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CAN 100% ORGANIC DIETS WORK FOR POULTRY?

Jason Gittins from ADAS investigates

Organic diets for poultry may need to be formulated without any non-organic materials in future.

This has focused attention on the possible impacts of such a move and in particular on raw material availability and cost and the impacts on the health, welfare and performance of the birds. In addition, there may be wider implications, due to changes in land use and crop rotation as well as environmental considerations.

EU legislation currently allows organic poultry (and pig) farmers to use a limited proportion of non-organic feed material where it is not possible to obtain feed exclusively from organic production. At present, this allowance is widely utilised. The maximum allowance for the inclusion of non-organic feed materials was originally set at 10% in 2009. This was reduced to 5% in 2010 with an end date of December 2014. In July 2014, it was announced that the 5% allowance would be extended throughout the EU for a further 3 years i.e. until the end of December 2017.
Whilst this extension has removed some of the time pressure from recent discussions, the issue remains relevant for the future and also for any businesses wishing to pre-empt possible future controls by assessing their options at an earlier stage.

Nutritional Challenges
Of the 22 amino acids used in protein synthesis in poultry, ten are 'essential', meaning that they cannot be manufactured by the bird and they must therefore be supplied in the diet. For poultry, methionine and cysteine are regarded as the main or first limiting amino acids, followed by lysine. Any imbalance in essential amino acid supply could result in reduced productivity or growth, together with reduced feed intake or utilisation. In addition, there could be impacts on bird health and welfare.

Compared to conventional rations, 95% organic rations are likely to contain higher levels of protein, in order to meet minimum methionine and cysteine requirements and a move from 95% to 100% organic diets is likely to exacerbate this effect. Any nitrogen consumed by birds in excess of their requirements will be excreted. Litter quality may deteriorate with resultant implications for health and welfare and there are risks of leaching and increased emissions of nitrous oxide and ammonia from storage and spreading of manure.

In conventional poultry diets, soya bean meal is typically the most important protein source, supplemented with synthetic amino acids to meet the required nutritional specifications. In organic production, the goal is to obtain feed from the holding where the animals are kept or from other holdings in the same region. The definition of 'same region', whilst inexact is unlikely to extend to the use of soya which is imported from non-European countries. In addition, an increasing proportion of soya bean meal is now derived from genetically-modified (GM) soya beans which cannot be used in organic rations, whilst chemically-extracted soya bean meal is also prohibited. Finally, EU organic legislation prohibits the use of synthetic amino acids.
Against this background, alternative protein sources have to be used in organic production. Fish meal can be a potentially important material, helping to maintain essential amino acid levels without the use of excessive levels of soya. However, there are restrictions in terms of its use. For example, multi-species feed mills which also produce feeds for ruminants are unable to use any fish meal in rations produced for poultry and pigs, but it is an option for mills which produce monogastric (pig and poultry) rations only. If used, fish meal must be derived as a by-product of fish for human consumption or from fisheries that have been independently certified as sustainably managed. It is important that the quantity used is consistent with avoiding the risk of taint developing in eggs or meat. At present, these limitations and high material costs generally mean that fish meal is either not used at all or its use is restricted to high-specification diets and where feed consumption is low (e.g. chick feeds).

Health and Welfare Implications
Dietary imbalances may cause stress in laying hens, which in turn can lead to unwanted behaviours such as feather

pecking. Dietary factors may also affect immune-competence, the bird's ability to respond to disease challenges and to ensure effective uptake of live vaccines.

There is a view that pullets and laying hens fed on 95% organic rations are already on a 'nutritional knife-edge' and that a move to 100% organic rations at present, using the same basic raw materials (particularly in the absence of fish meal) would increase the risk of health and welfare problems occurring.

Formulating 100% Organic Rations for Pullets and Laying Hens

In addition to whether fishmeal can be included or not, a key consideration is the range of organic materials which are available for formulation and their quality and reliability. For example, organic maize gluten meal (prairie meal) appears to offer good scope for helping to meet nutritional requirements in 100% organic rations but at present, it is unlikely to be available in sufficient quantity to meet all EU needs. Concerns have also been expressed over quality consistency and the need for importation from third countries (such as China), which again is not consistent with regional sourcing. At individual feed compounder level and also for on-farm 'home mixers', available storage capacity may also limit the range of raw materials that can be used.

Whilst noting these practical constraints, the following example specifications assume the availability of a relatively wide range of raw materials, but not maize gluten meal. Separate options are provided, according to whether fish meal can be used or not.

Comparative pullet grower specifications for conventional, 95% organic and 100% organic feeds are summarised as examples in Table 1 below.

The table shows that in order to maintain key amino acid levels, moving from 95% to fully organic rations without the inclusion of fish results in a two-percentage unit increase in crude protein, from 18.7% to 20.8%. In these example specifications, this increase in crude protein was however associated with a substantial increase in the inclusion rate of soya bean meal (from around 9% to 24%). Whilst the addition of fish meal would enable the crude protein content to be reduced, additional costs would almost inevitably be incurred.

In the event that maize gluten meal was available in addition to fish meal in 100% organic rations, the crude protein level could be reduced to around 18%, whilst still maintaining the required levels of essential amino acids.

Example early layer ration specifications for laying hens are set out in Table 2 on the following page.

The table shows that in the absence of fish meal, a move from 95% to 100% organic feeds would result in a further reduction in methionine, compared to a non-organic (conventional) feed. This is in spite of an increase in crude protein. The energy level would also be lower in the absence of fish meal. As before,

Table 1: Comparison of nutrient levels in non-organic, 95% and fully organic replacement pullet grower feeds

	MJ/kg	Non Organic	95% plus fish	95% no fish	100% plus fish	100% no fish
Metabolisable Energy (ME)	%	11.50	11.80	11.80	11.80	11.73
Crude Protein	%	15.0	17.9	18.7	18.3	20.8
Digestible lysine	%	0.60	0.60	0.60	0.67	0.86
Digestible methionine	%	0.30	0.30	0.30	0.30	0.30
Dig. methionine + cysteine	%	0.55	0.55	0.58	0.55	0.60
Linoleic acid	%	1.10	2.03	2.24	2.14	2.67

increased inclusion rates of soya bean meal would be expected, particularly in the absence of fish meal. Soya inclusion could be approaching 30% in 95% organic feeds and close to 40% in fully organic feeds. Increased levels of linoleic acid are likely to lead to increased egg weight, which may in turn be a contributor to stress.

In the event that maize gluten meal was available in addition to fish meal in 100% organic rations, the crude protein level could be reduced to around 19%, whilst still maintaining the required levels of essential amino acids.

An additional consideration in rations for laying hens is the need to achieve an acceptable yolk colour. In current 95% organic rations, small amounts of maize gluten meal are typically used together with maize, lucerne and non-solvent-extracted marigold and paprika meals. In 100% organic diets, it is suggested that only maize and lucerne would be available in sufficient commercial quantities. If so, this could make the achievement of an acceptable yolk colour more challenging.

Alternative Protein Sources and Other Approaches

Meeting essential amino acid requirements is central to the challenge of moving to 100% organic rations for poultry, hence there has been increased interest in identifying suitable protein sources for the future which can be grown closer to home. A current initiative, involving researchers in ten different European countries aims to produce profitable, 100% organic feeds for poultry and pigs. Within this, the use of a range of materials is being considered, including unprocessed seeds of grass pea and sainfoin, mussel meal and algae. A number of other recent and current studies focus on animal protein sources including insects and earthworms, in addition to other plant-origin materials.

A recent study in Denmark reported on the feasibility of growing more climate-robust soya bean cultivars in future, both in southern and northern Europe. It was concluded that there is potential to grow soya beans in Europe and to date, the levels of protein and methionine appear to be at least similar to those found in beans from USA, Brazil and China. However, there is a need for new cultivars and for the development of appropriate crop management techniques in Europe to achieve a higher and more stable yield.

Attempts are being made to enhance the methionine content of plants such as lupins, beans and peas through plant breeding programmes, so that these can play a more prominent role in future organic rations for poultry. The use of specialist laying hen genotypes, such as those selected from low-protein diets and more suited to organic management and feeding regimes is also a possibility.

Attention has also focused on enhancing the contribution made by range land to the diets of poultry. This is consistent with the ethos of organic systems and in favourable conditions, considerable amounts of herbage can be consumed but seasonal variations are inevitable. This can make feed planning difficult and adversely affect food consistency and consumer appeal.

Table 2: Comparison of nutrient levels in non-organic, 95% and fully organic laying hen feeds

	MJ/kg	Non Organic	95% plus fish	95% no fish	100% plus fish	100% no fish
Metabolisable Energy (ME)	%	11.50	11.50	11.50	11.50	11.30
Crude Protein	%	15.3	19.0	21.8	20.7	22.7
Digestible lysine	%	0.70	0.70	0.84	0.87	0.99
Digestible methionine	%	0.35	0.34	0.34	0.33	0.31
Dig. methionine + cysteine	%	0.60	0.61	0.65	0.59	0.60
Linoleic acid	%	1.45	2.48	3.78	3.71	4.61

Whilst a move to 100% organic rations for poultry would undoubtedly present a challenge to nutritionists and producers alike, these initiatives offer hope for the future. However, it will be important to fully understand the economic implications and to consider wider issues such as legislative constraints, environmental concerns and consumer acceptance. ■

Acknowledgement
This article is based on work currently being undertaken within Defra Project OF0397 (100% Organic Diet Mixes for Monogastrics – Impacts on UK Production) by ADAS, in conjunction with Premier Nutrition and St. David's Poultry Team Ltd. This study will also be assessing the economic implications of a move to 100% organic rations (based on likely changes in feed prices, flock performance and other factors) and the resultant environmental consequences. n

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