

A Review of Coccidiostat Residues in Poultry

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Contents

i. Preface	page 4
ii. Acknowledgements	page 5
iii. Introduction	page 6
1. Broiler Production	page 10
2. Treatment for Coccidiosis	page 20
3. Feed Manufacture, Specification, Supply and Use on Farm	page 24
4. Poultry Products, Markets and Imports	page 28
5. Quality Assurance Schemes	page 32
6. Future Developments	page 33
7. Conclusions	page 37
8. Appendix	page 38

i Preface

This report on the poultry (broiler) industry north and south of the island of Ireland is based on an extensive series of consultations with persons involved in different aspects of the industry, and on the answers to a questionnaire completed by 11 companies, representing in excess of 90 per cent of domestic broiler production on the island.

The introduction covers the basis for the **safefood**, the Food Safety Promotion Board funded project on "Poultry Meat: Improving food safety by improving chemical residue surveillance". It also covers the background to this review on coccidiostat residues in poultry and describes the approach taken in developing this database of information.

In section 1, broiler production is described in terms of its organisation, systems used, size within each company, biosecurity, measures used, harvesting of birds and restocking. The emphasis is to provide a profile of the industry which will support the approach to sampling for surveys on the occurrence of coccidiostat residues in poultry.

Prophylaxis and treatments for coccidiosis are described in detail in section 2, covering vaccination, drugs used in treatment, contribution of anti-coccidials to control of disease generally, treatment strategies used and influence of production practices on the occurrence of coccidiosis, need for treatment and likelihood of residues occurring in poultry. The material in this section provides information on the practices used by the poultry industry for treatment of coccidiosis in broiler production.

The section on feed manufacture and use covers the specification and supply of feed to poultry producers, steps taken to prevent cross-contamination during manufacture and feeding, and analysis of feed. This information provides the basis for identifying potential residue problems arising directly or indirectly from medicated feed.

Section 6 provides details on poultry products and markets and gives information on the range of products manufactured from domestic broiler production and the markets (including retail and catering) in which these products are sold. In addition, some information on imported chicken meat and its use in the various products and markets is provided. These data will assist in the planning and execution of sampling and analysis for domestic and imported chicken meat at the level of the market.

The involvement of companies with quality assurance schemes and their views on future developments relating to residues in poultry are described in the final sections.

ii Acknowledgements

The generous assistance provided by the persons consulted on different aspects of the poultry industry is gratefully acknowledged. The poultry industry, through completion of the questionnaire, have made a major contribution to the preparation of this report.

iii Introduction

safefood, the Food Safety Promotion Board, is responsible for increasing food safety awareness and for supporting north/south scientific co-operation. **safefood** is currently funding a project entitled "Poultry Meat: improving food safety by improving chemical residue surveillance". This joint project between the Veterinary Sciences Division, Queen's University, Belfast and the National Food Centre, Teagasc, Dublin, is addressing the problem of anti-coccidial drug residues in poultry meat and eggs through an all-island research and residue testing initiative. The project started in 2001 and will continue until 2004.

Poultry have a high susceptibility to the parasitic disease, coccidiosis. Because of this susceptibility, veterinary drugs, commonly known as coccidiostats are routinely used in intensively-reared poultry. The coccidiostats are potent drugs and, where residues occur in food, they may exacerbate certain coronary disease conditions. It is important, therefore, for poultry and egg producers to prevent the occurrence of residues of coccidiostats in food products.

Concerns over the presence of coccidiostats in poultry and eggs have been expressed recently in a report from the Soil Association¹. Results of surveillance programmes have shown the occurrence of a number of the commonly-used coccidiostats in poultry products (Table 1)². Follow-up investigations at poultry production units and specific research studies^{3,4} all point to feed contamination as the likely source of residues in poultry products.

To identify the potential problem with use of anti-coccidials in the poultry and egg industry, a comprehensive series of visits and consultations has been undertaken with representatives of the various elements of the poultry industry in Northern Ireland (NI) and the Republic of Ireland (ROI) (Table 2). These consultations were designed to develop information on poultry production systems, feeding of poultry for broiler and egg production, uses of medication and other treatments for conditions in poultry, particularly coccidiosis, and the importance of such issues for the marketing and retailing of poultry products, including quality systems. Contact was made with representatives of the poultry industries both in NI and in ROI so as to cover any differences between the two regions. The material gathered from these visits/interviews was used to identify the critical points relating to use of coccidiostats in poultry production and to identify the issues (and form of presentation) appropriate for inclusion in a questionnaire which was circulated to the 12 major broiler production companies in Ireland (eight in ROI and four in NI).

Throughout this report, in the appropriate sections, the information gathered during the extensive consultations is included to provide more detailed insight into the poultry industry.

The detailed questionnaire (Appendix 1) was completed by 11 of the 12 companies, representing over 90 per cent of total broiler production on the island. In terms of company size, broiler production ranges from 10,000 to 800,000 birds per week, or 0.5 million to 40 million birds per year (Figure 1). Three companies, producing between 20 and 40 million birds per year each, represent over 60 per cent of total production and four companies, producing between five and 15 million birds per year each, represent over 40 per cent of total production. In contrast, another four companies produce less than six per cent of total production, indicating the very broad range of size for companies in the poultry industry.

Table 1. Results of testing for coccidiostats in poultry (UK)

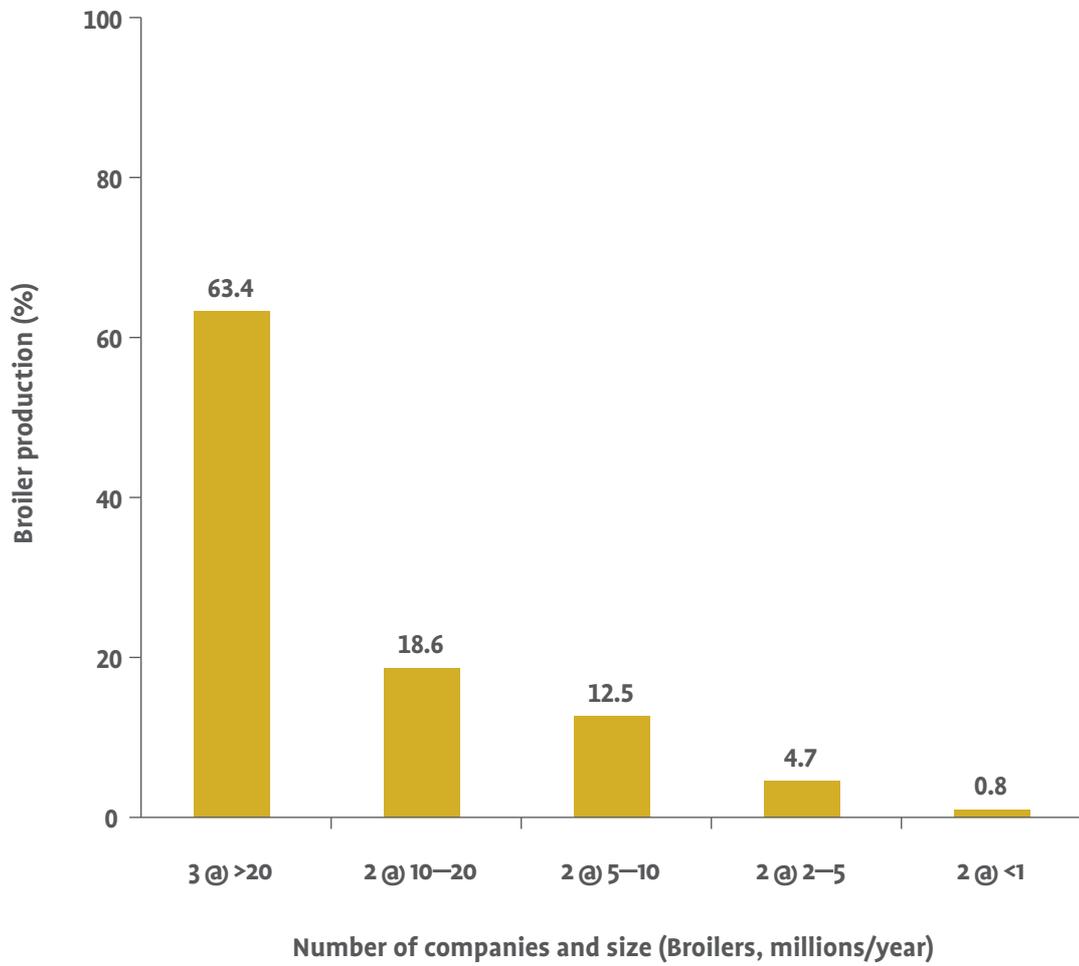
Year	Coccidiostat	Samples Tested		Positive Results	
		Liver	Eggs	Liver	Eggs
2000	Ionophores	267	102	1	0
	Lasalocid	280	212	1	5
	Nicarbazin	271	182	29	0
2001	Nicarbazin	210		35	

- 1 R. Young and A. Craig, *Too Hard to Swallow – the truth about drugs and poultry*. Soil Association, Bristol, June 2001, 68pp.
- 2 The Veterinary Medicines Directorate *Annual Reports on Surveillance for Veterinary Residues*, VMD, Surrey, UK
- 3 A. Cannavan, G. Ball and D.G. Kennedy, *Food Additives and Contaminants*, 2000, 17 (10) 829–836
- 4 A. Cannavan and D.G. Kennedy, *Food Additives and Contaminants*, 2000, 17 (12) 1001–1006

Table 2. Listing of poultry industry representatives consulted for the project

Person	Organisation	Category
Dr Pat Mulvehill	Irish Poultry Processors Association	Poultry Industry
Mr John B. Keane	An Bord Bia	Quality Systems and Marketing
Mr Bill Paterson	Tesco	Poultry and Egg Retailing
Dr Frank Hughes	Intervet	Veterinary Drugs
Mr Tom Horan	Carton Bros.	Poultry Production, Poultry Feed
Mr Michael Ennis	AW Ennis (Dublin) Ltd.	Poultry Feed
Ms Marie Sweeney	Corby Rock Eggs	Egg Production
Mr Fergal Sheridan	Monaghan Veterinary Laboratory	Veterinary Services
Mr Kieran Forbes	Nutrition Services Int.	Veterinary Services
Mr Michael Fallon	DAF (ROI)	Regulatory Agency
Mr Joe Lawson	Moy Park	Poultry Production
Mr Mike Alcorn	O’Kane’s	Poultry Production

Figure 1. Distribution of broiler production across companies. The number of companies and their scale of production (broilers, millions/year) are shown.



1 Broiler Production

Broiler production is a highly integrated industry from breeding stock to poultry processing. Most companies, particularly the larger companies, maintain all the stages – breeding, hatchery, broiler growing, slaughter and meat processing – within their company or under close contract systems (Figure 2). This may start with day-old chicks (parent stock) received from pedigree breeders, supplied to contracted rearers who rear the birds for 18–20 weeks, when they move to contracted breeders, i.e. laying farms, and produce eggs until age approximately 60 weeks. The eggs are sent to a contracted hatchery, producing day-old (commercial) chicks after approximately three weeks. If these are grandparent stock, another cycle of day-olds-rearing-laying-hatching occurs to produce day-old (commercial) chicks for broiler production. These day-old chicks are sexed and females reared separately from males in contracted grower farms (Figure 3). Females and males are separated because they grow at different rates, with females growing more slowly than males and becoming fatty earlier. In terms of products, females are used mainly as whole birds, having an attractive light fat cover, while males are used for production of fillets and processed products. The source of day-olds for broiler production are shown in Figure 4. Only 15 per cent of total broiler production is from day-old chicks sourced from outside the individual companies; of the 11 responding companies, four source day-olds exclusively from within, four exclusively from outside and the remaining three companies source day-olds from within and from outside.

The number of broiler grower farms owned and/or contracted by individual companies is related, generally, to company size (expressed in terms of broiler production, millions/year). Only a minority of the total grower farms, approximately five per cent, are directly company owned/managed. However, the highly integrated nature of the industry helps to provide broadly common standards and management across farms. The number of owned and/or contracted grower farms per company varies between approximately 10 and 150 farms (Figure 5). The average production from these farms, expressed as number of broilers per year, varies between 50,000 and 300,000; Table 3 shows that the average production per farm for most of the industry is in two ranges of (a) 150,000–200,000 birds/farm/year for approximately 30 per cent of total production and (b) 220,000–250,000 birds/farm/year for approximately 50 per cent of total production. The two smallest companies have farms with an average production of 40,000–70,000 birds/farm/year, representing < one per cent of total production. One company has farms with an average production of approximately 300,000 birds/farm/year, representing almost 10 per cent of total production. Within these average, annual production per year figures, there is a large variation in numbers of broilers per farm. Numbers range from four to 300,000 overall on individual farms and, within any particular company, there is a relatively broad range, except for the smallest companies (Figure 6). Five companies representing approximately 70 per cent of

total production have farms ranging in size from four to > 150,000 birds, one company representing approximately 20 per cent of total production has farms ranging in size from four to < 100,000 birds, while the five companies representing less than 10 per cent of total production have farms ranging in size from four to 100,000 birds.

Figure 2. Broiler production activities within or outside companies, as a percentage of total broiler production

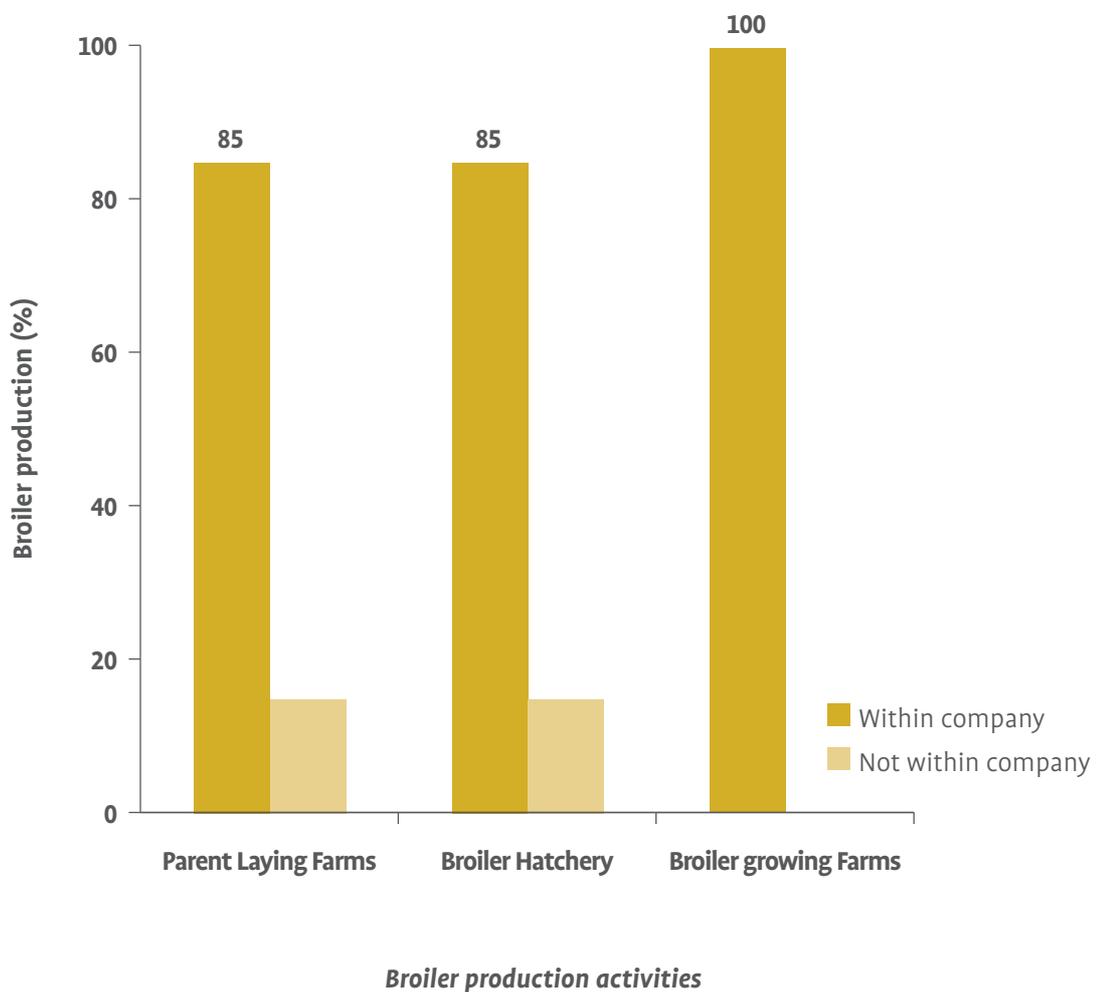


Figure 3. The integrated broiler production system commonly used

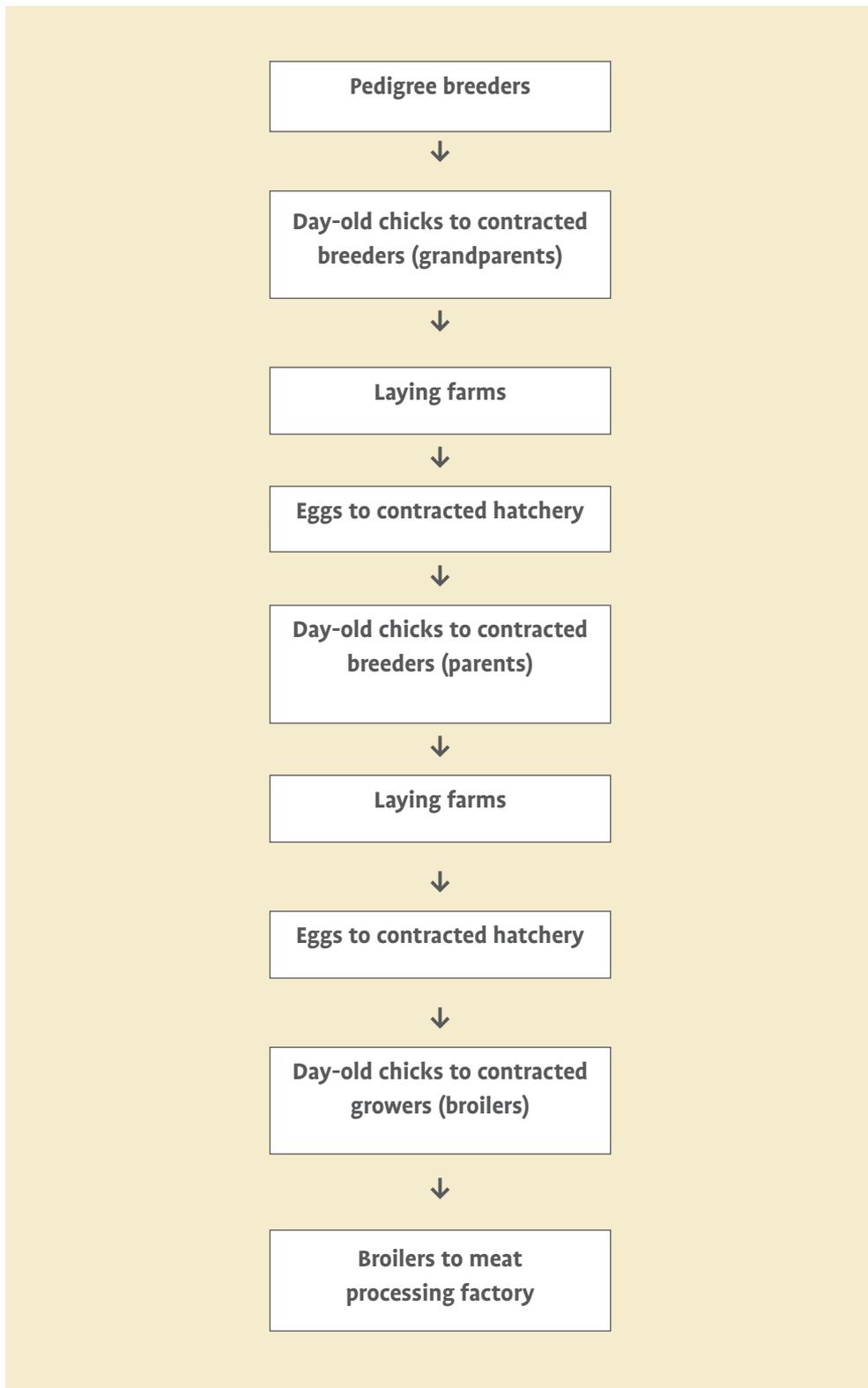
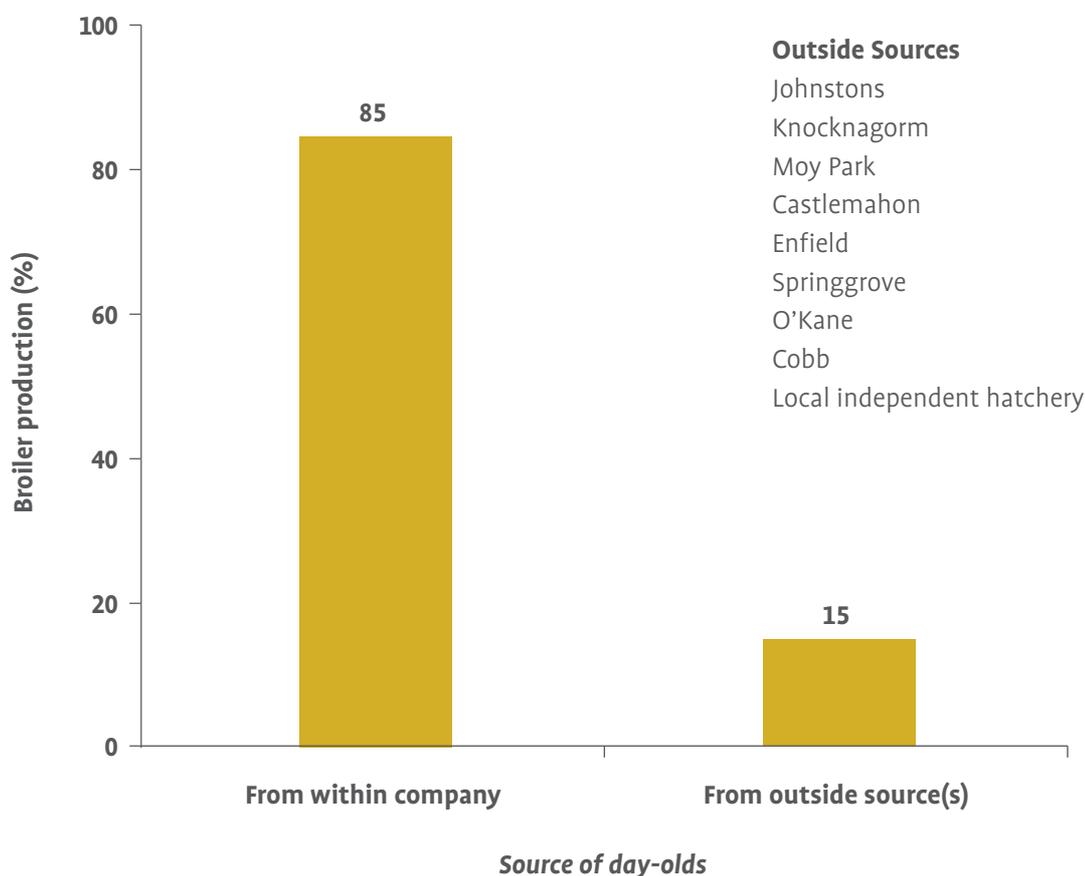


Figure 4. Source of day-old chicks, as a percentage of total broiler production. The common sources of day-old chicks external to companies are listed



There is considerable variation in the size of farms, expressed in terms of number of houses per farm, ranging from one to 12. No particular pattern related to company size is discernible in terms of number of houses per farm (Table 4), although there is some tendency for the larger companies to use larger farms, as would be expected. The number of birds per house is highly variable, ranging between < 1,000 to 42,000 birds per house. The larger companies, generally, have farms where houses contain larger numbers of birds – 10,000 to 42,000 – but some of the smaller companies, while having farms with houses containing < 5,000 birds, also have farms with houses containing bird numbers of up to 30,000.

Practically all production of broilers is on the basis of deep litter systems with < 10 per cent of farms being described as "free-range" (unspecified) and < one per cent of farms being described as "organic".

Figure 5. Numbers of broiler growing farms owned or contracted by each of the responding companies

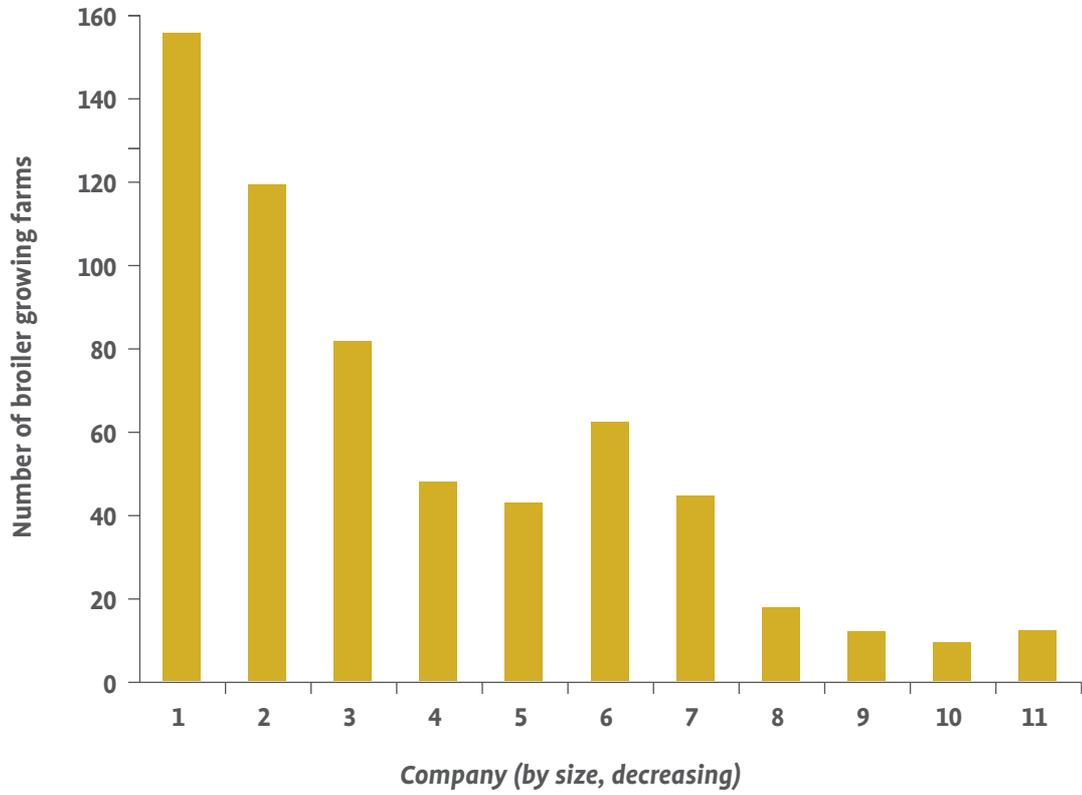


Table 3. Size of companies involved in broiler production

No. of birds/farm/year (thousands)	No. of companies	Proportion of total broiler production (%)
40–70	2	<1
150–200	4	28
220–250	4	50
300	1	9

Figure 6. Ranges of numbers of broilers on growing farms within each company

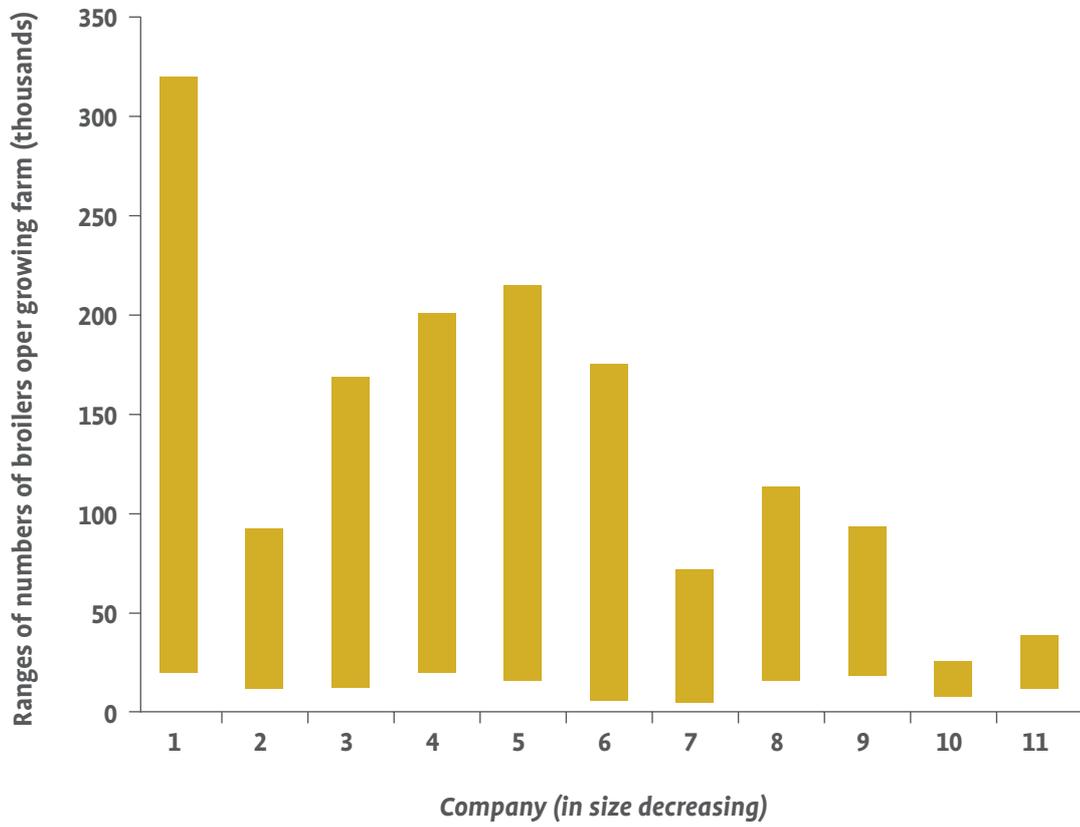


Table 4. Broiler Grower Farms: Numbers of houses per farm and birds per house.

Company (by size, decreasing)	Number of houses per farm	Number of birds per house (thousands)
1	NI	18–35
2	≤4	10–20
3	≤6	12–40
4	≤12	20–35
5	≤10	14–42
6	≤9	4–28
7	≤4	4–30
8	≤6	5–30
9	≤5	1–25
10	≤2	6–13
11	≤5	10–28

NI - no information provided

The poultry companies were asked about biosecurity measures in place in houses and on farms. All responding companies indicated that such measures are in place in their broiler production units. These measures include physical barriers, control of access, chemical treatments, protective clothing and appropriate production practices. A listing of some of the biosecurity measures employed by the companies is given in Table 5. Some companies report use of limited biosecurity measures while other companies, particularly the larger ones, report use of very extensive measures; it is not clear from the replies received to the questionnaire whether a common standard of biosecurity measures is applied to all broiler grower farms/houses within each company.

Typically, harvesting of birds for slaughter occurs at three age/weight categories, as follows: –

- At day 35, pullets, at a weight of approximately 1.6 kg
- At day 40-42, pullets, at a weight of approximately 2.0 kg
- At day 49-50, cocks, at a weight of approximately 3.0 kg.

The feed conversion rates for these three categories of birds taken for slaughter are approximately 1.7, 1.8 and 1.9 kg feed per kg bodyweight, respectively.

The responses to the questionnaire on the issue of system of harvesting were unclear, probably due to a misunderstanding on the terminology used. Companies were asked whether they operated "thinning" or "all-in/all-out" systems. From the replies received, it appears that most broiler production is on the basis of an "all-in/thinning/all-out" system. That is, a full complement of birds are started together and no addition of new birds is made during the production cycle, "thinning" of birds for slaughter at particular target weights is carried out, and all birds are removed at the end of the production cycle with cleaning of the house prior to another production cycle. Only a minority of farms, representing < seven per cent of total production, were indicated as operating a true "all-in/all-out" system, meaning no addition of new birds during the production cycle and a single harvesting of all birds at the end (Figure 7).

"Thinning" is favoured by companies because of the flexibility which it provides. Removal of birds from the house at different times allows growers to achieve (a) space for birds as they increase in size and (b) birds of different sizes to suit the market. While this practice allows for use of less housing (probably 10 per cent more housing would be required if "thinning" were not used), there are two potential problems with the practice. Firstly, residues of veterinary drugs may occur in younger birds harvested by "thinning" because insufficient withdrawal periods have been applied. Secondly, the risk for introduction of disease, such as infection of poultry with *Campylobacter*, by "catchers" coming into the houses is increased since biosecurity is not maintained.

Following completion of broiler production in a house and cleaning and disinfection of the house, the most commonly-used period before introduction of

new stock is two weeks (Figure 8). Over 50 per cent of production is carried out within systems using this two-week break period, with the remainder generally using periods of two to three weeks; less than five per cent of total production is in farms using break periods of less than two weeks.

Table 5. Biosecurity measures applied on broiler grower farms by the companies

<ul style="list-style-type: none"> • Step over barriers; all-in/all-out intercrop break; terminal disinfection/ fumigation; dedicated clothing/footwear/wash basins; rodent control; bacteriological monitoring
<ul style="list-style-type: none"> • Two-way radios and siren
<ul style="list-style-type: none"> • Perimeter boundary; pest-rodent control; visitor access restrictions
<ul style="list-style-type: none"> • On all sites - "No Unauthorised Entry" signs: foot dips; disposable overalls and overshoes; foot barriers
<ul style="list-style-type: none"> • Doors fast at all times; foot dips outside door; only farmer or company representative may enter
<ul style="list-style-type: none"> • Footdips; change of footwear/clothing; "all-in/all-out" with complete cleanout/disinfection
<ul style="list-style-type: none"> • Heat-treated feed; all-in/all-out farms; clearly defined area on each farm specifically for poultry; no unnecessary visitors; foot dips; protective clothing
<ul style="list-style-type: none"> • Controlling human traffic; isolating poultry from contaminated equipment, animals and people; controlling insects and rodents; vaccinations; disinfection and good housekeeping
<ul style="list-style-type: none"> • Disinfection point at entry; hand cleaning facilities; rodent control
<ul style="list-style-type: none"> • Foot dips at every house and provision for wheel dips on every farm; full cleaning and washing at end of each cycle.

Figure 7. Type of harvesting of birds used on farms for each of the responding companies

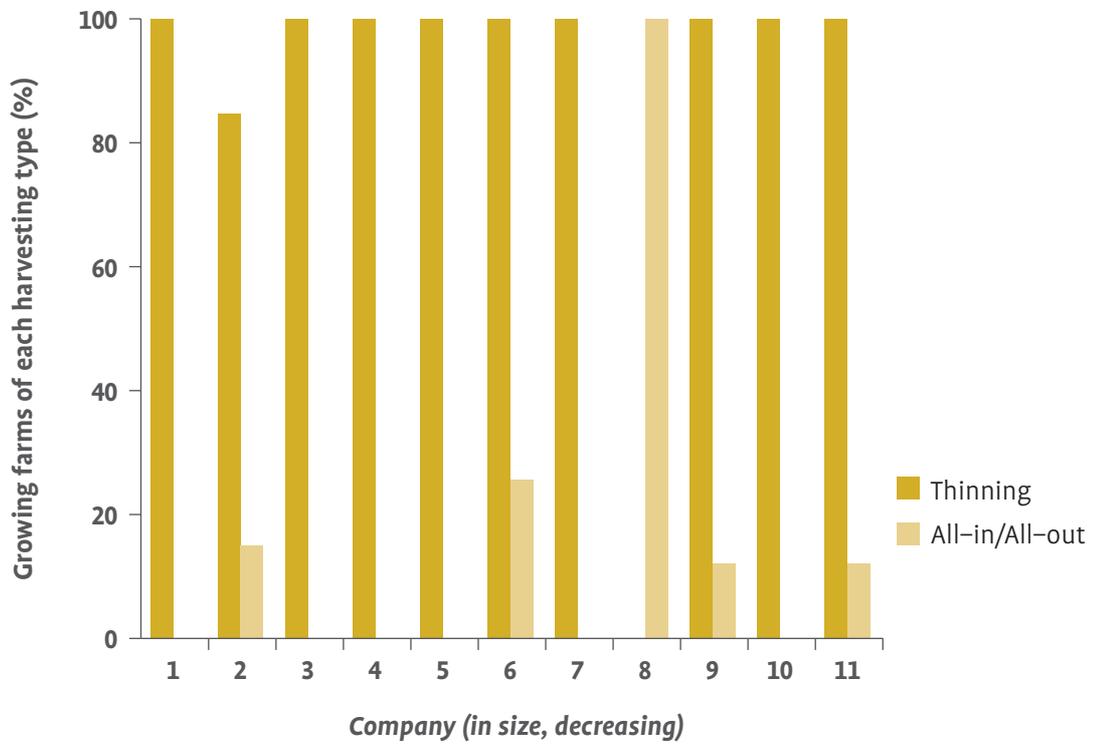
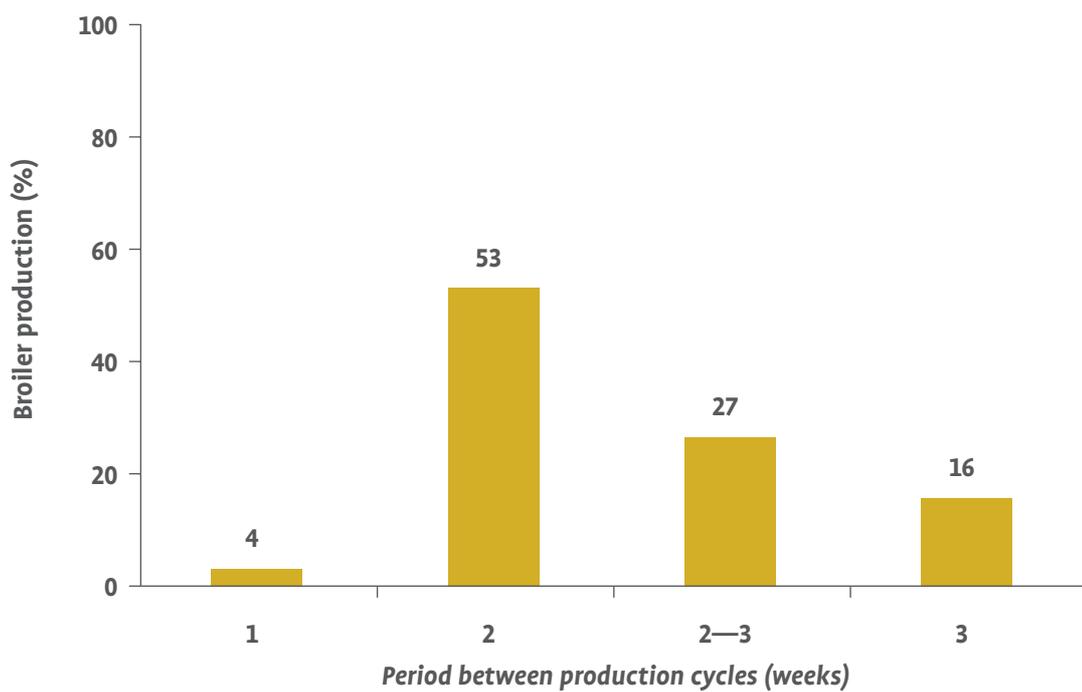


Figure 8. Period between harvesting of birds and start of new production cycle in broiler grower houses



2 Treatment for Coccidiosis

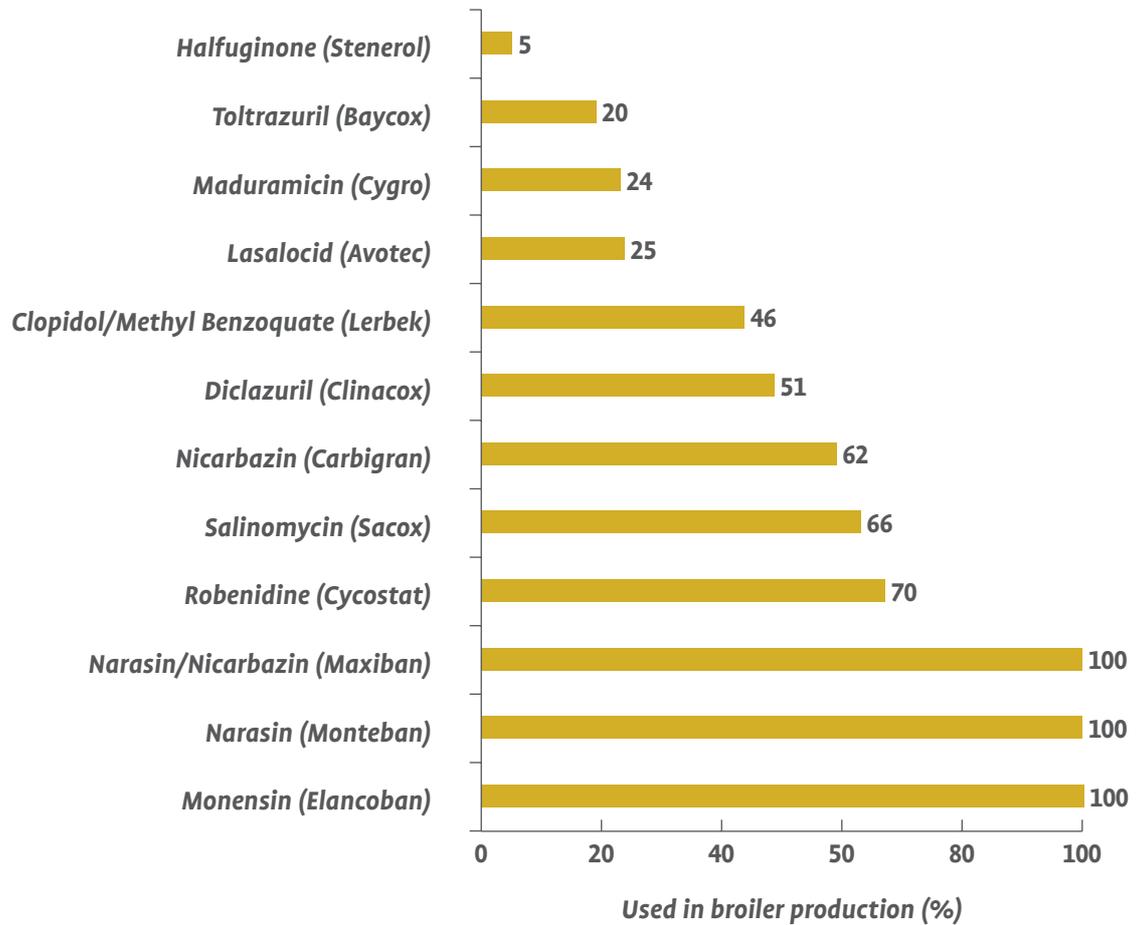
All commercially-produced poultry are susceptible to coccidiosis, requiring action which may be by way of vaccination or drug treatment. Vaccination is relatively expensive and tends to be used only with breeding stock (grandparents/parents) or for birds in organic production. Vaccination, while efficient in preventing coccidiosis, will not give any of the secondary or indirect benefits which may be associated with use of drug treatments; improved performance and/or other therapeutic effects have been attributed to use of anti-coccidials. The reasons advanced by companies for not using vaccination routinely on broilers were the following, in descending order of importance:

- vaccination is too expensive
- vaccination results in negative effects on performance
- in the absence of anti-coccidial drugs, there is susceptibility to higher incidence of clostridial infections resulting in necrotic enteritis
- vaccination is an ineffective treatment for coccidiosis.

In this connection, removal of many of the feed additive antimicrobials, such as Flavomycin, from use on poultry has led to an increased potential for outbreaks of necrotic enteritis. In such circumstances, any secondary anti-clostridial effect of anti-coccidials is valuable. Necrotic enteritis is a serious issue for the poultry industry, particularly in Ireland where the wheat-based diet for poultry predisposes birds to this disease. Wheat-based diets are not as digestible as the maize-based diets used in the USA and Brazil. The more easily digestible maize-based diets have faster gut passage, with lower disposition towards development of necrotic enteritis. Narasin, which demonstrates good anti-gram-positive effects in addition to its coccidiostat action, is favoured for use in grower feed. Other strategies for control of coccidiosis and necrotic enteritis may be by combinations of ionophores and therapeutic antibiotics.

Some 12 drugs or drug combinations are used as anti-coccidiostats (Figure 9). All companies use Narasin, Monensin and Nicarbazin in their anti-coccidiosis treatment strategies. Other drugs used fairly widely are Salinomycin and Robenidine, while only a minority of companies use Diclazuril, Lasalocid, Naduramicin, Clopidol, Toltrazuril and Halfuginone. The number of different drugs used by individual companies ranges from five to 10. Useful information on drugs approved for use as anti-coccidials, and on correct usage in terms of dose and withdrawal period, may be obtained from sources such as the Veterinary data sheet compendium produced by the Animal and Plant Health Association (APHA) and from the list of authorised feed additives obtainable from the Department of Agriculture and Rural Development (DARD) NI and the Department of Agriculture (DAF), ROI.

Figure 9. Use of anti-coccidials in broiler production. The usage of each drug is shown in terms of the percentage of the total broiler production to which it may be applied



Susceptibility of poultry to coccidiosis is greatest in the early stages and it has been a typical treatment to use the coccidiocide, Nicarbazin, in the starter diet for approximately the first two weeks. Subsequent treatment is with ionophores, such as Monensin, included in the grower and finisher diets from two to four weeks. Finally, non-medicated feed is fed to broilers from approximately four weeks of age to slaughter (five to seven weeks). To avoid development of resistance in the causative agent of coccidiosis, treatment regimes for the infection are varied. In particular, winter and summer treatments have been used with (a) reliance on a coccidiocide and coccidiostat (Nicarbazin, followed by ionophores) approach in the winter, and (b) use of different ionophores in the summer. Monensin (Elancoban™) may be favoured as an ionophore in winter treatments because it has a secondary effect of reducing water intake, leading to a better quality of litter. With the removal of licensing of Nicarbazin from May 2002, treatment for coccidiosis may become more difficult; availability of the combination product Narasin and Nicarbazin (Maxiban™) is expected to continue. There may be a move towards more use of other anti-coccidials, such as Lasalocid.

There are a number of aspects of broiler production which may make routine control of coccidiosis difficult. The common practice of harvesting birds by "thinning", in order to get sufficient number of birds of the correct weight for the market, has associated risks with introduction of disease. Additionally, an unscheduled requirement to harvest birds at short notice means that anti-coccidial treatment may not be re-introduced easily once withdrawal (coccidiostat-free) feed has been started. In this connection, Monensin is an attractive anti-coccidial treatment because of its very short persistence time, requiring a withdrawal period of as little as one to two days. However, with a double-bin feeding system and well-scheduled harvesting for different weights, switching between finisher feed, containing Monensin, and withdrawal feed may be an option but the risks for residues in poultry are obvious.

The preferred approach, to achieve good veterinary/manufacturing practice and food safety, is to operate a true "all-in/all-out" system. A broiler grower farm would designate specified houses for slaughter of all birds at predetermined age/weight categories. Using this planned system, birds of different sizes could be provided for the market within an "all-in/all-out" system. Houses providing the different growing periods would have different productivity rates, but such differences could be addressed in a management model for the "all-in/all-out" system.

Coccidiosis may be present in flocks at a sub-clinical level, resulting in poorer performance and reduced weight gain. The reported greater uniformity in size in vaccinated flocks may indicate the presence of sub-clinical coccidiosis in flocks treated alternatively with anti-coccidials. Lack of size uniformity is an important constraint in poultry production where the market has requirements for very specific weight categories; this may encourage extensive use of "thinning" rather than single-harvest approaches with consequent negative effects in terms of disease control. Outbreaks of clinical coccidiosis are treated generally with Toltrazuril by inclusion in the drinking water. Continued intake of anti-coccidials, even when the broilers have been moved on to withdrawal feed, may occur because of the availability of anti-coccidials in the litter on which the broilers are kept. These anti-coccidials in litter may arise from medicated feed and/or faeces occurring during previous stages in the production cycle.

3 Feed Manufacture, Specification, Supply and Use on Farm

Feed manufacturing, specification and supply to the poultry industry may be divided, generally, into two systems. Some poultry producers, particularly the larger companies representing approximately 60 per cent of total broiler production, have an integrated system in which they produce their own feed (using a company feed-mill or a sole-contractor feed-mill) and supply it to their own and contracted broiler farms. Others, particularly smaller companies, purchase their feed from independent feed manufacturers. In either case, generally the company specifies and supplies feed to the growing farms; for less than five per cent of broiler production do the broiler growing farms source their own feed from independent feed manufacturers (Figure 10).

Specification of feed to be used on broiler growing farms is provided, in most cases, by the company nutritionist to the feed mill (including specification of anti-coccidial drugs to be included in medicated feed). Only four, of 11, companies source feed from mills manufacturing for poultry exclusively. Most feed mills are producing both medicated and non-medicated feed, with separation either by separate lines or by time. The risk of cross-contamination may be reduced by using a "buffer" system between medicated and non-medicated feed manufacture on the same line. For example, manufacture of turkey grower feed after manufacture of ionophore-medicated broiler feed may serve as a buffer prior to manufacture of withdrawal broiler feed. A rule-of-thumb for cross-contamination prevention might be that the maximum carryover from ionophore-medicated to non-medicated feed should be at < one per cent. For drugs exhibiting relatively long persistence times in broiler tissues, such as Nicarbazin, the maximum carryover needs to be close to zero. For Lasalocid, a concentration effect in eggs has been identified; for this reason many British egg producers will not purchase feed from feed mills where Lasalocid is used. Other factors which may contribute to cross-contamination problems are mistakes in manual addition of medicated pre-mix and whether the medication is in a granular or powder form.

Further investigation of the steps taken to prevent cross-contamination from medicated to non-medicated feed within the plant indicates that all manufacturing plants use separate storage areas for different feeds, while a majority use additional approaches such as separate lines/conveyors and/or shutes/weighbridges. Some companies have well-developed special container and transport systems to reduce the possibility for cross-contamination and/or errors in feed supply (Figure 11). Some of the larger companies have different vehicles assigned to different feeds with incompatibilities identified – for example, starter feeds may never be transported in vehicles designated for withdrawal feed. Use of compartmentalised vehicles, for different feeds, has been found not to be sufficiently secure and the move is to use different vehicles designated for different feeds.

In feed manufacture, it is common to "flush" the system with small amounts of non-medicated feed immediately after the manufacture of medicated feed has been completed. These flushings are designed to clear medicated feed from the system, but a number of problems arise, namely (a) the incomplete cleaning of the system due to unavailable "dead spaces," and (b) use and/or disposal of the

flushings which contain reduced levels of medication. The most widely practiced procedure for use/disposal of flushings is to incorporate them into future batches of similar medicated feed. This approach may raise further problems, such as storage of flushings, achievement of homogeneous mixing of flushings in medicated feed, and presence of non-prescribed drugs in medicated feeds.

Manufactured feeds are analysed routinely for composition and less frequently, and only by some feed mills, for other parameters such as Salmonella, anti-coccidials and other drugs.

On broiler production farms, a range of strategies are used to control transfer from one feed type (starter, grower) to the subsequent feed type (grower, finisher). The feeding systems used on the grower farms are largely a double-bin system, accounting for slightly over 75 per cent of farms. The remaining 24 per cent of farms use a single-bin system (Figure 12). Only two companies have greater than 90 per cent of their grower farms using single-bin feeding systems and these companies correspond to approximately seven per cent of total production. Those companies accounting for almost 75 per cent of total production have 70–100 per cent of their farms using double-bin systems.

Figure 10. Source of poultry feed used by companies and supply of feed to broiler growing farms

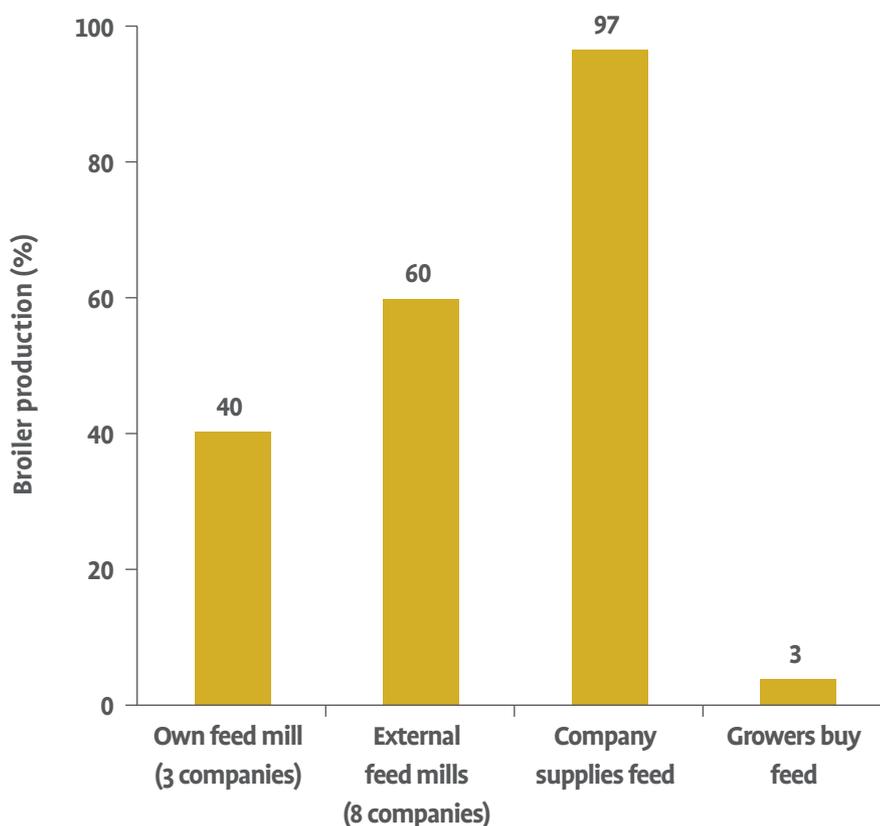
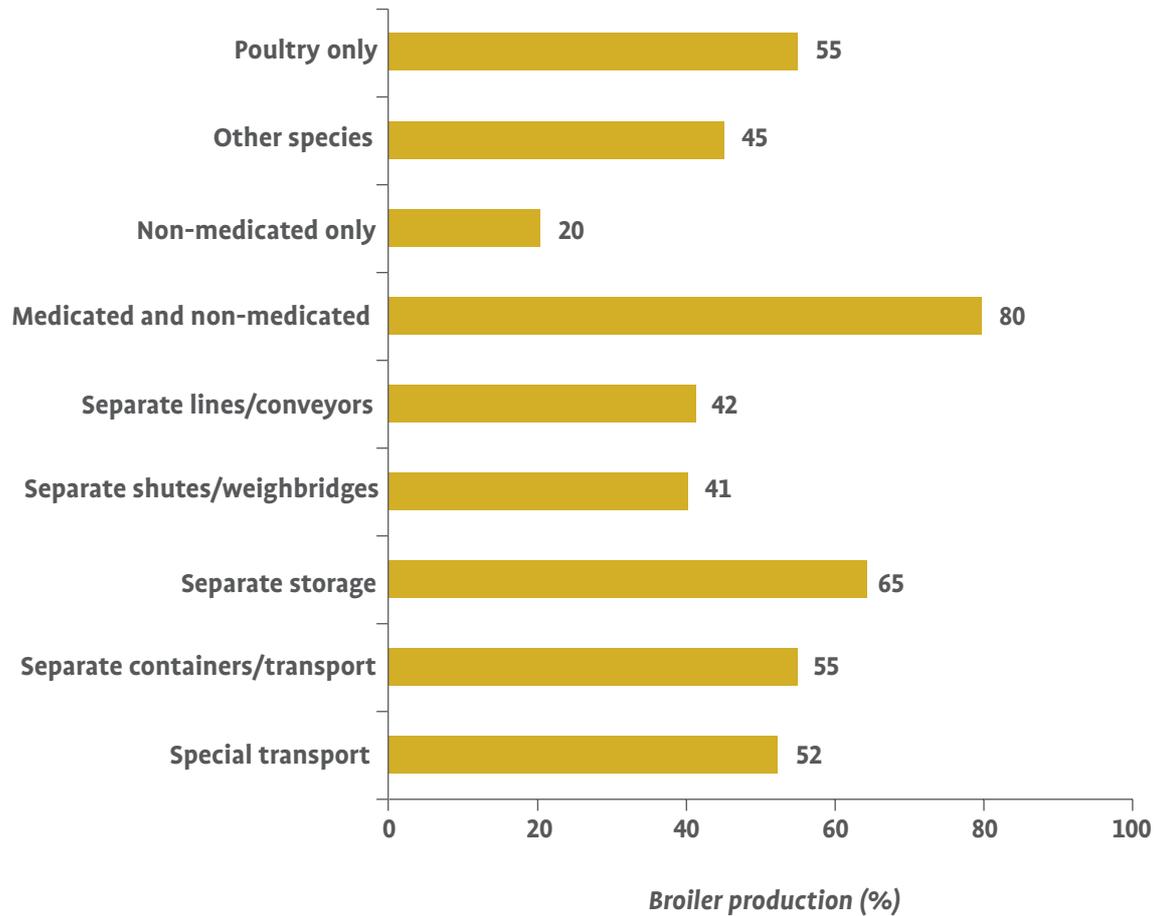


Figure 11. Types of feed manufacturing and practices used to prevent cross-contamination in poultry feed



In addition to, or instead of, the double-bin feeding system, a number of strategies are used by companies, including: –

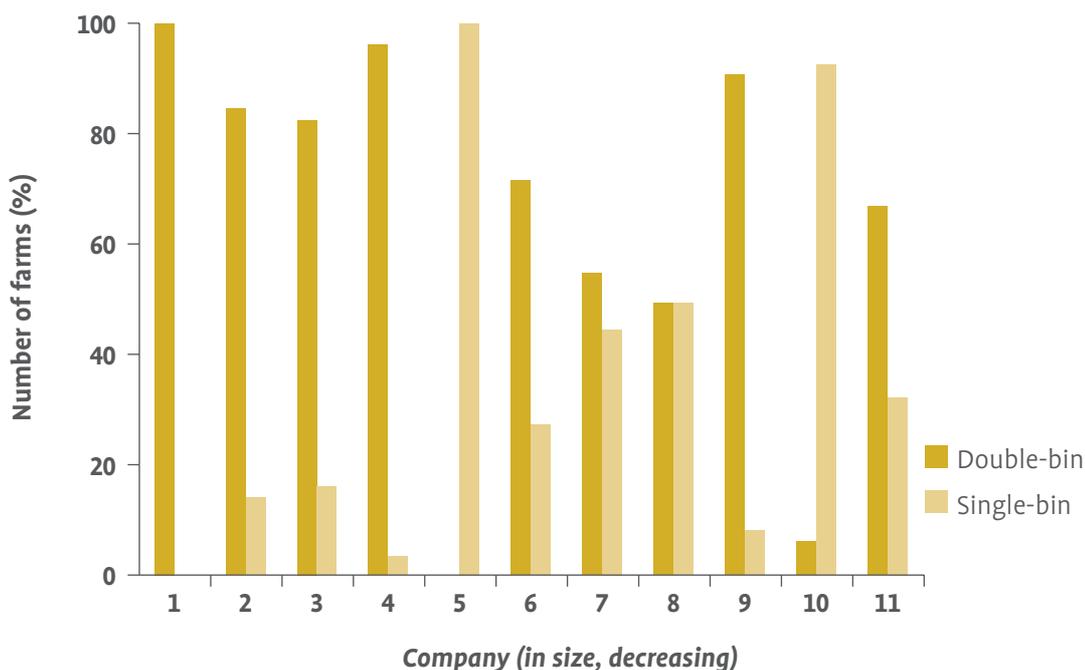
- specified feeding programmes which calculate the amount of a particular feed required for each 1,000 birds per day
- emptying, washing and fumigating of bin(s) between feed types
- recording of feed usage, and
- specification of when withdrawal feed must be used.

A variety of checks are undertaken by companies to ensure that the appropriate feed is being used. These include: –

- programmed feeding and supply of feed to farms
- auditing of farm records and inspection of farms
- sampling of feed for analysis.

Analysis of feed for anti-coccidials on a regular or occasional basis was indicated by four companies, representing approximately 65 per cent of total production. Another two companies, representing < 10 per cent of total production, undertake analysis of feed for anti-coccidials where there is a question over flock performance, while the remaining five companies (< 30 per cent of total production) indicated that analysis of feed for anti-coccidials is not undertaken.

Figure 12. Feeding systems used on broiler grower farms, showing percentage of farms for each company using double-bin and single-bin systems



In summary, cross-contamination of poultry feed with anti-coccidial drugs, leading to the potential for residue-positive poultry meat, may occur during feed manufacture or on farm. The likelihood of its occurrence during feed manufacture is dependent on good control of manufacturing and separation of medicated from non-medicated feed during manufacture, storage and supply. Reworking at a feed manufacturing plant of rejected or leftover feed, or movement of leftover feed from one farm to another, provides the potential for cross-contamination to occur. At farm level, the risk of cross-contamination may be reduced by use of a double-bin system, together with careful control of feeding programmes, maintenance of high quality records and application of strict "all-in/all-out" production systems without "thinning". Any use of leftover medicated feed, outside its use for the intended birds/house, has implications for cross-contamination and disease.

4 Poultry Products, Markets and Imports

Data received on the products manufactured from domestic broiler production by the responding companies were incomplete, with four companies, representing approximately 45 per cent of total production, providing no data. An analysis of the data provided by the other companies is shown in Table 6. For most companies "whole, fresh chicken" and/or "portions, fresh, uncooked" represent most (70–100 per cent) of their production. Expressed in terms of total production, these two products account for 23 per cent and 65 per cent, respectively, and are manufactured by all of the responding companies. Four, of seven companies, manufacture "whole, frozen chicken" and "processed, value-added products, fresh", representing in each case only two per cent of total broiler production. Two companies manufacture "portions, frozen, uncooked", accounting for four per cent of total broiler production. Only one company manufactures "processed, value-added products, frozen", representing one per cent of total production and another company manufactures "cooked products", accounting for three per cent of total production.

Only six companies, representing < 25 per cent of total production, provided data on the markets in which products manufactured from domestic broiler production are sold (Table 7). Therefore, the data may not be representative of the markets for poultry products from the total production. Four categories of product are described both fresh and frozen. For each product category, fresh product is mainly sold in the retail market, accounting for approximately 50 per cent of total production, while another 25 per cent of total production, approximately, is sold as fresh products in the catering market. Less than seven per cent of total production is sold as fresh and frozen products in the hot counter/fast food market. Most of the frozen products, representing less than 20 per cent of total production, are sold in the catering market.

Five of eight responding companies, accounting for approximately 40 per cent of total production, indicated that they manufacture "own brand" products for multiple retailers. Only three companies, representing only 12 per cent of total production, provided a breakdown between products manufactured as "company" and "own brand" products in the retail market; because of the little data provided, this information may not be representative of the poultry industry. This limited data indicate that most "own brand" products manufactured are whole, fresh chicken or chicken portions and, in most cases, represent less than 50 per cent of a company's production of these products.

Table 6. Poultry products manufactured by companies

PRODUCT CATEGORY	Company (in size, decreasing)						
	1	2	3	4	5	6	7
	Product category manufactured (%)						
FRESH PRODUCTS							
Whole chicken	15	26	35	60	20	40	35
Portions, uncooked	85	46	30	25	70	60	10
Processed, value-added products			3	13	10	50	
Cooked products		15					
TOTAL FRESH PRODUCTS	100	87	68	98	100	100	95
FROZEN PRODUCTS							
Whole chicken		5	5	2			5
Portions, uncooked		7	20				
Processed, value-added products			7				
Cooked products		1					
TOTAL FROZEN PRODUCTS	0	13	32	2	0	0	5

Table 7. Markets in which poultry products from the domestic production are sold

Product category	Product sold in each market (%)																	
	Retail outlets						Catering						Hot counter and fast food					
	Company						Company						Company					
	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
Fresh products																		
Whole chicken	90	25	80	10	90	60	5	60	10	90	10	28	5	15	10			12
Portions, uncooked	90	25	80	10	20	28	5	60	15	90	80	24	5	15	5			48
Processed products			90	10		92		80		90		8		20	10			
Cooked products	80						10						10					
Frozen products																		
Whole chicken			10				100	70	90			100		30				
Portions, uncooked	2						93	90					5	10				
Processed products								80						20				
Cooked products							100											

Only eight companies, accounting for approximately 50 per cent of total production, provided information on their use of imported chicken in product manufacture. Three companies, accounting for approximately 25 per cent of total domestic production of broilers, indicated that they use chicken imported from the Netherlands, Brazil and Thailand in product manufacture. No information on the distribution of products, manufactured from imported chicken, between the retail, catering and hot counter/fast food markets was provided.

The comments from a number of the persons consulted provide additional information on the markets for poultry and on the relative importance of imported chicken. Over one-third of the weekly consumption of poultry in NI and ROI is provided from imports, and is a growing proportion of total poultry consumption. These imports may be broken down into (a) fresh, whole chicken and portions from countries within the EU, such as Denmark and The Netherlands, and (b) frozen portions and processed products from EU countries and from Brazil, China and Thailand. Imports into Europe are facilitated by the much lower costs of production in exporting countries; for example, in Brazil labour costs are at approximately one-third the cost in the EU and total production costs are at approximately half the cost in the EU. Most companies involved with domestic broiler production also import poultry products. Some of the larger companies in Britain, such as Grampian, have established companies in countries exporting to the EU. Apart from fresh whole birds and fillets in the retail market, much of the other poultry products are likely to be from imports. Whether such products are from domestic production or from imports is difficult to establish as the labelling system used is limiting. Even multiple retailers, normally supplying fresh poultry from domestic production, may use imported poultry for "special offers" or "promotions". It is estimated that > 70 per cent of poultry used in the catering trade, including further processed products, is imported.

From a retailer perspective, poultry consumption in NI and ROI, at approximately 33 kg/head/year, is high within the EU. Poultry is a relatively problem-free food for retail sale. Most multiple retailers have both their "own brand" products, supplied by one to a few companies, and also company branded products.

5 Quality Assurance Schemes

Seven to eight companies, accounting for greater than 95 per cent of total production, indicated that they had membership of external quality schemes, such as Assured Chicken Production and Bord Bia. Eight companies, accounting for over 85 per cent of total production, are members of multiple retailer assurance schemes, many of the companies being members of a number of schemes. Apart from the various quality schemes referred to above, some companies apply a variety of additional quality assurance measures such as Hazard Analysis Critical Control Point (HACCP), ISO 9000 manufacturing standard, the British Retail Consortium (BRC) Scheme and company internal quality assurance schemes.

Companies would welcome a single quality assurance scheme so as to avoid multiple audits. For example, the Assured Chicken Production Scheme, which is UK-based, is accepted by most multiple retailers, and the same might apply for the Bord Bia scheme which is under development. Some multiple retailers, while not fully accepting the Assured Chicken Production Scheme, are prepared to use it with only some specific additional requirements.

6 Future Developments

The companies were asked to identify future developments which they considered might increase/decrease the likelihood of anti-coccidials and other veterinary drugs being present in poultry products. Ten, of 11, companies responded to this question and identified a range of factors (Table 8). The factors, which are presented as described by the respondents, indicate that most companies consider that there will be a decrease in the incidence of residue-positive poultry meat. These factors cover most elements of the poultry industry including: –

- changes in treatment of poultry for coccidiosis and in regulation of veterinary medicines
- better practices and control of feed manufacture and broiler production on farm
- improved testing/monitoring for residues, including testing of imported poultry
- market-driven influences from consumer expectations for safe food.

The companies identified fewer factors which might cause an increase in the likelihood of residue-positive poultry meat. The influences identified are mainly concerned with the following: –

- changes in usage patterns and withholding times for veterinary medicines and in application of greater restrictions on drug usage
- commercial pressures towards more intensive production
- the likelihood of imports from outside the EU having higher incidence of residue-positive poultry.

The companies were asked to comment on the issue of anti-coccidials in poultry production generally, and on the research project, in particular. The respondents comments are listed, under these two categories, in Table 9. On the general issue of anti-coccidials in poultry, points were made regarding: –

- the need for treatment of coccidiosis and the safety of the anti-coccidials currently used in Ireland
- the expected positive influence, in terms of residues in meat, from the removal of nicarbazin (as a single product) from the list of approved drugs
- one company's experience of having no residue-positive samples, suggesting a low risk.

In relation to the research project, there is general welcome for it with descriptions of "topical", "necessary", "worthwhile", "a good idea" and "worthy of support". It is expected to provide useful information for the industry and to assist industry in developing best practice. The residue testing and survey activities of the project are welcomed if they serve to increase consumer confidence in poultry products. Respondents are concerned that imported poultry should be tested on a comparable basis so that domestic poultry production is treated equitably.

Table 8. Factors likely to affect the occurrence of residues in poultry products

<i>Factors which might increase the likelihood of residues occurring in poultry products</i>	<i>Factors which might decrease the likelihood of residues occurring in poultry products</i>
<ul style="list-style-type: none">• Use of prescription antimicrobials• Reluctance to extend the withholding times on drugs• The total withdrawal of growth promoting agents• Adoption of "American style" production systems• Increased imports from outside of the EU.	<ul style="list-style-type: none">• Development of better vaccines against coccidiosis• Use of vaccines against coccidiosis• Use of anti-coccidials with shorter withholding times• The total withdrawal of growth promoting agents• Better management practices at feed mills and at farms• Good housekeeping and hygiene practices• Better control of feed manufacturing• Development of farm codes of practice• Auditing and monitoring of feeding• Residue testing• Development of proper residue monitoring systems• More rigorous testing of imported poultry• Safety concerns from consumers will cause a reduction in residues in poultry.

Regarding the value of residue testing programmes and companies' willingness to participate, a generally positive response was received (Figure 18). Eight companies, accounting for almost 90 per cent of total production, consider that testing programmes for residues would help to add value to their products, and 10 companies indicated that they would participate (or would consider participating) in a residue testing programme. Respondents who would consider participating in a residue testing programme were concerned with issues such as the cost of testing, the use of verified methods and the duplication with current residue testing programmes.

Table 9. Comments on the issue of coccidiosis treatment in poultry and on the research project

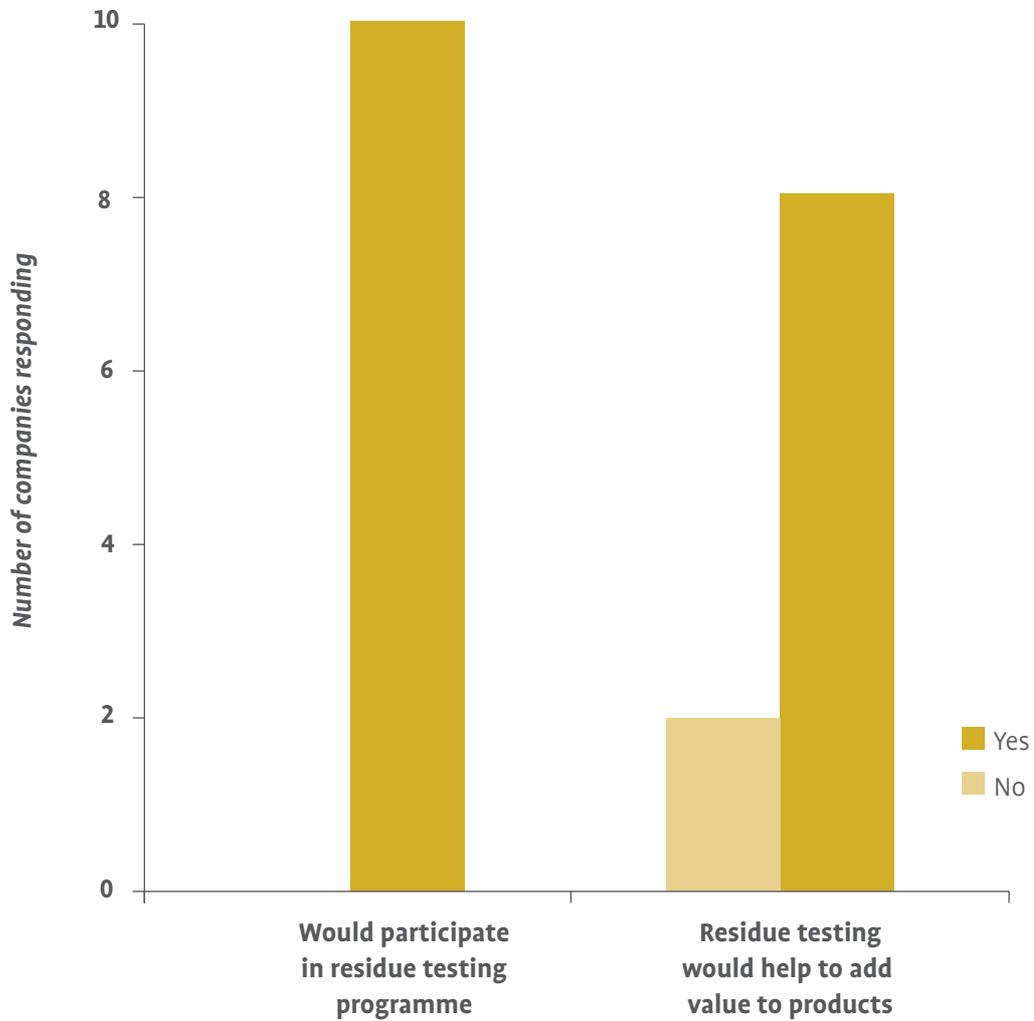
General Comments

- 1 Anti-coccidials are a necessity in poultry production and the agents which currently are approved for use are safe.
- 2 There should be less of an issue with anti-coccidial residues in poultry meat when Nicarbazin, as a single product, is no longer available, unless there is development of more sensitive testing.
- 3 There has never been a positive test result for anti-coccidial residues in poultry meat, in this particular company, and the risk associated with poultry from domestic production is considered to be very low.

Research Project

- 1 The research project is very topical, necessary and should be supported; consideration of imported poultry is important.
- 2 The research project is very worthwhile and information should be disseminated to the poultry industry.
- 3 The research project is a very good idea and, if testing/monitoring is properly undertaken, the project will be of benefit to the industry.
- 4 The residue testing envisaged in the research project is welcome if it increases consumer confidence in poultry products; imported poultry products must be tested similarly.
- 5 The research project will be of assistance in providing information on this topic and in helping the industry to develop best practice.
- 6 Imported poultry must be tested similarly to domestic production.

Figure 13. Interest of companies in a residue testing programme for **anti-coccidials in poultry**



7 Conclusions

A characteristic feature of the poultry industry, both in NI and in ROI, is the high level of vertical integration within each company. This feature should be of assistance in dealing with control of residues of veterinary drugs in poultry meat. The increase in poultry consumption, an approximately 50 per cent growth over the last decade, means that there is an increasing interest by the consumer in the quality and safety of poultry products. From the extensive consultations and from the data supplied by the poultry industry to the questionnaire, it is clear that the industry has a strong commitment to quality assurance schemes. This commitment to quality, is likely to assist control of residues in poultry. While the responses from the poultry industry indicate that there may be some factors contributing to an increased likelihood of anti-coccidial residues occurring in poultry in the future, most factors identified by the industry encourage the view that a reduction in residue-positive poultry is likely. The poultry industry demonstrated a generally positive attitude to the current research project as a means of enhancing the image and actual safety of poultry meat to the consumer; in excess of 90 per cent of domestic production is represented in replies to the questionnaire.

In contrast to this favourable situation, there are a number of issues which may contribute to the potential for residues of anti-coccidials in poultry. A problem has been identified, particularly with Nicarbazine residues in poultry, from the UK's residue monitoring programme. Some of the issues which may be important for residues in poultry, and on which the current research project may provide information, are: –

- the very different scale of production between companies, in terms of company size, broiler growing farm size and house size
- problems associated with feed manufacture, transport and use on farm, particularly possibilities for cross-contamination
- the need for treatment with anti-coccidials, including secondary benefits from these drugs
- problems relating to broiler production and harvesting systems used.

An important issue is the position of imported poultry, the expected continued growth in imports and the quality of imports, relative to domestic production, in terms of residues of veterinary drugs.

8 Appendix

Questionnaire to Broiler Production Companies

COCCIDIOSTAT RESIDUES IN POULTRY
QUESTIONNAIRE FOR THE POULTRY INDUSTRY

1. Company Details

1.1 *Name of company:* _____

1.2 *Address:* _____

Telephone: _____ Fax: _____ Email: _____

1.3 *Contact person:* _____

1.4 *Position in company:* _____

1.5 *Company activities*

Parent laying farms: Yes No

Broiler hatchery: Yes No

Broiler growing farms: Yes No

Feed production: Yes No

1.6 *Company size/details*

Total number of broilers produced: per week _____ per year _____

Total number of growing farms:

Number of broilers per growing farm: From _____ To _____

2. Production System

2.1 *Source of day-olds:* From within company From outside

If from outside, what is the source _____

2.2 *Broiler growing farms*

Number of farms: _____

Range of numbers of broilers per farm: From _____ To _____

Management of farms: Company Contractors

Number: _____ Number: _____

Type of farms: Deep litter Free-range Organic Other

Number: _____ Number: _____ Number: _____ Number: _____

Numbers of houses per farm: From _____ To _____

Numbers of birds per house: From _____ To _____

2.3 *Feed systems used:*

Single bin: , number of houses or farms: _____

Double bin: , number of houses or farms: _____

Other: , number of houses or farms: _____

Details: _____

2.4 *Are biosecurity measures in place in houses/farms?*

Details: _____

2.5 *Systems of harvesting used:*

Thinning: , number of houses or farms: _____

All-in/all-out: , number of houses or farms: _____

2.6 *Typical period between removal of last birds and introduction of new stock:*

3. Feed on Farm

3.1 Feed production

in company feed mill(s):

in external feed mill(s): , number of suppliers: _____

3.2 Does your company supply feed to all growing farms?

Yes No

If "No", please give details of supply, specifications and controls:

3.3 How is feed to growing farms specified and supplied?

3.4 What procedures are followed on growing farms for transfer from one feed to the subsequent feed?

3.5 What checks are carried out on growing farms to ensure that the appropriate feed is being used?

3.6 Are analyses of feed from growing farms for anti-coccidials undertaken?

4. Feed Manufacturing

4.1 *Is the feed mill(s) preparing feed for:* Poultry only

Poultry and other species

4.2 *Is the feed mill(s) preparing feed:* Non-medicated only

Medicated and non-medicated

4.3 *If the feed mill(s) is preparing both medicated and non-medicated feed, are they separated?* Yes No

4.4 *What systems are used to prevent cross-contamination of non-medicated feed with medicated feed?*

Separate lines/conveyors Yes No

Separate shuttles/weigh bridges Yes No

Separate storage areas Yes No

Separate containers/transport Yes No

Special transport for different feeds Yes No

4.5 *Where the system is "flushed" after medicated feed manufacture, what is done with the flushings?*

4.6 *What analyses on manufactured feed are undertaken and with what frequency?*

5. Anti-Coccidial Treatments

5.1 Does your company specify treatment of broilers for coccidiosis by:-

Vaccination: Yes No

Veterinary drugs: Yes No

Vaccination and veterinary drugs: Yes No

5.2 If vaccination is not used, is it because of:-

Expense

Negative effects on performance

Ineffective treatment

Other reasons

Details: _____

5.3 Of the following drugs, which are/have been used by your company for treatment of broilers for coccidiosis?

Clopidol (Coyden) Narasin (Monteban)

Decoquate (Deccox) Nicarbazin (Carbigran)

Diclazuril (Clinacox) Robenidine (Cycostat)

Halfuginone (Stenerol) Salinomyin (Sacox)

Lasalocid (Avotec) Toltrazuril (Baycox)

Maduramicin (Cygro) Clopidol/Methyl Benzoquate (Lerbek)

Monensin (Elancoban) Narasin/Nicarbazin (Maxiban)

Other drugs used: _____

6. Products

6.1 *What is the percentage breakdown of products manufactured by your company from domestic broilers?*

Whole, fresh chicken	_____
Whole, frozen chicken	_____
Portions, fresh, uncooked	_____
Portions, frozen, uncooked	_____
Processed, value-added products, fresh	_____
Processed, value-added products, frozen	_____
Other products, fresh (_____)	_____
Other products, frozen (_____)	_____
Total	<u>100</u>

6.2 *In which markets are these products sold?*

Product	Market			Total
	(%) Retail outlets	(%) Hot counter/ fast-food	(%) Catering	
Whole, fresh chicken	_____	_____	_____	<u>100</u>
Whole, frozen chicken	_____	_____	_____	<u>100</u>
Portions, fresh, uncooked	_____	_____	_____	<u>100</u>
Portions, frozen, uncooked	_____	_____	_____	<u>100</u>
Processed, value-added products, fresh	_____	_____	_____	<u>100</u>
Processed, value-added products, frozen	_____	_____	_____	<u>100</u>
Other products, fresh	_____	_____	_____	<u>100</u>
Other products, frozen	_____	_____	_____	<u>100</u>

6.3 *Does your company manufacture "own brand" products for multiple retailers?*

Yes No

6.4 *What proportion of products manufactured by your company for the retail market would be provided as "own brand" products?*

Product	Your company brand (%)	Own brand (%)	Total (%)
Whole, fresh chicken	_____	_____	<u>100</u>
Whole, frozen chicken	_____	_____	<u>100</u>
Portions, fresh, uncooked	_____	_____	<u>100</u>
Portions, frozen, uncooked	_____	_____	<u>100</u>
Processed, value-added products, fresh	_____	_____	<u>100</u>
Processed, value-added products, frozen	_____	_____	<u>100</u>
Other products, fresh	_____	_____	<u>100</u>
Other products, frozen	_____	_____	<u>100</u>

6.5 *Does your company use imported chicken for product manufacture?*

Yes No

6.6 *From which countries are these imports obtained?*

6.7 *What products are manufactured by your company from imported chicken?*

Product	Market			Total (%)
	(%) Retail outlets	(%) Hot counter/ fast-food	(%) Catering	
Whole, fresh chicken	_____	_____	_____	<u>100</u>
Whole, frozen chicken	_____	_____	_____	<u>100</u>
Portions, fresh, uncooked	_____	_____	_____	<u>100</u>
Portions, frozen, uncooked	_____	_____	_____	<u>100</u>
Processed, value-added products, fresh	_____	_____	_____	<u>100</u>
Processed, value-added products, frozen	_____	_____	_____	<u>100</u>
Other products, fresh	_____	_____	_____	<u>100</u>
Other products, frozen	_____	_____	_____	<u>100</u>

7. Quality Assurance Schemes

7.1 *Is your company a member of external quality schemes?*

Independent Quality Assurance Schemes (such as Assured Chicken Production, An Bord Bia, etc.)

Yes No

Multiple Retailer Quality Assurance Schemes

Yes No

Other

Yes No

Details: _____

8. Future Developments

8.1 *What future developments do you consider will increase or decrease the likelihood for residues of anti-coccidials, and veterinary drugs generally, to be present in poultry products offered for sale?*

8.2 *General comments on the project and on the issue of coccidiostats in poultry*

8.3 *Do you consider that testing programmes for veterinary drug residues would help to add value to your company's products?*

Yes No

8.4 *Would your company participate in such a testing programme?*

Yes No

