RECENT ADVANCES IN ANIMAL NUTRITION

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PREFACE

This volume is based on the Twenty-third University of Nottingham Feed Manufacturers Conference and considers a range of issues important to the feed industry.

The first section addresses various aspects of legislation relevant to the feed compounder and producers of livestock products. There is a plethora of legislative changes with which the feed industry must comply. These include changes and rationalization in the detailed labelling of animal feeds, new regulations relating to maximum aflatoxin levels and pesticide residues in feeds, and the compulsory registration of feed mills designed to control the sale and distribution of medicated feed. All of these issues are clearly discussed in the first chapter. The presence of drug residues in animal products is a topic of considerable concern to consumers, and this is considered in the second chapter. Information is provided on the way in which the licensing system for veterinary medicinal products is designed to ensure consumer safety. Results from statutory monitoring for residues in animal products illustrates the responsible attitude of the industry in observing the correct withdrawal periods. The third chapter in this section highlights the opportunities for the UK feed compounding industry from the removal of trade barriers and the creation of a single European market in 1992.

The first chapter in the section on poultry and rabbit nutrition addresses the issue of vitamin requirements of chickens and turkeys. The working party considered information available before and since the 1974 ARC Review, but reassessed it on the basis of dose-response relationships to provide new guidelines on requirements, and their translation into suggested dietary allowances for the different classes of poultry. A second chapter on poultry nutrition indicates why pelleting of the feed given to meat birds usually improves performance, but emphasizes the need to maintain pellet quality and to supply a diet with adequate protein to ensure that any additional productive energy will be directed towards lean rather than fat deposition. The final chapter in this section highlights the special features of digestion in the rabbit and seeks to provide guidelines on diet composition designed to maintain a high level of performance while minimizing digestive upsets.

Silage represents a major feed input in many systems of ruminant production, but rationing systems in the past have had to contend with errors in predicting its nutritive value. As illustrated in the first chapter on ruminant nutrition, the advent of the NIR technique offers the promise of more accurate estimates of nutritive

value and hence more precise rationing systems. A further chapter in this section indicates that silage additives can improve animal performance, especially when fermentation characteristics are less than ideal, but that wilting of silage often reduces digestibility and thus animal performance. The formulation of compounds designed to complement high intakes of silage aim to minimize substitution rate yet encourage efficient microbial utilization of nitrogen in the rumen, and a chapter is devoted to a consideration of how this might be achieved. In recent years there has been increased interest in systems of early lamb production in which the lambs are early weaned and finished indoors on all-concentrate diets. It is fitting that the final chapter in the section on ruminant nutrition should concentrate on various aspects of the nutrition of intensively reared lambs.

The final section is devoted to non-ruminant nutrition. The first chapter tackles the difficult area, often overlooked in the past, of electrolyte balance and its importance in animal nutrition. A further chapter describes the use of a factorial procedure to estimate nutrient partitioning in the sow and suckling piglet during lactation, and then uses this information to build a robust computer model to predict the outcome of different feeding strategies on sow productivity. Information on the design and interpretation of experiments to determine amino acid requirements of pigs and poultry is covered in another chapter, together with information on how to translate requirements into allowances. The final chapter considers the aetiology of diarrhoea in pigs and pre-ruminant calves, and indicates that the problem is complex and can have a number of different causes, but suggests that a sound management strategy for preventing diarrhoea is to formulate weaner diets with highly digestible nutrients, preferably with a composition as close as possible to that of whole milk.

The organizers and the University of Nottingham are grateful to BP Nutrition (UK) Ltd for their support in the organization of this conference.

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Legislation

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PRESENT AND FUTURE LEGISLATION AND ITS IMPLICATION FOR THE FEED COMPOUNDER

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New legislation covering the manufacture, sale and distribution of feeds was introduced in the UK and EEC in 1988 and more will be agreed in early 1989 for implementation in 1989/90. This chapter describes the most important aspects which require feed manufacturers to introduce new practices in the mills and additional warranties and information on feed labels.

Areas which are addressed are the marketing of feeds, medicated feeds, feed additives, and health and safety at work regulations.

Most of the legislation which is specific to feeds originates in the EEC, and the 1992 target date for the removal of trade barriers is encouraging the legislators to introduce regulations for implementing harmonized feed laws by that date. The clear implications of this are that feed manufacturers will be faced with the costs of complying, and the commitment of management time to ensure compliance.

Marketing of feeds

The EEC have proposed further substantial changes for harmonizing feed labels. When the original 'marketing' directive was adopted in 1979 (79/373) it contained several derogations permitting member states to exercise options for declaring some the constituents of feeds on labels. It was considered that this has given rise to barriers in the free movement of feeds in the Community. The new proposals, listed below, effectively cancel the derogations. The Commission has tried to balance a number of requirements: the need to provide the livestock producer with meaningful information which is accurate; the need for the compounder to provide objective information whilst safeguarding formulation expertise arising from costly research and development investments; and also the need, in the public interest, to ensure that declarations can be adequately policed. The following are the principal changes which are likely to be adopted in 1989.

DECLARATION OF INGREDIENTS

By October 1988 no clear decision had been made, but it is probable that compulsory listing of ingredients by category will be agreed. The European feed trade interests have considered possibilities and many, including UKASTA, favour

the listing of categories, in decreasing order of inclusion in the feed. The following is a suggested list being put forward for consideration by FEFAC:

(1) Oil meals and other protein products of vegetable origin.
(2) Protein of animal origin.
(3) Cereals and other carbohydrate products and by-products.
(4) Oils and fats of animal and vegetable origins.
(5) Dried products (fruit, leaves, etc.).
(6) Minerals.
(7) Premixes.

It is clearly in the interests of compounders to keep the list of categories as short as possible whilst still offering information on the types of new materials used. The size of labels may have to be increased to accommodate the new declaration (and others) and it will be necessary to ensure the correct order of inclusion. Enforcing the declaration will pose problems and may lead the authorities to inspect formulations rather than try to apply optical microscopy to determine the accuracy of the ingredient statement.

STORAGE LIFE

Two forms of declaration are proposed namely:

(1) 'use before' followed by the date for highly perishable feeds, or
(2) 'best before' followed by the date for other feeds.

DATE OF MANUFACTURE

It is likely that the actual date of manufacture will be required although UKASTA and other European Trade Associations have advised of the practical problems involved. Month of manufacture is more sensible!

Compounders already declare a warranty period for vitamins A, D and E and additional declaration of dates of manufacture and shelf-life seem to be superfluous.

MOISTURE

The moisture content will have to be stated on compound feeds if it exceeds 14%. This requirement will probably lead to all compounds containing significant quantities of cereals and cereal by-products carrying a 14% declaration simply to protect the compounder. Cereals and beans are bought at up to 16% moisture! Attempts by UKASTA to have the limit raised were not supported by the Commission. An upper tolerance of 1% is anticipated.

ASH INSOLUBLE IN HYDROCHLORIC ACID

This new control and declaration is particularly useless and takes a characteristically complex form as follows:

'The level of ash insoluble in hydrochloric acid shall not exceed 3.3% of the dry

matter in the case of compound feeds composed mainly of rice by-products and 2.2% of dry matter in other cases.
However, that level may be exceeded in the case of:
- compound feeds containing authorized mineral binding agents,
- mineral compound feeds, and
- compound feeds containing more than 50% of sugar beet chips or sugar beet pulp, provided that the level is declared as a percentage of the feed as such'.

LYSINE AND METHIONINE

Lysine will be a compulsory declaration of all pig feeds and methionine for all poultry feeds. The implications for the compounder arise mainly from the inadequate tolerances of only 15%. There is no official method of analysis and policing of these declarations will be a problem until realistic tolerances are agreed on the basis of collaborative tests on samples by an officially agreed method.

ENERGY VALUE

The declaration of ME will be optional and not compulsory as at present in the UK. Declarations of energy for pig and ruminant feeds using national official methods will also be optional.

There are several amendments in the new proposals but they apply mainly to small volume categories of feed.

AFLATOXIN LEVELS

The new controls on aflatoxin came into force in December 1988 and apply to six raw materials and their by-products:
groundnut, cottonseed, maize, palm kernel, babassu and copra and from 3 December 1988, an offence will be committed if:

(1) a shipper/merchant sells, or has in his possession with a view to sale, for use as an ingredient, any of the listed raw materials if the level of aflatoxin B_1 is above 0.2 mg/kg;
(2) a shipper/merchant sells, or has in his possession with a view to sale, for use as an ingredient, any of the listed raw materials if the level of aflatoxin B_1 is above 0.05 mg/kg unless the material is for use by a recognized manufacturer and it is accompanied by a document stating:
    (a) that the material is for use by a recognized manufacturer;
    (b) that the material must not be fed unprocessed to livestock;
    (c) the amount of aflatoxin in the material.

One of the conditions of registration is that a manufacturer must have facilities, equipment (including that for analytical testing), and skills necessary to ensure:

(1) the totally even distribution (homogeneous) of the aflatoxin B_1 throughout the premixture or finished feed;
(2) that the quantities of contaminated ingredients used are such that the maximum permitted level of aflatoxin B_1 in the feed is not exceeded.

The Ministry of Agriculture, Fisheries and Food confirms that it is not necessary for a compounder to have in-house laboratory facilities. Access to outside consultancy laboratories will be sufficient. They also point out that any manufacturer wishing to check on the aflatoxin level could use one of the rapid test kits, which are now on the market, to give a rough guide.

It is not necessary for a shipper/merchant to apply for membership of the national list if he is selling any of the six raw materials covered by the legislation but not mixing them into a compound feed.

MAFF advise that the person who either imports for sale from a third country or is the first to place one of the six raw materials on the market in the UK, is responsible for checking the aflatoxin B_1 content. Anyone importing from another member state of the Community should request the appropriate information from his suppliers, should the aflatoxin B_1 level fall between 0.05 and 0.2 mg/kg. Any consignment of raw materials must be accompanied by a document stating:

(1) that the raw material is for a manufacturer on the MAFF list;
(2) that the raw material may not be fed unprocessed to livestock;
(3) the aflatoxin B_1 level in the raw material.

It is clearly in the interests of receivers of these raw materials further down the distribution chain, within the UK, to check the aflatoxin B_1 level.

As with the current legislation, the compounder would commit an offence if the level of aflatoxin B_1 in the finished feed exceeded the maximum permitted level. In addition, a compounder would commit an offence if he sold a listed raw material for use as a feed ingredient, and the aflatoxin B_1 content exceeded the maximum permitted level (i.e. the offence is commited by sale not by possession for own use).

The onus would be on the trader (merchant or compounder) to make sure that the material was not above 0.2 mg/kg. There should be no material on sale in the UK that contains levels of aflatoxin B_1 above 0.2 mg/kg.

PESTICIDE LEVELS

The maximum pesticide residue limits which apply to raw materials, straights and feeds are shown in Table 1.1. These come into force from December 1990.

Analyses of several hundred samples of raw materials and feeds from UK compounders are nearing completion. MAFF organized the survey and the analyses were carried out at the Laboratory of the Government Chemist.

The results to date show that the feeds comply with the new requirement.

UK compounders do not have the same opportunities for cross border trade in feeds as most other member states, so it may be argued that a harmonized feed label is not so advantageous to the UK, and incurs additional costs. On the other hand, the continuous review of labelling is necessary to keep pace with nutritional and public health advances.

Medicated feeds

This section of the chapter is applicable to the UK and describes the next steps in the completion of legislation in the form of regulations under the Medicines Act to control the sale and distribution of medicated feeds.

Table 1.1 MAXIMUM PERMITTED LEVELS OF PESTICIDES IN FEEDS

Substances	*Feeding stuffs*	*Maximum content in mg/kg of feeding stuffs referred to a moisture content of 12%*
Aldrin } singly or combined expressed as Dieldrin } dieldrin	All feeding stuffs	0.01
	except fats	0.2
Camphechlor (Toxaphene)	All feeding stuffs	0.1
Chlordane (sum of *cis* and *trans* isomers and of oxychlordane	All feeding stuffs	0.02
	except fats	0.05
DDT (sum of DDT, TDE and DDE isomers, expressed as DDT)	All feeding stuffs	0.05
	except fats	0.5
Endosulphan (sum of alpha and beta isomers and of endosulphan sulphate, expressed as endosulphan)	All feeding stuffs	0.1
	except maize	0.2
	oilseeds	0.5
	complete feeding stuffs for fish	0.005
Endrin (sum of endrin and delta, keto endrin, expressed as endrin)	All feeding stuffs	0.01
	except fats	0.05
Heptachlor (sum of heptachlor and of heptachlor epoxide, expressed as heptachlor)	All feeding stuffs	0.01
	except fats	0.2
Hexachlorobenzene (HCB)	All feeding stuffs	0.01
	except fats	0.2
Hexachlorocylohexane (HCH)		
alpha isomer	All feeding stuffs	0.02
	except fats	0.2
beta isomer	Straight feeding stuffs	0.01
	except fats	0.1
	Compound feeding stuffs	0.01
	except compound feeding stuffs for dairy cattle	0.005
gamma isomer	All feeding stuffs	0.2
	except fats	2.0

This new legislation follows on from the Medicines (Medicated Animal Feeding Stuffs) Regulation 1988, which came into force in July 1988, and containing the following provisions:

(1) A medicinal product may not be incorporated into an animal feedingstuff unless it is incorporated in accordance with a Product Licence, an Animal Test Certificate or a Veterinary Written Direction.

(2) With effect from 1 July, 1988 any person incorporating a medicinal product at a rate below 2 kilograms per tonne must register the premises where the incorporation is to take place in Part A of the Register to be kept by the Royal Pharmaceutical Society of Great Britain/Department of Agriculture for Northern Ireland (RPSGB/DANI). (In any case, with effect from 1 July, 1989, he must be registered with either Part A or Part B.) A fee of £150 for Register A and £50 for Register B is payable annually.

(3) A person not registered in Part A of the Register may not incorporate into an animal feedingstuff a medicinal product for which there is no Product Licence or Animal Test Certificate.

(4) Manufacturers must comply with the relevant Codes of Practice, A or B, which cover quality assurance, personnel and training, documentation, premises and equipment. Register B will be appropriate for on-farm mixers and a few of the smaller compounders.

(5) If a person operating mobile mixing equipment chooses to register, then this will be in respect of the premises where the equipment is normally kept.

(6) The Regulations prohibit a person from selling or supplying any animal feedingstuff in which a medicinal product (not being a prescription-only medicine) has been incorporated unless the medicinal product was incorporated in accordance with a Product Licence, an Animal Test Certificate or a Veterinary Written Direction.

(7) The Regulations generally prohibit a person from selling or supplying any animal feedingstuff in which a prescription-only medicine has been incorporated or from importing any such animal feedingstuff except in accordance with a Veterinary Written Direction.

REGISTRATION

Distinction is made between Register A manufacturers who also have under their control animals either as their sole or part of their business activities and those who do not. The keeping or maintenance of animals for research or educational purposes is not regarded as being a sole or part of the business activity.

VETERINARY WRITTEN DIRECTION

These Regulations also introduce a revised standard form of Veterinary Written Direction, the essential features of which are:

Vets may authorize the use of medicinal products for which there are no licences for use in feeds (i.e. vets' specials) and also for their incorporation by unregistered manufacturers in emergencies. (A veterinary special is 'any medicinal product, whether licensed or not, other than a licensed medicinal feed additive'. It does not include a licensed medicinal feed additive used outside the terms of its product licence, e.g. Romensin in sheep feed).

A certificate of analysis is required on the final medicated feed showing the contents of all medicinal products in the feed if a medicinal product has been incorporated for which there is no Product Licence or Animal Test Certificate for its use in animal feeds (i.e. a certificate of analysis is required for a veterinary special). Individual compounders have to decide on the guaranteed level they give on a feed label for any unlicensed product in the feed. Also, they have to decide who should pay for the analysis of the feed containing a veterinary special. Individual compounders have to resolve this issue with their farmer customers and veterinary surgeons. There is a legal requirement to ensure that the veterinary special drug levels comply with the permitted limits of variation and that the period of potency guarantee has therefore to be considered.

Analysis is required before sale and supply except in an emergency authorized on the Veterinary Written Direction by the vet. The new Regulations also introduced new emergency procedures. If the veterinary surgeon decides to invoke these procedures then the appropriate part of the new section has to be completed in triplicate by the veterinary surgeon. If the emergency section is completed the manufacturer must send a copy of the form to the RPSGB or DANI.

The new controls on the manufacture, sale and distribution of medicated feeds have two principal aims: to ensure high standards of safe manufacture; and to ensure that medicinal products, e.g. medicated feeds, are uniquely identified from source through incorporation in feeds, their sale and distribution. Since a large production of medicated feeds, especially intermediate medicated feeds (e.g. protein concentrates and supplements) are distributed through agricultural merchants, legislation was required to extend the current registration scheme for merchants who sell medicinal products, to those who sell only intermediate medicated feeds. At present, there are no restrictions on the latter. These merchants will be required to register with the RPSGB (or DHSS in Northern Ireland) and comply with a simple code of practice.

The Code will require documentation of receipt and sales of intermediate medicated feeds and good storage. This will enable the authorities to satisfy EEC requirements to trace the origin and destination of medicated feeds and completes the only remaining gap in the chain.

This new legislation will be published early in 1989 and apply from July 1989.

Feed additives

A number of important developments in the control of additives are in progress and the EEC are preparing Directives for agreement in 1989.

The main categories under consideration are probiotics, prophylactics and growth promoters, beta-agonists, and products of biotechnological processes.

Of immediate concern is the proposal to transfer prophylactic medicinal products such as coccidiostats and growth promoters from the additives directive (70/524) to the medicinal products directive (81/851). Unless special exemptions were made to maintain their current status, they would become prescription only medicinal products. This would have the effect of making all medicated feeds as defined in the UK available only on veterinary written direction (prescription).

All European feed trade associations, and FEFAC are seeking to maintain these products in the additives directive but the outcome is uncertain.

Beta-agonists are to be added as a new category to the additives directive (70/524) but may of course be transferred to the medicinal products along with growth promoters.

There are now more than 30 probiotics available on the UK market and even more throughout the EEC. Legislative control is imminent and two options are being considered, namely that they should be a new category in the additives directive or become subject to a probiotics directive. In either case provisions will be made for each probiotic to be assessed for safety, quality and efficacy and for appropriate labelling requirements to be made. Scientific dossiers will be required and once the controls are in operation, only listed products could be marketed.

A major change in licensing procedures for medicinal products is under discussion which will have two fundamentally important aspects. The first is the proposal to institute Community Marketing Authorization for Veterinary Medicinal Products (centralized licensing) and the second is to require a new category of assessment for growth promoters namely their 'social and economic impact' in addition to safety, quality and efficiency. Environmental impact is also newly specified but this aspect is usually covered by other legislation. The proposed requirement for 'social and economic impact' is being strenuously opposed since it introduces a subjective political aspect into the licensing procedure. The issue is in sharp focus with the controversy surrounding the injection of dairy cows with bovine somatotrophin (BST) and the current licence application being considered by the Commission expert group. The implications to feed compounders are far reaching in that public opinion may be prejudiced against important livestock products and the feeding systems and nutritional aspects could be influenced.

Health and safety legislation

New UK regulations on the Control of Substances Hazardous to Health (COSHH) come into force on the 1 October, 1989. They were laid before Parliament on the 12 October, 1988. They are meant to protect the health of people exposed to substances hazardous to their health from work activities. They apply to all places of work including feed mills (and offices and laboratories). These regulations are the most far-reaching health and safety legislation since the introduction of the Health & Safety at Work Act in 1974.

A substance hazardous to health means any substance in preparation which creates a hazard to health of any person and includes substances already classified as very toxic, toxic, harmful, corrosive or irritant; a microorganism which creates a hazard is also included as is dust of any kind when present at a substantial concentration in air (limits already exist e.g. 5 mg/m^3, 8-h time weighted average of respirable dust). The legislation was prepared in consultation with industry and the trade unions, and the main requirements may be summarized as follows.

ASSESSMENT OF RISKS

The employer will have a statutory duty to assess the risk to which his employees and others might be exposed through inhalation of or contact with hazardous substances at the work place. The assessment will entail a systematic review to ensure that the employer knows from available data the types of substances his employees are liable to encounter, the health effects of those substances, the places where the substances are likely to be and the ways and extent to which his workers and others on, and in the vicinity of, his premises could be exposed. Details will have to be available to employees and their representatives.

CONTROL OF EXPOSURE

The employer will have to ensure that exposure of employees and others to substances identified as hazardous is prevented or controlled below set exposure limits (where they exist) to the extent required to prevent adverse health effects.