PRACTICAL ASPECTS OF CHOICE FEEDING IN POULTRY AND ITS FUTURE ROLE

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SUMMARY

The practical application of choice feeding to poultry - the choice of unground grain and a protein, vitamin and mineral concentrate (plus granular calcium for laying birds) is discussed. Layers should be exposed during the growing period to all the feedstuffs they may encounter and should have the three choices before them at all times. Some problems nay be experienced in distributing the feedstuffs in laying cages with some mechanical feeders, but these problems can be overcome. Choice feeding is readily applied to birds on litter. A method of scattering firm protein pellets and whole grain is suggested for choice feeding broiler breeders.

The problems of feeding breeding males - excessive protein and calcium intake - may be overcome by choice feeding. Evidence is presented to suggest that the incorporation of high levels of finely ground limestone in layers' rations may not result in optimum eg; production, especially during periods of heat stress. The feeding of low calcium laying rations with free choice of granular calcium is suggested as a better alternative,

Choice feeding of broilers is widely practiced in Scandinavian countries and experimental evidence suggests it should be very successful in the Australian environment.

For the future it is suggested much more research in the area is required, including behavioural and genetical aspects. It is suggested that choice feeding has particular relevance to the poultry industries of developing countries.

INTRODUCTION

Choice feeding does work and work well in the Australian environment in particular, where we have small grains and comparatively poor housing in an extremely variable environment. The rations in choice feeding are always significantly cheaper than complete rations and invariably give more efficient feed conversion ratios than complete diets in real life situations. In this context we would like to emphasize that choice feeding is presenting the birds with unground grain and a protein, vitamin and mineral concentrate (plus calcium chips for laying birds) and not merely diluting a generous complete ration with additional whole grain. If choice feeding does not work efficiently the reason almost certainly lies in the method in which the choice feeding has been applied (Cumming and Mastika 1987). We would like to discuss the application of choice feeding to the modern poultry industry, dealing with various facets.

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Laying Hens

Choice feeding is readily applied to laying hens as the birds have plenty of time before reaching sexual maturity to learn to balance their diets and identify feed sources. Choice feeding may be introduced at any time from day old to 18 weeks of age, but we feel strongly that the pullets should be experienced in this technique well before they reach sexual maturity.

Choice feeding during rearing produces some very interesting results, with different strains of pullets consuming different proportions of protein and energy (Cumming unpub. data). The limited time method of food restriction works well with choice feeding (Cumming 1984) and target weights can be readily achieved. During the rearing period the pullets should be exposed to all the grains, calcium chips and other feedstuffs they are likely to be fed during the laying period, although it has been demonstrated that, if care is taken, layers in full production can be changed from whole wheat to whole sorghum over a 14 day period without any drop in production (Cumming 1984).

The form that the protein vitamin and mineral concentrate should be presented in does not appear to be important and pullets and hens perform equally well on mash, crumbles or pelleted concentrates.

Laying hens should have the choice of whole grain, protein concentrate and granular calcium at all times. The feeds should be mixed in the appropriate proportions and supplied in a single feed trough, the birds selecting what they require. There is no need to supply the various feeds in separate feed troughs, as hens very readily pick up small individual feed ingredients. After all, selective feeding of complete laying mashes has been a practical problem for many years.

Problems may be encountered in feed delivery in laying cages fitted with certain types of automatic feeders and the form of the protein concentrate - mash, crumbles or pellets - may have advantages in some systems. These problems are being overcome and are receiving attention from agricultural engineers (Tauson and Elwinger 1986). On the other hand some automatic feeders, especially those that deposit feed from travelling hoppers into the feed trough, can be readily adapted to choice feeding. A recent survey by the New South Wales Department of Agriculture has revealed that over 50% of layers in cages are fed from feed carts and -these can be readily adjusted to apply choice feeding.

Choice feedingcan be very readily applied to layers on the floor, where the various feeds may be supplied in separate feeders. Thus this feeding method is most readily adopted by those interested in housing layers in systems other than cages. The feeding of breeder hens of layer strains can therefore be readily adapted to choice feeding but broiler breeder hens do present a challenge.

However, we would like to suggest an approach to the choice feeding of broiler breeders along the following lines. Firstly, granular calcium grit should be readily available in containers in the shed at all times. The protein, vitamin and mineral concentrate could be fed at approximately mid-day, the quantity supplied being sufficient to provide about 20 grams of protein per hen. This concentrate, in the form of good firm pellets, could be dispersed in feeders across the shed that would enable all hens to eat and thus obtain their share. Alternatively these

hard pellets could be broadcast in the litter by some mechanical means. At the same time a small portion (approximately 20%) of the whole grain allocation could be broadcast to encourage scratching in the litter and to enable all birds to obta in their share of concentrate. The pellets and grain could be broadcast by a fertilizer spreader behind a small tractor and such equipment has been used by farmers in Victoria to disperse grain in the litter of broiler breeder sheds (T.R. Walter, pers. comm.).

Later in the afternoon the remainder of the whole grain allocation could be broadcast in the litter. This late feed would have the advantage of obtaining the maximum energy from the grain, encouraging exercise in the birds and perhaps reducing leg problems and certainly improving the litter conditions in the shed. Necessary alterations to the body weight of the broiler breeder birds could be made primarily by altering the grain allocation. Such a system, although requiring a deal of experimentation, should improve the health and production of broiler breeder flocks. Certainly it should ensure the daily intake of adequate amounts of protein and micro-ingredients for optimum fertile egg production and enable the body weights of the hens to be closely controlled.

Breeding males

One of the pecularities of the modern poultry industries is the manner in which breeding males are fed. Complete rations, with the high protein, vitamin and mineral levels required for maximum egg production by the hens are mandatory consumption for the breeding males. Thus these males are forced, when attempting to satisfy their energy requirements to consume excessive amounts of protein and calcium - at levels far above their optimum requirement.

Recent research at Auburn University (McDaniel 1987) has concentrated on the excessive protein intake of broiler breeder males and shown the advantages of feeding them a lower protein diet. Work at this University (Cumming unpub. data) has shown that Old English Game males reject a complete laying diet with 3.5% calcium in favour of the same ration with 1% calcium.

How does the adult male bird cope with this excessive calcium intake and does this play any role in the leg problems encountered in broiler breeder males in the breeding pens? Do these nutritional excesses - protein and calcium - adversely affect the reproductive capacity of the male bird? This is an area obviously requiring urgent research input but the application of choice feeding to breeding pens should alleviate, if not totally correct, the position.

Calcium

The modern laying hen is usually fed complete diets and the large calcium requirement of approximately 4 gms daily is met by including up to 4% calcium, finely ground, in the complete ration. The hen has a strong calcium appetite, which is particularly noticeable when shell deposition commences in the afternoon of the day before oviposition. Taylor (1970) remarked that the increase in feed intake of complete rations in the afternoon is largely to satisfy this calcium appetite.

Under the natural farm yard system and the deep litter systems of the 1950's laying hens were usually supplied with a concentrated calcium source, such as oyster shell. or limestone chips and the hens regulated their intake of calcium. Recent work in the United States (Classen and Scott 1982) has shown that the modern American laying hen can readily satisfy her calcium requirements if given free choice. Further, all seven modern Australian laying strains investigated at the University of New England have satisfactorily balanced their calcium intakes when choice fed whole grain, protein concentrate and granular calcium (Cumming and Mastika 1987).

The practice of incorporating high levels of finely ground limestone in complete laying diets has been reported to result in lower production under practical conditions than when calcium was supplied in granular form. Firstly, Karunajeewa (1977) reported that in hot weather oyster shell grit maintained egg shell quality better than finely ground limestone. Further Karunajeewa (1978) reported that oyster shell also increased egg production in hot weather - at 27°C. Secondly, Picard (1985) and co-workers have recently reported that in layers, under heat stress of 33°C, fed a complete low calcium mash diet with granular calcium (oyster shell) free choice consumed 17% more energy, produced 18.5% greater egg mass, plus better egg shell quality, than similar hens fed the same diet with the calcium finely ground. Thirdly, Belgian workers (Wambeke and de Groote 1986) compared broiler breeders fed the same ration with granular calcium source (oyster shell) vs finely ground limestone and found that the oyster shell birds outlayed the ground limestone birds **66.4%** to **64.3%**. A similar result has been recorded in a recently completed trial using crossbred layers in single laying cages with a common feed trough at the University of New England (Cumming - unpubl. data).

The whole question of how to supply calcium to the modern laying hen therefore appears to require some fairly basic information and experimentation. Theoretically, the hen developed with a physiology attuned to eating foods generally with a low calcium content, the extra calcium for egg shell deposition being obtained from calcium rich sources , such as snail shells and bone chips. These concentrated calcium chips lodge in the gizzard where they are slowly digested and absorbed night and day. This is quite unlike the modern complete diet fed hen, where the finely ground, high calcium diet will move through the digestive tract in a matter of a few hours. These hens then have to mobilize calcium from their bones for the continued calcification of the egg shell in the small hours of the morning. This is perhaps not a "normal" or ideal physiological situation.

Thus we suggest that the problems of egg shell quality in the modern laying hen are perhaps partially self inflicted by our nutritionists and geneticists, who feed hens on complete diets with finely ground limestone in both the breeding pens and the commercial laying pens. Would we not have considerably better egg shell quality if we selected and produced under a more natural system, with pieces of granular calcium always lodged in the gizzard of laying hens?

Workers at Cornell University (Shane et al. 1969) very clearly demonstrated the problem of nephritis and urolithiasis that may follow the feeding of high calcium (above 3.0%) and low available phosphorus (under 0.4%) to immature pullets. We have investigated a number of

outbreaks of nephritis and urolithiasis in Australasian flocks over the past ten years - and always found the problem due to the feeding of excessive levels of calcium with low available phosphorus. This low available phosphorus level is important and was completely ignored in the report by Munt and McDonald (1985). The problem of low phosphorus in Australian poultry rations is likely to become more important in the future, as we move to the use of greater quantities of vegetable proteins and a lessened reliance on meat and bonemeal.

In addition, Kuranajeewa (1977) reported that the calcium of the bone fraction of meat and bonemeal was less available to the laying hen than that of finely ground limestone. If this is so, then the phosphorus of the bone fraction of meat and bone meal will be less available as well. Thus in laying rations where the available phosphorus is largely of meat and bone meal origin and the phosphorus level is near to 0.4%, the situation described by Shane et al. (1969) of high calcium and low available phosphorus becomes more of a reality and problem when such complete rations are fed to immature pullets. Such problems will not arise in choice feeding situations, where the pullet is fed diets not fortified with ground calcium and she can select the additional calcium she may require in the granular form as her physiology demands.

The source of the high calcium is not important - be it oyster shell or limestone chips (Coon and Cheng 1986) as long as the particle size is large - greater than 3mm. Cumming (1984) recommended that the calcium level of the protein concentrate for choice feeding layers be maintained at about 3% and this may be important. In a large layer field trial where choice feeding was used, the consumption of protein concentrate was below the anticipated level, with consequent lowered egg number and egg size. The protein concentrate was found to have a 7% calcium level and when this was lowered to about 3% (by removal of all ground limestone), protein concentrate consumption and egg production immediately returned to normal (Cumming and Carey, unpubl. data),

Broilers

Special automatic weighing machines to enable choice feeding to be applied to automated commercial chain feeders in broiler sheds are available in Denmark, where choice feeding of broilers is now widely accepted (World Poultry 1986). The ability of the young choice fed broiler to adjust its nutrient intake according to varying ambient temperatures is remarkable (Mastika and Cumming 1987c), and should enable considerable nutritional savings to be made in Australian broiler sheds.

A further possible advantage of choice feeding is the well developed gizzard and normal sized proventiculus (Mastika and Cumming 1987 a,b) that develops in chickens fed whole grain and apparently increases the chickens* resistance to coccidiosis challenge (Cumming 1987). If confirmed in the field, this factor alone could ensure that choice feeding of broilers is more widely practiced.

The future

The delicate and immediate response by broiler chickens in terms of grain intake to varations in temperature suggest that choice feeding has particular advantages in Australia, with our very variable climate. If widely adopted choice feeding could have dramatic effects on the balanced

feed industry, as there is already a surplus in milling capacity. As grains are not crushed in choice feeding this could significantly aggravate the problem of surplus capacity. Further, the tonnage through mills would be very significantly reduced if choice feeding was widely accepted. Let us hope this aspect is rationally discussed and the advantages of choice feeding are not crushed by vested interests.

The ability of chickens to recognise differing energy and protein levels when choice fed (Mastika and Cumming1985) is of particular interest to home mixers, who do not usually have ready access to chemical analyses of raw ingredients. However the fowl may well be able to make the necessary adjustments to the varations of the raw ingredients if choice fed. Further, the cost of equipping a home mixing plant for choice feeding can be remarkably reduced - probably by at least 50% less than a plant for making complete rations. All these aspects are of particular importance to small producers in developing countries.

There is a large behavioural component in choice feeding and this area requires urgent attention, with nutritionists and behaviouralists working in close collaboration. The response to different seeds shown by commercial and feral chickens (Adret-Hausberger and Cumming 1985) suggest that genetical differences may be important. This suggestion is further supported by the different proportions of 'slow learners' in different breeds (Mastika and Cumming1987c). Thus the involvement of behaviouralists and nutritionists may become essential in breeding plans.

Obviously more research into both the basic aspects and application of choice feeding is required - the present work has merely scratched the surface. Examples that spring to mind are the feeding of granular calcium to laying hens in various environments. What amounts are eaten, when and what is the rate of digestion? How often is it necessary to feed out granular calcium? The role of insoluble grit requires attention - day old broilers eat grit avidly and its presence results in a larger gizzard muscle than in complete crumble fed birds. Other species, such as ducks and turkeys can be choice fed satisfactorily, but more information is required.

In developing countries, especially in South and South East Asia, the traditional duck in the paddy field has played a most important role in the economy of small farmers (see Farrell and Stapleton 1985). These ducks are in practice choice feeding,' picking up dropped rice grains and eating small crustaceans and other animals, but little scientific information is available on the intake of the birds. Further, as cropping practices alter in these countries, the future of the duck in the paddy field is unclear and a degree of intensification is a possibility. Correctly applied, choice feeding could play a crucial role here.

Choice feeding is in reality harnessing the inherent nutritional wisdom of the chicken to the scientific expertise of the modern poultry nutritionist. For too long we have perhaps tended to ignore the varied nutritional responses of the fowl, relying only on the energy appetite, and there is a need to re-evaluate some of our practical approaches to production problems. We feel choice feeding has a great deal to offer us.

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