird behavior, as well as nutrition and performance, become factors in an experiment. For instance, waterers need to be repositioned frequently to prevent patterning, fluids must be changed with the same frequency, and concentrations should be in an acceptable range for each substance. How do we allow for solutions being of different color, and what is the best background color to present them on for acceptance? Birds may also react differently to flavors presented with different feed ingredients. Kare and Pick (1960) also felt that bird-to-bird variation was another reason for inconsistent results. They mentioned that the ability to taste was not uniformly present in all chickens. They observed a few birds that were “taste blind” and would readily accept feed avoided by others. We would add that we have had similar experiences with birds getting high levels of salt. Some show edema and reduced feed intake while others continue to eat and grow normally.

There was a flavoring compound being marketed for poultry back in the 50s and 60s, but published results concerning its effectiveness are very scant. Sizemore and Lillie (1956) tested such a product for four weeks with broiler chicks and reported no improvement in growth or feed efficiency. On the other hand, two small broiler trials at Texas A & M (Tribble, 1962) showed some numerical advantage in gain and feed efficiency of broilers consuming old feed that had the additive. Total feed consumption was not improved in either experiment and it was concluded that the product contained an “unidentified digestive factor” that improved feed energy utilization.

The subject of flavoring poultry feeds has lain dormant for years while the number of companies manufacturing or processing flavoring agents for livestock has grown, and the products have gained acceptance in the ruminant and swine industries. There just hasn't been enough confirming evidence generated in the past to convince scientists or

industry that such a product was advantageous for poultry feeds.

So, what has been done to help solve this efficacy dilemma? Results of studies with a commercially available flavoring agent studied at Mississippi State and the University of Florida (Damron and Day, 1988) are briefly summarized in the following paragraphs.

In other countries where feed may be stored for longer periods, flavoring might be beneficial in improving palatability and performance. In a Mississippi trial, feed was stored for seven weeks before being given to broiler chicks for 21 days. Intake of both fresh and old feed was greater, as were body weights, for treatment groups that received flavoring; however, performance from fresh and old feed was comparable.

Additional short-term chick studies demonstrated a numerical growth advantage for flavor inclusion. Similar results were noted in a full-term broiler grow-out where up to 0.10% flavoring was incorporated. In only one of the three seven-week broiler experiments conducted at Florida or Mississippi was the body weight response to flavor statistically significant. This experiment was repeated in mid-summer (the previous trial was completed in the spring) in another facility and no response was noted. Feed consumption was reduced by the hot weather, which may have had some bearing on the outcome. It should be noted that none of these studies demonstrated any real feed efficiency improvement. The flavor seemed to stimulate feed intake that resulted in additional growth. Also, work with broilers at the University of Arkansas (Lucariello and Waldroup, 1988) was unable to demonstrate any advantage of adding flavor to a well-balanced diet. There are two other studies from the University of Florida that can be briefly mentioned. The addition of flavoring to diets of growing White Leghorn pullets for the first 18 weeks provided no appreciable response. However, it was associated with increased egg production and feed intake during the first two months of a separate egg production trial.

Industrial vs Statistical Significance

What should we make of all this? The data have shown few statistical advantages, but a fairly consistent trend of numerical improvement. As scientists we are required to demonstrate statistical significance, usually with 95% confidence, before data are even considered for inclusion in a scientific journal. Obviously, on that basis a clear case has yet to be made for flavor use with poultry. But the data do seem to be indicating what might be likened to an “antibiotic-like response;” smaller improvements that are fairly consistent but not present in every experiment.

From an industry viewpoint we ask ourselves, “How often are we able to be 95% certain that a new process or product will be successful before we use or recommend it?” USDA numbers indicate that, industry-wide, an additional gram of weight per broiler grown equates to approximately $6,656,761 of gross income, while the amount for another egg per hen is about $16,569,722. Given this dramatization, it seems that there is a place for both “statistical” and “industrial” significance.

Flavors: a Variety of Roles

Flavoring appears to have several possible roles in poultry production. It might be useful in preventing early “starveouts” and to keep birds on feed during periods of disease or stress. Flavoring might limit the decrease in feed consumption caused by ingredients such as blood meal, fish solubles and fermentation byproducts or dusty ground grains like wheat and milo. An important possibility in the hot weather of the South is the potential improvement of feed intake by hens and broilers during the summer.

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