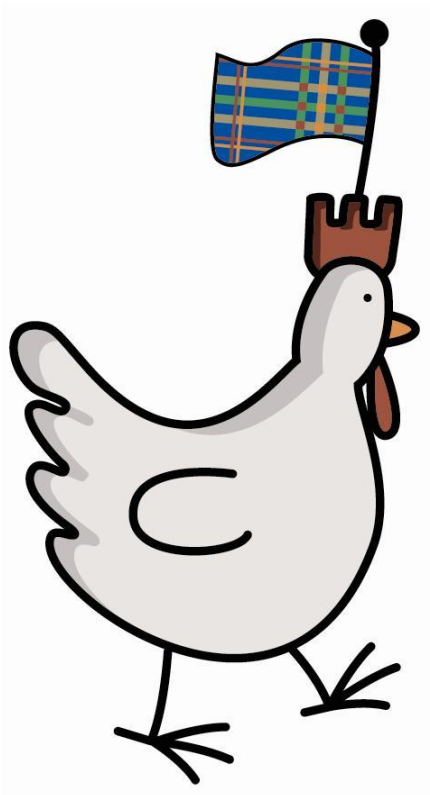
WPSA-UK Branch

30th Poultry Science Symposium

Alternative Systems for Poultry – Health, Welfare and Productivity



7th – 9th September 2011

University of Strathclyde, Glasgow

Table of Contents

General Information

Abstracts
As well as appearing here, these will also be published in the CABI book which will be made available to you after the symposium.

Badges
The name badge issued to delegates at registration serves as an admission pass to all scientific sessions, the poster area and inclusive social events. Delegates are asked to ensure that they wear their name badge at all times. If your badge is lost, a new badge will be issued. The administration cost for a new badge is £2.50.

Bank
The nearest ATM to the symposium venue is located facing the Village Office on Cathedral Street (Clydesdale Bank). Branches of all major UK banks may be found in the city centre. Generally, weekday opening hours for banks are 09:15 – 16:45 hrs, although this does vary. A limited number are open on Saturday mornings.

For exchanging foreign currency and traveller cheques the banks usually provide the most competitive rate. However, it is also possible to change money in airports, larger rail stations, travel agents, some larger hotels (if you are a resident) and in most Post Offices; there is usually a handling fee and commission. The Glasgow Tourist Board located in George Square is open from 09:30 – 18:00 hrs every day, including Saturday and Sunday for the purposes of exchanging foreign currency and travellers cheques.

Credit Cards
Commonly accepted credit cards in hotels, restaurants and stores are American Express, Visa, MasterCard and Diners.

Dress Code
You may dress informally for the symposium and the corresponding social events.

Exhibition
Two exhibitors will be present in **room K326** in the John Anderson Building: Taylor and Francis and British Poultry Science journal. This room is open during the dates and times detailed below:

Wednesday 7 September 2011	14.00 – 17.30
Thursday 8 September 2011	09.00 – 17.30
Friday 9 September 2011	09.00 – 12.30

Internet Facilities
Wireless internet access is available to purchase from the venue at a rate of **£5.99 for 90 minutes** of non-consecutive access over a 24 hour period or alternatively unlimited access over a **24 hour** period is available at a rate of **£9.99**. Two internet access stations are also located in the Lord Todd Building.

Language
The official language of the symposium will be English. No simultaneous translation will be available.

Lost Property
Enquiries regarding items lost or found can be made at the Registration Desks located on the level four foyer of the John Anderson Building. To minimise losses, please ensure that you do not leave your Delegate Bag in any of the session halls.

Lunches and Refreshments
Tea/coffee will be served during the morning and afternoon breaks in the foyer in the John Anderson Building. Lunch will be provided on Thursday 8th September and Friday 9th September in the Lord Todd Building (these are included in your registration fee).

Mail and Messages
A message board will be located beside the Registration Desks located in the level four foyer of the John Anderson Building during the symposium and you are encouraged to check it regularly. Mail can be forwarded to delegates at the University of Strathclyde. Mail should be addressed as follows:

PSS 2011
c/o Residence and Catering Services
Graham Hills Building, University of Strathclyde
50 Richmond Street, Glasgow G1 1XP

Mobile Telephones
It should be noted that mobile phones must be switched off when delegates are in session halls.

Posters
Poster sessions will take place in **room K326** in the John Anderson Building, this room is open during the dates and times detailed below:

Wednesday 7 September 2011	14.00 – 17.30
Thursday 8 September 2011	09.00 – 17.30
Friday 9 September 2011	09.00 – 12.30

Registration Opening Times
The registration desks are located in the foyer of level 4 in the John Anderson Building. Opening times are:

Wednesday 7 September 2011	14.00 – 17.30
Thursday 8 September 2011	09.00 – 17.30
Friday 9 September 2011	09.00 – 12.30

Scientific Sessions
The Scientific Sessions will be held in **room K325** in the John Anderson Building, please refer to the full programme listing for full information on the sessions.

Security
Any security problems or concerns should be reported to a uniformed member of staff.

Shops
Most stores in central Glasgow are open from 09:00 – 17:30 hrs Monday – Wednesday and Friday – Saturday. Most large department stores and boutiques are open until 19:00 hrs on Thursday evenings and some stores also open from 11:00 – 16:00 hrs on Sundays.

Smoking Policy
By law, smoking is not allowed anywhere within the University of Strathclyde or any of the social venues.

Social Events
The welcome reception, hosted by Glasgow City Council, will be held at the City Chambers on George Street, just a short walk away from the meeting venue. Tickets are still available for the Gala dinner on Thursday evening, please ask at the registration desk.

Tipping
Tipping is not as widespread or regulated in Scotland as it is in other parts of the world. Tipping is at your discretion, a reward for service. It is customary to tip hotel porters (£1.00 per piece of luggage) and taxis (10% of the fare). A gratuity of about 10% is usual in restaurants if good service is received, and it is not already included on the bill.

Travel
To/from Glasgow International and Prestwick Airports
For travelling to Glasgow International Airport from Glasgow city centre there are taxi ranks located around the city and also a regular airport bus service. For further information please visit www.glasgowairport.com/.

For travelling to Prestwick International Airport from Glasgow city centre use Glasgow Central train station. Trains leave every half hour; this journey takes approximately forty-five minutes. There is also an airport bus service from Buchanan Street Bus Station to the airport. For further information please visit www.gpia.co.uk/AirportInfo/HowTo/default.asp

Rail
Glasgow has two mainline rail stations – trains to the south depart from Glasgow Central Station, while Queen Street Station serves the North and East of Scotland. Taxis are readily available at both stations as well as local buses. For more information on the rail network within the UK click here or visit www.nationalrail.co.uk

Bus
Buchanan Street Bus Station is the main bus station located in Glasgow city centre and provides bus connections which stretch across the UK. For information on the bus routes available to this location please visit www.spt.co.uk/bus/bbs/

Parking

The nearest car park to the University of Strathclyde, John Anderson Campus is the NCP car park located on George Street.

Useful Websites

Glasgow City Marketing Bureau	www.seeglasgow.com
Scottish Tourist Board	www.visitscotland.com
Scottish Exhibition and Conference Centre	www.secc.co.uk
British Airport Authority, Glasgow Airport	www.glasgowairport.com
Glasgow Buses	www.firstgroup.com
National Express	www.nationalexpress.com
ScotRail	www.firstgroup.com
Rail Europe	www.raileurope.com

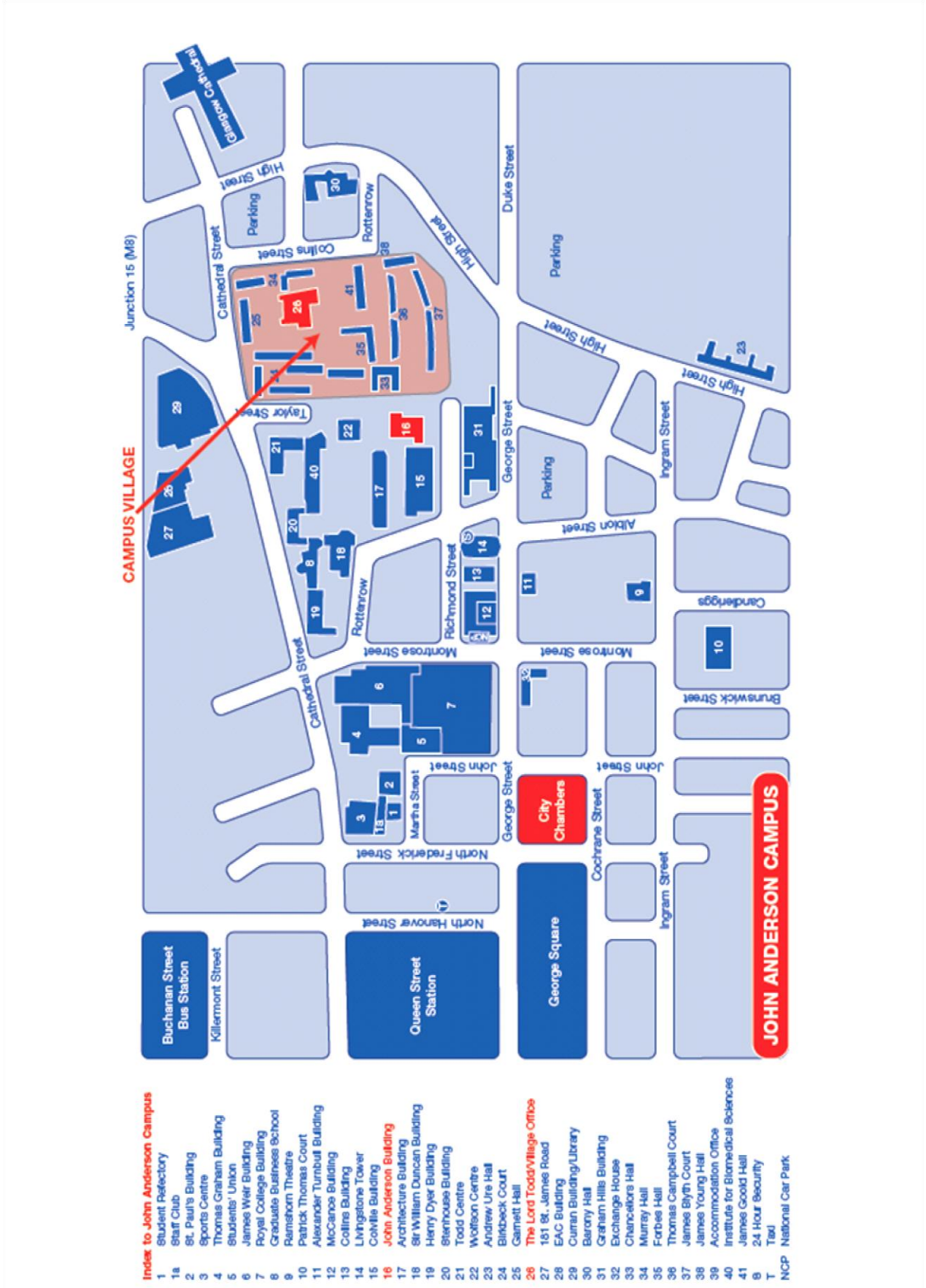
Value Added Tax (VAT)

Value Added Tax and similar taxes are charged on most goods and services in the United Kingdom. At the time of going to press, VAT in the United Kingdom is 20%. VAT must be paid on goods or services at the point of sale. Business travellers within Europe, subject to certain conditions, may reclaim VAT for Congress registration fees, etc. This applies to both non-European business travellers visiting Europe and to European business travellers to other EU countries. For further information please contact Customs and Excise on departure at the airport.

Venue

The University of Strathclyde, John Anderson Campus is located in the heart of the city centre, just a few minutes walk George Square and the City Chambers, as well as Queen Street Train Station. For further information on the venue please visit: www.strath.ac.uk/maps/johnandersoncampus/

Campus map


CAMPUS VILLAGE
JOHN ANDERSON CAMPUS
Junction 15 (M8)
Glasgow Cathedral
High Street
Parking
Cathedral Street
Collins Street
Rotterrow
Duke Street
Taylor Street
George Street
Richmond Street
Montrose Street
Albion Street
Ingram Street
Candleriggs
Brunswick Street
John Street
Cochrane Street
North Frederick Street
North Hanover Street
Martha Street
Killermont Street
Buchanan Street Bus Station
Queen Street Station
George Square
City Chambers
Index to John Anderson Campus
1 Student Refectory
1a Staff Club
2 St. Paul's Building
3 Sports Centre
4 Thomas Graham Building
5 Students' Union
6 James Weir Building
7 Royal College Building
8 Graduate Business School
9 Ramshorn Theatre
10 Patrick Thomas Court
11 Alexander Turnbull Building
12 McCance Building
13 Collins Building
14 Livingstone Tower
15 Colville Building
16 John Anderson Building
17 Architecture Building
18 Sir William Duncan Building
19 Henry Dyer Building
20 Stenhouse Building
21 Todd Centre
22 Wolfson Centre
23 Andrew Ure Hall
24 Blindbeck Court
25 Garnett Hall
26 The Lord Todd/Village Office
27 181 St. James Road
28 EAC Building
29 Curran Building/Library
30 Barony Hall
31 Graham Hills Building
32 Exchange House
33 Chancellors Hall
34 Murray Hall
35 Forbes Hall
36 Thomas Campbell Court
37 James Blyth Court
38 James Young Hall
39 Accommodation Office
40 Institute for Biomedical Sciences
41 James Goold Hall
8 24 Hour Security
T Taxi
NCP National Car Park

Organising Committees

With grateful thanks to the following:

Scientific Committee

Victoria Sandilands	Chair and Editor
Paul Hocking	Editor
Anna Bassett	
James Bentley	
Alice Clark	
Arnold Elson	
Andrew Joret	
Dan Pearson	
Claire Weeks	
Kelvin McCracken	WPSA-UK Treasurer
Steve Lister	WPSA-UK Secretary
Patrick Garland	WPSA-UK President

General Organising Committee

Paul Hocking

Kelvin McCracken

Sharon McIntyre and the team at Congrex

Victoria Sandilands

Sponsors and Exhibitors

We are grateful for the generous support of the following:

Principal Sponsor:

P.D. Hook (GROUP) LTD

Session and Speaker Sponsors:

BOCM PAULS

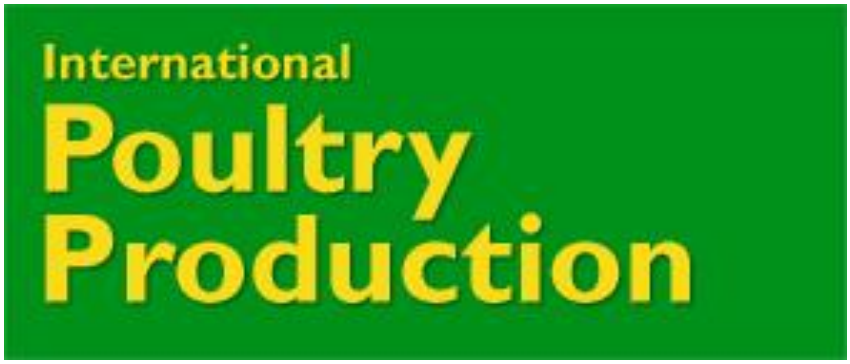
BRITISH POULTRY SCIENCE
An International Journal


Pfizer
Animal Health
Global Poultry


ST DAVID'S POULTRY TEAM
VETERINARY SURGEONS


The Scottish Government

Other sponsors:



Scientific Programme

Date	Time	Event		
Wednesday 7th September	**10:00-18:00**	**Registration open** (also Thurs 08:00-18:00, Friday 08:00-14:00)		
	14:00-15:35	**Session 1 Alternative systems, Legislation & Economics** Chairperson: Paul Hocking		
	14:00	Opening of meeting	**Patrick Garland**	WPSA UK branch president
	14:05	What are alternative systems for poultry?	**Ernst. K. F. Fröhlich**, Knut Niebuhr, Lars Schrader, Hans Oester	Plenary
	14:35	The impact of legislation and assurance schemes on alternative systems for poultry welfare	**David G. Pritchard**	Plenary
	15:05	Politics and economics	**Michael C. Appleby**	Plenary
	15:35-16:00	**Coffee break and poster viewing (foyer and K326)**		
	16:00-17:30	**Session 2 Disease and Health** Chairperson: Barry Thorp		
	16:00	The effects of alternative systems on disease and health of poultry	**Stephen Lister,** Bert van Nijhuis	Plenary
	16:30	Production systems for laying hens and broilers and risk of human pathogens	Sebastiaan Van Hoorebeke, Jeroen Dewulf, Filip Van Immerseel, **Freida Jorgensen**	Plenary
	17:00	Erysipelas in laying hens in different housing systems	**H. Eriksson**, C. Fellström, D.S. Jansson	Oral
	17:15	Sustainability and performance of two novel laying systems the Netherlands	**P.W.G. Groot Koerkamp**, T. van Niekerk, B. Reuvekamp, I. Vermeij	Oral
	18:00-20:00	**Welcome Reception at City Chambers**		

Date	Time	Event		
Thursday 8th September	**09:00-10:30**	**Session 3 Village and Backyard Poultry** Chairperson: Tom Pennycott		
	09:00	Introduction to village and backyard poultry production	**Robert A.E. Pym**, Robyn G. Alders	Plenary
	09:30	Technology and programmes for sustainable improvement of village poultry production	Badi Besbes, **Olaf Thieme**, Antonio Rota, E. Fallou Guèye, Robyn G. Alders	Plenary
	10:00	Performance characteristics and cost benefits of village chickens fed compounded ration under intensive and semi-intensive system of management in Nigeria	**J. Olupona**, O. Adejinmi, A. Raji	Oral
	10:15	Exploring the extent of food insecurity and coping strategies of households keeping freely ranging indigenous chickens under improved rearing practices in KwaZulu-Natal, South Africa.	**H. Swatson**, R. Themeli, T. Gobhozi	Oral
	10:30-11:00	**Coffee break and poster viewing (foyer and K326)**		
	11:00-12:30	**Session 4 Waterfowl and Game Birds** Chairperson: Victoria Sandilands		
	11:00	Production systems for waterfowl	**Daniel Guémené**, Z. Dan Shi, Gérard Guy	Plenary
	11:30	Game bird breeding, brooding and rearing – health and welfare	**Tom Pennycott**, Charles Deeming, Marion McMillan	Plenary
	12:00	Effect of three open water resources on duck health: a commercial trial	**G. Liste**, R.D. Kirkden, D.M. Broom	Oral
	12:15	Effect of sight barriers in pens of breeding ring-necked pheasants (*Phasianus colchicus*) on behaviour, welfare and reproduction	**D.C. Deeming**, H.R. Hodges, J.J Cooper	Oral
	12:30-14:00	**Lunch Break (Lord Todd building)**		

Date	Time	Event		
Thursday 8th September	**14:00-15:30**	**Session 5 Laying Hens** Chairperson: Claire Weeks		
	14:00	Housing and management of layer breeders in rearing and production	**Hans-Heinrich Thiele**	Plenary
	14:30	Furnished cages for laying hens	**H. Arnold Elson,** Ragnar Tauson	Plenary
	15:00	Performance, welfare, health and hygiene of laying hens in non-cage systems in comparison with cage systems	**T. Bas Rodenburg**, Koen De Reu and Frank A.M. Tuyttens	Plenary
	15:30-16:00	**Coffee break and poster viewing (foyer and K326)**		
	16:00-17:30	**Session 6 Meat Birds** Chairperson: James Bentley		
	16:00	Housing and management of broiler breeders and turkey breeders	**Ingrid C. de Jong,** Magnus Swalander	Plenary
	16:30	Alternative systems for meat chickens and turkeys: production, health and welfare	**Tracey A. Jones,** Jutta Berk	Plenary
	17:00	Is Astroturf a good dust bathing substrate for hens?	G.M. Alvino, G.S. Archer, **J.A. Mench**	Oral
	17:15	Use of covered and open outdoor ranges by laying hens of different flock sizes	**S.G. Gebhardt-Henrich**, E. Fröhlich	Oral
	19:30-00:00	**Gala Banquet**		

Date	Time	Event		
Friday 9th September	**09:30-10:30**	**Session 7 Free Session** Chairperson: Patrick Garland		
	09:30	Nutritional challenges of alternative production systems	**Murdo G. MacLeod**, James S. Bentley	Plenary
	10:00	A field study of access to day light, ammonia, plumage condition and mortality in loose housed laying hens in south east Sweden	**J. Yngvesson**, J. Gustafsson, C. Berg, I. Larsson, S. Gunnarsson, K. Odén	Oral
	10:15	The effect of keel fractures on egg production parameters, mobility and behaviour in individual laying hens	**M.A.F. Nasr**, J. Murrell, L.J. Wilkins, C.J. Nicol	Oral
	10:30-11:00	**Coffee break and poster viewing (foyer and K326)**		
	11:00-12:30	**Session 8 Challenges and Opportunities** Chairperson: Kelvin McCracken		
	11:00	Genotype environment interaction: breeding layers with different requirements for varying housing systems	Wiebke Icken, Matthias Schmutz, **Rudi Preisinger**	Plenary
	11:30	Is there a future for alternative systems?	**Victoria Sandilands**, Paul Hocking	Plenary
	12:00	Discussion		
	12:30-14:00	**Lunch break (Lord Todd building) and depart**		

Plenary lectures

What are alternative systems for poultry? (Wed 14:05)

E.K.F. Fröhlich[1], K. Niebuhr[2], L. Schrader[3], H. Oester[1]

[1]Centre for Proper Housing: Poultry and Rabbits (ZTHZ), Zollikofen, Switzerland

[2] Institute of Animal Husbandry and Animal Welfare, Department of Farm Animals and Veterinary Public Health, University of Veterinary Medicine, Vienna, Austria

[3] Friedrich-Loeffler-Institut of Animal Welfare and Animal Husbandry, Dörnbergerstrasse, Celle, Germany

Ernst.Froehlich@bvet.admin.ch

By the late 1960s, poultry production had developed from a small-scale rural enterprise to an economically important branch of agriculture. Flock sizes increased and production systems, for hygienic and economic reasons, became more intensive. Rearing and housing of laying hens took place in conventional cages. At the same time, public concern for intensively housed birds began to increase, particularly following publications such as “Animal Machines” written by Ruth Harrison in 1964. New animal protection laws came into force and agriculture was forced to adapt to the welfare concerns of consumers. Alternative systems for housing laying hens that provided greater freedom of movement and facilities for natural behaviour including the use of the third dimension (perching, nesting) were developed. Production systems for meat birds were introduced that, in addition to higher space allowances, specified maximum rates of growth and feed ingredients. Time alone will show which type of system for poultry egg or meat production will survive the evolving social and economic pressures on producers and consumers.

The impact of legislation and assurance schemes on alternative systems for poultry welfare (Wed 14:35)

D.G. Pritchard

Senior Veterinary Consultant, Animal Welfare, Defra, London, UK

DavidGeorgePritchard@gmail.com

Whereas a wide range of policy instruments - legal, economic, education and publicity - are available to effect changes in production systems, legislation and market-led assurance schemes have been the main forces used to protect and enhance the welfare of farm animals. The Conventions of the Council of Europe (COE) and their Recommendations focussed on the provisions of resources and duty of care to meet the needs of animals. They are part of the aquis of the European Union (EU) and are incorporated into some national legislations as well as being used as the basis for private standards. The European single market harmonised welfare and health rules, methods of production and labelling for hen's eggs and chicken meat, so allowing consumers to buy foods with known provenance. The EU responded with a legal framework from "farm to fork" to secure food safety, animal health and welfare. Farmers, food processors and large retailers sought to provide evidence of the quality of their products by private assurance schemes not only to meet new obligations for due diligence and gain commercial advantage. These schemes often merely reflected minimum legal standards but some also focussed on improved health, welfare or environmental provisions. Membership of assurance schemes is associated with better compliance with legal standards in Great Britain. The EU WELFARE QUALITY project concluded that assurance schemes usually had impact only at a niche market level. The EU ban on conventional cages for hens in 2012 has had the greatest political and economic impact on poultry in Europe. Some countries have banned enriched cages ahead of the deadline, despite scientific evidence that supported continued use of enriched cages. New EU legislation to improve the quality of care of intensively-kept meat chickens was novel in limiting stocking densities by measuring welfare outcomes at abattoirs. The COE Recommendations on geese, turkeys, ducks and Muscovies have been implemented by national rules and private codes of practice which are often used to support assurance schemes. Major impacts have been on traditional systems through the ban on live plucking of feathers from geese and on gavage and individual cages for the production of foie gras.

Politics and economics (Wed 15:05)

M.C. Appleby

World Society for the Protection of Animals, London, UK

michaelappleby@wspa-international.org

Choice of production systems for poultry is complex given the different attitudes and needs of different stakeholders, including producers, retailers, consumers and governments, with welfare and environmental considerations playing an important role. Political and legal decisions both affect and are affected by the attitudes of people to poultry and their management. Increasingly, legislation in European countries originates from the European Union, notably the 1999 Directive on laying hens and the 2007 Directive on broilers. Legislation and other decisions are strongly influenced by the activities of stakeholder groups, including trade associations, scientific societies and animal welfare organizations. These groups also influence the economic context of poultry production. In egg production, costs are generally higher in systems perceived to have higher welfare, but the demand for eggs is inelastic and sales of eggs from systems such as free range have led the way for welfare improvements in all livestock production. High welfare poultry meat production has also expanded in recent years, helped by overlap with other criteria such as organic standards, but sales are less reliable than for eggs. Free trade outside Europe threatens welfare-friendly production within Europe, but voluntary agreements and emphasis on local origin may combat such free market pressures. The way in which decisions are made about poultry production systems will alter over the next few years as legislation changes and other stakeholder forums increase their impact.

The effects of alternative systems on disease and health of poultry (Wed 16:00)

S. Lister[1], B. van Nijhuis

[1]Crowshall Veterinary Services, 1 Crows Hall Lane, Attleborough, Norfolk NR17 1AD, UK

[2]Verbeek's Broederij en Opfokbedrijven B.V., Postbus 11, 6741AA Lunteren, The Netherlands

salister@crowshall.co.uk

Poultry health management is a pivotal component of successful poultry production. Disease and its effects on poultry health can damage productive performance and have an adverse effect on bird welfare and food safety. A whole host of factors can affect disease incidence and its impact on poultry health. These include the prevalence and interaction of many pathogens, availability and use of vaccines and medicines, standards of husbandry and management, and levels of stockmanship. One area with potential to have the most dramatic influence is the birds' environment and how the birds respond to it. This impact has been well known throughout the development of the global poultry industry as it adapted to varying climates and market requirements. This involved considerable advances in technology and husbandry techniques. The first major changes tended to intensify poultry production. As such systems became the norm, they have often been described as 'conventional'. Key drivers in poultry production have changed in recent years including a re-evaluation of the welfare impact of such production systems for both egg laying and meat birds. Part of this has been some move away from conventional systems and a re-introduction of more traditional systems or the development of novel alternative systems. The list of diseases that can affect poultry is the same regardless of the system of production. However, the clinical effects of those disease challenges and impacts on health, performance and welfare can be specific to a particular system. In order to ensure health and welfare is maintained, the interaction of the bird with the environment and the effect this can have on poultry health and the birds' response to disease challenges must be understood.

Production systems for laying hens and broilers and risk of human pathogens (Wed 16:30)

S. Van Hoorebeke[1], J. Dewulf[1], F. Van Immerseel[2], F. Jorgensen[3]

[1]Veterinary Epidemiology Unit, Department of Reproduction, Obstetrics and Herd Health, Faculty of Veterinary Medicine, Ghent University, Merelbeke, Belgium

[2]Department of Pathology, Bacteriology and Avian Diseases, Faculty of Veterinary Medicine, Ghent University, Merelbeke, Belgium

[3]Health Protection Agency, Microbiology Services, Porton Down, Salisbury, UK

Frieda.Jorgensen@hpa.org.uk

There is evidence that the type of production systems used for laying hens and broilers can affect the likelihood of the chickens being colonized by human pathogens. The most significant public health risk associated with layers is transmission of *Salmonella* to humans via eggs. Based on experimental and epidemiological data, however, it seems unlikely that the move from conventional cages to enriched cages and non-cage systems will result in an increase in the prevalence and/or shedding of *Salmonella* in laying hen flocks. Studies on broiler chickens suggest that free range and organic flocks are significantly more likely to be positive for *Campylobacter* at slaughter in comparison with first depopulated batches of conventionally reared broilers. Data in relation to broiler rearing system and the likelihood of birds being infected by other pathogens including *Salmonella* are scarce but there is no significant evidence to suggest that organic and free range broilers are more likely to be infected with *Salmonella* than are conventionally reared ones. There is some evidence for a higher level of antibiotic resistant *Campylobacter* strains in conventional broilers compared to that found in organic ones and other antibiotic resistant human pathogens are also more commonly isolated from conventionally reared broilers.

Introduction to village and backyard poultry production (Thurs 09:00)

R.A.E. Pym[1], R.G. Alders[2]

[1]Division of Animal Health and Production, University of Queensland, Australia

[2]International Rural Poultry Centre, Kyeema Foundation, Brisbane, Australia, and Environment and Population Health, Tufts University, USA

R.Pym@uq.edu.au

Small-scale family poultry farming involving semi-scavenging flocks of mostly indigenous breed poultry in rural regions of many developing countries, contributes in a very meaningful way towards the social and financial needs of rural families. Whilst productivity is relatively low, so too are inputs, which makes the production system reasonably viable, as evidenced by the many millions of such flocks world wide. The principal constraint to profitability is the high mortality rate in young chicks, due to a combination of disease, predation, malnutrition and climatic exposure, combined with moderate to high mortality rates in grower and adult stock due to the effects of disease, of which Newcastle Disease is a common cause. Simple cost effective interventions involving vaccination of the flock against Newcastle Disease with heat tolerant vaccines combined with early confinement of the chicks with the hen and creep feeding over the first three to four weeks, has been demonstrated to impact dramatically on survival of the birds and on household food security and profitability. Such improvements are fully compatible with programs aimed at the development of the commercial poultry meat and egg industries in developing countries to meet the needs of the urban and peri-urban populations. Family poultry raising is making a resurgence in many “developed” countries. The number of families raising backyard poultry is on the increase due to both a growing enthusiasm for organic poultry products and the economic downturn. Backyard production systems vary in accordance with local government regulations, producer preferences, household residential circumstances and climatic conditions.

Technology and programmes for sustainable improvement of village poultry production (Thurs 09:30)

B. Besbes[1], O. Thieme[1], A. Rota[2], E.F. Guèye[3], R.G. Alders[4]

[1]Animal Production and Health Division, FAO, Viale Delle Terme Di Caracalla, 00153 Rome, Italy

[2]International Fund for Agricultural Development, Via Paolo Di Dono, 44 00142 Rome, Italy

[3]Regional Animal Health Centre For Western And Central Africa, FAO, B.P. 1820, Bamako, Mali

[4]International Rural Poultry Centre, KYEEMA Foundation, Brisbane, Australia, and Environment and Population Health, Tufts University, USA

Badi.Besbes@fao.org; Olaf.Thieme@fao.org

Although the commercial poultry sub-sector has reached a dominating position globally during the last three decades, village poultry production is still very important in most developing countries. Village poultry make up more than 80 percent of the poultry stocks in many of the countries of Africa, Asia Pacific and Latin America. The village poultry sub-sector contributes significantly to food self-sufficiency, poverty alleviation and gender empowerment. It is a noticeable source of employment and well-being, especially for disadvantaged groups and in less-favoured areas. Despite many constraints, including high mortality from diseases and poor nutrition, significant improvements can be achieved through well-designed development programmes that endow the different actors dealing with village poultry with the necessary knowledge, skills and resources. Beyond this need for substantial improvement in human and institutional capacity building, planners and policy makers should be sensitized to recognize the significance and potentials of village poultry production. This paper highlights the importance of village poultry production as a tool for poverty reduction, food security and gender-empowerment strategies in developing countries. It identifies the development objectives for such production systems and their contributions to meeting the Millennium Development Goals. It reviews the options, strategies and technologies that have been used to achieve these objectives and draws a few lessons.

Production systems for waterfowl (Thurs 11:00)

D. Guémené[1], Z.D. Shi[2], G. Guy[3]

[1]INRA, UR83 Recherches Avicoles, F-37380 Nouzilly, France and SYSAAF, Centre INRA de Tours-Nouzilly, URA, F-37380 Nouzilly, France

[2]South China Agricultural University, Dept of Animal Sciences, 510642 Guangzhou, China

[3]INRA, UE89 Palmipèdes à foie gras, Domaine d'Artiguères, F-40280 Benquet, France, and INRA, UMR 1289, Tissus Animaux, Nutrition, Digestion, Ecosystèmes et Métabolisme. F-31326 Castanet-Tolosan, France

Daniel.Guemene@tours.inra.fr

Ducks and geese, which represent up to 7% of world poultry production, are raised for meat production, eggs, foie-gras, down and feathers. Asia represents more than 80% of total waterfowl production**,** with China being the most important, and Europe accounting for around 13%. Traditional rearing conditions differ widely across the world, due to various species and breeds, environmental, cultural backgrounds and conditions production purposes. However, due to growing involvement of Western duck breeding companies and demand for good production performances and high economic returns, more uniformity has been observed in recent years. However, demands for alternative rearing systems are emerging although, depending upon the country, the significance of alternative systems differ. Indeed, while this trend is exemplified by the ban of some cage systems and the development of free-range systems in Europe; it is illustrated by the recent placement of duck layers for table eggs in conventional battery cages and the placement of an increasing number of geese in lightproof barns under control photoperiod to get out-of-season production, in China. These few examples illustrate the different uses and meaning of the term "alternative system" in Eastern and Western countries.

Game bird breeding, brooding and rearing – health and welfare (Thurs 11:30)

T. Pennycott[1], C. Deeming[2], M. McMillan[1]

[1]SAC Consulting Veterinary Services, Ayr Disease Surveillance Centre, Auchincruive Ayr KA6 5AE, UK

[2]Department of Biological Sciences, University of Lincoln, Riseholme Park, Lincoln, UK

Tom.Pennycott@sac.co.uk

Large numbers of game birds, mainly pheasants (*Phasianus colchicus*) and red-legged partridges (*Alectoris rufa*) are released for sporting purposes in the United Kingdom. The released birds are derived from eggs produced by captive breeding flocks and incubated artificially. This paper considers the systems of housing of adult pheasants and partridges during the breeding season, including group size, stocking density and the use of sight barriers as a means of environmental enrichment and refuge provision. The conditions and constraints of artificial incubation are explored. It is concluded that radical changes to the conditions under which pheasants and partridges are bred will require experimentation and research. Further development of the game industry will also require a switch to modern incubation equipment designed for poultry but adapted to hold pheasant and partridge eggs. The paper then goes on to describe some of the current methods of rearing pheasants and partridges from day-old to release, and relates husbandry practices to the requirements of the new Codes of Practice for the Welfare of Game birds Reared for Sporting Purpose. In general most of the recommendations in the welfare codes are being complied with. Areas that require further attention by game bird rearers include improved environmental enrichment in some systems; the best use of artificial lighting; a re-evaluation of the use of bits; improved cleaning and disinfection of crates and vehicles used to transport birds to release pens; greater involvement of local veterinary practices; preparation of flock health plans; and improved biosecurity.

Housing and management of layer breeders in rearing and production (Thurs 14:00)

H.-H. Thiele

Lohmann Tierzucht GMBH, Am Seedeich 9-11, 27454 Cuxhaven, Germany

Thiele@ltz.de

Housing and management of layer breeders has to be done in an optimal way otherwise farmers waste their genetic potential and high economic value. A good start secured by optimal brooding conditions, excellent feed quality and appropriate management in the early life of chicks is a prerequisite. The development of sufficient eating capacities during the later rearing period and a fine tuned light stimulation ensures a good start into the production phase. Furthermore they have to be adjusted to the different housing systems for layer breeders and via a fitting vaccination schedule prepared to react to the different disease challenges in their production environment. Once in production, the nutrient requirements of the birds have to be secured by a phase feeding program. Good hatching egg quality can be achieved when avoiding floor eggs and by an appropriate egg handling.

Furnished cages for laying hens (Thurs 14:30)

H.A. Elson[1], R. Tauson[2]

[1]ADAS Gleadthorpe, Meden Vale, Mansfield, Nottingham, UK.

[2]Department of Animal Nutrition and Management, Swedish University of Agricultural Sciences, Uppsala, Sweden

Arnold.Elson@adas.co.uk

Furnished cages (FCs) were conceived over 30 years ago when the welfare deficiencies of barren conventional ones were realised. Their use was intended to enhance hens' behavioural repertoire and welfare without the disadvantages of non-cage and extensive housing. Since then their design has been refined and improved, resulting in the much improved performance and hen welfare reported here. Group size has been an important consideration, especially in relation to variation in damaging pecking in differing genotypes with or without beak treatment. Regulations on the latter vary from country to country and have affected design, group size and management. The trend has been to move from small group FCSs, used mainly in Scandinavia, to medium/large group FCMs and FCLs subsequently developed in other countries. The three group sizes have generally performed well under good management. Interventions such as beak trimming and controlled light intensity are most often applied in FCLs and to brown genotypes. Large scale studies, in which performance and welfare have been compared across all currently available systems, enable us to conclude that they are at least as good in FCs as in any other system, and probably superior. Council Directive 1999/74/EC, which requires the demise of all conventional cages in the EU by 2012, has accelerated the move into FCs and it seems likely that the majority of laying hens in Europe will be housed in them for the foreseeable future, with the aim of enhancing laying hen welfare. However, FCs have potential for further improvement; this paper suggests some possible developments.

Performance, welfare, health and hygiene of laying hens in non-cage systems in comparison with cage systems (Thurs 15:00)

T.B. Rodenburg[1], K. De Reu[2], F.A.M. Tuyttens[3]

[1]Animal Breeding and Genomics Centre, Wageningen University, P.O. Box 338, 6700 AH Wageningen, The Netherlands

[2]Institute for Agricultural and Fisheries Research, Technology and Food Unit, Product Quality and Food Safety, Brusselsesteenweg 370, 9090 Melle, Belgium

[3]Institute for Agricultural and Fisheries Research, Animal Sciences Unit, Animal Husbandry and Welfare, Scheldeweg 68, 9090 Melle, Belgium

Bas.Rodenburg@wur.nl

This paper compares the performance, welfare, health and hygiene of laying hens in different types of non-cage systems, focusing on barn, free range and organic systems. These non-cage systems are compared with each other and with cage systems. This comparison shows that both between barn, free range and organic systems and between non-cage and cage systems large differences can be identified. Moving from conventional cages to furnished cages, barn, free range and finally organic systems results in increasing environmental complexity, which is positive for some aspects of hen welfare, but also increasing risks for performance, health and hygiene, which is negative for other aspects of hen welfare. For the improvement of the welfare of laying hens in non-cage systems and furnished cages, we recommend that the focus should be on creating a better match between the animals and their husbandry environment. Good examples are the development of new housing designs that combine the benefits of non-cage systems with improved performance, health and hygienic status. Further, promising approaches in animal breeding and optimizing rearing environments are expected to yield major improvements in the welfare of laying hens in non-cage systems and furnished cages.

Housing and management of broiler breeders and turkey breeders (Thurs 16:00)

I.C. de Jong[1], M. Swalander[2]

[1]Wageningen UR Livestock Research, PO Box 65, 8200 AB Lelystad, The Netherlands

[2]Aviagen Turkeys Ltd, Chowley Oak Business Park, Tattenhall, CH3 9GA, UK

Ingrid.deJong@wur.nl

This paper describes the housing and management of broiler breeders and turkey breeders in Europe. The majority of broiler breeders in Europe are the standard, fast growing genotype, but 18-20% of the broiler breeders are dwarf parental females that produce standard and alternative (medium or slow growing) broilers. Broiler breeder housing systems are very similar, there is a low percentage of birds in cages, and alternative systems are not used. Broiler breeders are generally housed in climate controlled houses with litter floor during the rearing period and partially slatted floors during the production period. Males and females are reared separately until 18-21 weeks of age and then transferred to the production farm where they are housed together until 60-65 weeks of age. The restricted feeding regime during rearing is generally seen as one of the major welfare issues in broiler breeders as it leads to chronic hunger and frustration of the feeding motivation. The majority (>95%) of turkey breeders in Europe are of either heavy or heavy medium genotype with white plumage. The remainder of the turkey market consists of small strain white or coloured birds for whole bird seasonal production. Both conventional large strain turkeys and small strain traditional turkeys are used for outdoor/alternative production systems. Rearing of breeding turkeys is floor-based on deep litter, and predominantly in environmentally controlled housing. Males and females are reared separately until 29 weeks of age and then transferred to laying facilities. Male parent stock is selected at 16-18 weeks paying attention to health, fitness, plumage and conformation. Laying facilities are either open-sided houses or controlled environment for breeder females, and typically controlled environment housing for breeder males. Breeding turkeys are kept in production until 56-60 weeks of age (i.e. 24-28 wks lay). Quantitative feed restriction is applied in breeder males from selection age (16-18 wks) to end of production, to maximize fitness and reproduction. Breeder females are fed unrestricted throughout rearing but on a lower protein diet to avoid fatness of the hens. Injurious pecking is generally seen as the most important welfare issue in flocks where beak trimming is not applied.

Alternative systems for meat chickens and turkeys: production, health and welfare (Thurs 16:30)

T.A. Jones[1], J. Berk[2]

[1]Compassion in World Farming, River Court, Mill Lane, Godalming, Surrey, GU7 1EZ, UK

[2]Institut für Tierschutz und Tierhaltung (FLI), Dörnbergstr. 25/27, 29223 Celle, Germany

Tracey.Jones@CIWF.org

Legislative and assurance scheme requirements for standard and alternative indoor and outdoor broiler and turkey production systems are described. Generally, health and welfare are protected to various extents by a series of input requirements, largely related to stocking density, light, environmental control parameters, environmental enrichment, mutilations, and growth rate. Outcome measures (usually related to physical wellbeing) highlight flocks that performed poorly, and success depends on the effectiveness of the input and output measures, the reporting structure and any remedial action taken. Alternative systems represent a low market share of broiler and turkey production in the EU (approximately 10 and 30 % respectively) and generally production costs more. Free range and organic systems are largely considered to have the potential to provide good living conditions and reduce environmental pollution. However, concerns have been raised over bird health (*Campylobacter* infection), welfare (higher foot lesions and breast blisters, and lack of outdoor ranging), product quality and consumer willingness to pay. Research shows that breed suitability is one of the largest factors in determining welfare in alternative systems, particularly for broiler chickens. More robust, hardy breeds with lower growth rates should be used; these birds are better suited to a wide range of environmental parameters and lower energy dense diets. The quality of the diet (particularly in relation to indispensible amino acids and protein balance) and the free range environment (particularly in relation to the provision of natural cover outdoors) are also highly important for both broilers and turkeys. The meat from slow growth broiler breeds is more suited to the whole bird market (as opposed to portioned or further processed) and generally contains less fat and more protein than from conventional breeds. Consumers tend to be unable to differentiate chicken products from alternative systems by odour and taste, but can differentiate by appearance and texture.

Nutritional challenges of alternative production systems (Fri 09:30)

M.G. MacLeod[1], J.S. Bentley[2]

[1]The Roslin Institute and Royal (Dick) School of Veterinary Studies, University of Edinburgh, Midlothian, EH25 9RG, UK

[2]Consultant, Woodbank, Cheshire, UK

MMacLeo8@exseed.ed.ac.uk

Many of the nutritional challenges posed by alternative systems can be addressed by application of existing scientific knowledge. However, regulations applied to alternative systems may limit the nutritionist's freedom of action, particularly with regard to the ingredients which can be used to formulate diets. Practical comments on meeting the nutrition-related stipulations of the various regulations are included in the present chapter. It is possible to formulate diets without animal protein, potential GMO (e.g. soyabean and maize products) and synthetic amino acids but it is difficult to attain nutritional optima. On the positive side, in free-range systems, the bird's nutritional inputs may be enhanced by access to forage plants and animals. Also, there is clearly greater scope for the bird to be provided with food in ways that give greater opportunities for a repertoire of feeding behaviour, such as feedstuff choice. Some alternative systems may increase the bird's energy requirements because of increased expenditure of energy on physical activity and on thermoregulation in a cooler environment. Since there is so much scope for variation in environmental factors in alternative systems, nutritional decisions may have to be made on an iterative basis, meaning that cooperation between the producer and the nutritionist may be the key to success. This is particularly true where there are strict regulatory limitations on rate of growth or final body weight. There is a tendency for alternative systems to have a greater ecological impact than conventional systems, largely because of the lower efficiency of nutrient utilisation. This chapter comments on nutritional methods of helping to reduce environmental impact.

Genotype environment interaction: breeding layers with different requirements for varying housing systems (Fri 11:00)

W. Icken, M. Schmutz, R. Preisinger

Lohmann Tierzucht GmbH, Cuxhaven, Germany

Preisinger@ltz.de

In addition to conventional selection criteria like egg production, feed conversion and egg quality, traits related to animal welfare have become more important in Europe and North America. To improve these traits and simultaneously capture performance data in non-cage environments hen-specifically, the Weihenstephan Funnel Nest Box (FNB) was developed. The FNB captures egg production and egg quality data individually as well as nesting behaviour traits. A comparison of performance parameters from full siblings, tested in single bird cages and the FNB, lead back to potential genotype environment interactions that will determine which testing system should be mainly used in future for continuous improvement of egg production and egg quality. Low genetic correlations between full siblings, tested in varying housing systems, were estimated for the egg number during the main laying periods. Otherwise, high genetic correlations and therefore, no potential genotype environment interactions could be assumed for the traits egg weight and egg number at the beginning of production. An additional breeding tool which has the potential to improve selection traits, regardless of the housing system, is genome wide selection. Therefore, phenotypic performance recording must first be established for new traits before markers can be applied. Due to all these assumed effects, a comprehensive performance testing with an evaluation of birds, consequent selection and reproduction of the best layers, layer breeding companies should implemented hen-specific tests in non-cage systems in their breeding program.

Is there a future for alternative systems? (Fri 11:30)

V. Sandilands[1], P. Hocking[2]

[1]Avian Science Research Centre, SAC Auchincruive, Ayr, UK

[2]Roslin Institute, University of Edinburgh, Easter Bush, Midlothian, UK

Vicky.Sandilands@sac.ac.uk

The trend towards alternative systems of production for poultry meat and eggs in the developed economies is paralleled by moves to increase intensification in the developing world. Alongside these changes is the clearly identified imperative to feed an increasing affluent human population in a sustainable manner. Pressure to intensify from the economics of production continue to favour intensive systems but legislation to ban the most intensive systems of production for animal welfare concerns will have a major effect on the way poultry are kept. The least intensive of alternative systems may be associated with greater behavioural freedom for the animals, but can have a significantly greater environmental impact than intensive systems, higher mortality and possibly reduced product quality. In general there is a need for more evidence of all the inputs and outputs from different systems and economic conditions. Such analyses will allow policy makers to identify areas that need to be changed or modified by appropriate action and by suitably targeted research.

Short oral papers

Erysipelas in laying hens in different housing systems (Wed 17:00)

H. Eriksson[1,2], C. Fellström[2], D. S. Jansson[1]

[1]Dept. of Animal Health and Antimicrobial Strategies, National Veterinary Institute, SE-751 89 Uppsala, Sweden

[2]Dept of Clinical Sciences, Swedish University of Agricultural Sciences, Box 7054, SE-750 07 Uppsala, Sweden

helena.eriksson@sva.se

The Swedish Animal Welfare Act of 1988 lead to a change of housing systems for laying hens, from conventional battery cages to alternative housing systems (i.e. furnished cages and litter-based housing systems, with or without access to outdoor pens). By 2005 almost all flocks were housed in the new systems. Presently, 35% of Swedish laying hens are housed in furnished cages and 65% on litter. In 1998, the first outbreak of erysipelas (infection with the bacterium Erysipelothrix rhusiopathiae) was diagnosed in a commercial laying hen flock in one of the alternative housing systems (an organic farm). During the following years erysipelas became an emerging disease problem, associated with high mortality (up to 50%) and production losses. The aim of this study was to compare the occurrence of erysipelas in different housing systems in Sweden from 1998 to 2010. Data on the number of infected flocks and the population per housing system per year were compiled. Between 1998 and 2010, erysipelas was diagnosed in 50 separate flocks. Twenty-five of these flocks were housed on fifteen farms with indoor litter-based systems (total number = 186 farms in 2010) and the other 25 flocks were housed on eighteen free-range farms (total number = 69 farms in 2010). So far no flock in furnished cages has been diagnosed with the disease. The results of our study suggest that the probability of an outbreak of erysipelas is dependent of housing system. The probability of an outbreak in flocks in free-range systems tends to be higher than in flocks in indoor litter-based systems. These results were also supported by serological investigation.

Sustainability and performance of two novel laying systems in the Netherlands (Wed 17:15)

P.W.G. Groot Koerkamp[1,2], T. van Niekerk[1], B. Reuvekamp[1], I. Vermeij[1]

[1]Wageningen UR Livestock Research, Lelystad, The Netherlands

[2]Farm Technology Group, Wageningen University, The Netherlands

peter.grootkoerkamp@wur.nl

In 2004 two new designs for the keeping of laying hens were proposed as stepping stones towards more sustainable livestock husbandry methods: the Roundel and the Plantation (in Dutch: Rondeel and Plantage). In the designs special attention was paid to solutions that unify the needs and requirements with respect to animal welfare and health, consumer and citizen emotions, and working conditions and pleasure of the farmer. Two attempts to realize essential parts of these design concepts in practice were successful: 1) a rearing and laying hen house for 6,000 organic hens on the Lankerenhof farm in Voorthuizen (approx. 6 hens/m^2, separation of functional areas for different behaviour, no beak trimming, natural day light, and outdoor access for rearing and hen house), and 2) a round Roundel hen house for 30,000 hens in Barneveld (approx. 6 hens/m^2, covered but letting in natural day light with a light foraging area, and a separate dust bathing area in the outer ring), both in the Netherlands. The Roundel house was granted 3 stars of the BeterLevenKenmerk of the Dutch Association for the protection of animals because, amongst other reasons, no beak trimming is currently tested and foreseen in the future. Monitoring of various aspects of sustainability during the first laying cycles was carried out. Results with respect to indoor climate, gaseous emissions, nitrogen and phosphorus load of the outdoor run (including use by the hens), hen behaviour and use of functional areas (for resting, laying eggs, eating and drinking, dust bathing, foraging, social behaviour), and economics of the Lankerenhof will be shown and discussed. Results of the Roundel will focus on the behaviour of the hens, the plumage, and production results. Most remarkable is the performance and limited feather pecking of hens despite the day light conditions under which the hens were reared and kept.

Performance characteristics and cost benefits of village chickens fed compounded ration under intensive and semi-intensive system of management in Nigeria (Thurs 10:00)

J. Olupona, O. Adejinmi, A. Raji

Federal College of Animal Health and Production Technology, Institute of Agricultural Research and Training, Ibadan, Nigeria

olupy2008@yahoo.com

The growth potential of village chickens in Nigeria was evaluated by comparing their growth performance under intensive and semi-intensive systems of management. Fifty-two chicks of eight weeks old were collected from villages in Ibadan South West local government and individually raised in cages. Hatch mates of cage-raised chicks (n = 56) remained with the farmers and were raised under semi-scavenging conditions. On-farm made grower mash (18% CP) was fed to chicks raised under intensive condition and the birds were treated against common diseases and parasites. Data were collected on feed intake, weight gain and growth efficiency. Feed costs (FC) were calculated by multiplying total feed intake by price per kg feed. Revenue (RV) was calculated by multiplying final weight per bird by price per kg live weight of chicken. Gross margin over feed cost was calculated by subtracting FC from RV. Village and systems of management significantly ($P < 0.05$) influenced growth rates. The values for birds under intensive conditions were significantly ($P < 0.05$) higher than for birds under semi-scavenging condition for feed intake, weight gain and growth efficiency. Economic evaluation showed a positive mean gross margin with a wide variation. Similarly, both rate of return on feed costs and bird costs showed wide variation. It is concluded that growth potential of village chickens can be enhanced by providing enough feed under semi-scavenging condition; however, It may not be economically justifiable when other costs such as labour cost are taken into consideration to improve feeding of local chicken except with farm waste.

Exploring the extent of food insecurity and coping strategies of households keeping freely ranging indigenous chickens under improved rearing practices in KwaZulu-Natal, South Africa (Thurs 10:15)

H. Swatson[1], R. Themeli[2], T Gobhozi[3]

[1]Cedara College of Agriculture, KwaZulu-Natal Dept. of Agriculture, Environmental Affairs, and Rural Development. PB X6008, Hilton, 3245 KZN, South Africa.

[2]Mangosuthu University of Technology, Durban, South Africa.

[3]Food and Agriculture Organization of the United Nations, KZN Project GCP/RAF/412/SAF, Cedara, South Africa.

harry.swatson@gmail.com

A series of studies were conducted to evaluate ongoing free-range indigenous chicken projects, which were implemented to improve the capacity of resource-limited and vulnerable families to enhance their protein food security and generate an income for a more sustainable livelihood. 470 six-week old, indigenous chickens of the Ovambo, Venda, and Naked Neck breeds were distributed to 50 resource limited households. The agile Ovambo has a variety of camouflaging feather patterns; the broody Venda is multi-colored with white, black and red speckle patterns, whilst the naked neck has a completely featherless neck. Technical support was also provided to improve upon poultry rearing skills, knowledge and experience, enabling households to take greater responsibility for poultry development. Data was collected using household and participatory rural appraisal methodologies. Preliminary results indicate that the dependence on coping strategies decreased in 67% of households rearing more than 25 chickens for use and for generating an income, thus reducing food insecurity. The body weights of cocks at 20 and 36 weeks of age, under improved communal rearing conditions, for the Naked Neck, Venda and Ovambo chickens were 1879, 1950, 2007g and 1982, 2017, 2413g respectively. Chick size varied greatly depending on breed, egg size and dehydration after hatching. The average egg sizes and chick weights ranged from 50.1 to 53.4g, and 30.5 to 36.1 g respectively. Egg shell thickness ranged from 0.26 to 0.34 mm. A few eggshell imperfections were observed, however, hatchability improved from 62.7 to 67%. It is concluded that an improvement of poultry rearing and disease control practices led to an increased number of eggs, and higher body weights of chickens available for household consumption and sale. This resulted in an overall increase in per capita income and improved household food security.

Effect of three open water resources on duck health: a commercial trial (Thurs 12:00)

G. Liste, R.D. Kirkden, D.M. Broom

Department of Veterinary Medicine, Cambridge University. Madingley Road, Cambridge, CB3 0ES, UK.

gl318@cam.ac.uk

This study forms part of a wider project investigating the provision of open water sources for commercially farmed ducks. Previous stages of the project have shown that access to open water leads to health improvements when tested in small groups. But how will open water resources work in a commercial situation? The purpose of this trial was to test three open water resources: Troughs measuring 150x15x8cm (length/width/depth), RSPCA Freedom Food approved units 150x20x10cm and Pools 100x50x10cm. Eight commercial barns, each housing between 3500 and 5000 ducks, were tested during three replications. Ducklings (Cherry Valley Pekin) were commercially reared under RSPCA Freedom Food standards until day 21, when treatments were introduced. Barns were built of concrete flooring with straw bedding. A raised slatted floor area, where water resources were allocated, ran along both sides of the barns and was accessible via a concrete ramp. Ducks were assessed three times during the production cycle, on days 21, 28 and 35. The health measures taken, from a sample of 30 birds per barn, were: weight, eye condition (score 0-3), nostril condition (0-2), feet condition (0-3), feather hygiene (0-3) and gait score (0-5). Data were analysed using PASWStatistics18 software and the effects of treatment and age were calculated. Results from the first two replications are presented here. On average, all scores of poor health were low (range from 0.07±0.23 for nostril condition to 0.82±0.57 for feet condition). Treatment effect: Feather hygiene ($p \leq 0.001$) and weight ($p \leq 0.005$) were worse when Troughs were used. Age effect: All measures were significantly affected, except for nostril and feet condition. Weight and gait scores increased with age, while eye condition and feather hygiene seemed to improve as time went on. All data from the three replications need to be analysed before final conclusions can be drawn.

Effect of sight barriers in pens of breeding ring-necked pheasants (Phasianus colchicus) on behaviour, welfare and reproduction (Thurs 12:15)

D.C. Deeming, H.R. Hodges, J.J Cooper

Department of Biological Sciences, University of Lincoln, Riseholme Park, Lincoln, LN2 2LG, UK

cdeeming@lincoln.ac.uk

The effects of sight barriers (straw bales and metal sheets) in the pens of breeding ring-necked pheasants were investigated on a commercial game farm. Data were collected from eleven conventional pens (control) and eleven pens with additional sight barriers (barrier) over the course of a ten week breeding season. Each pen contained 8 males and 56 females at the beginning of the season. There was a higher rate of mortality in males (6.25%) than females (2.11%) though pen type did not influence mortality. Feather damage increased over the breeding season although both male and female pheasants showed significantly better feather condition in the barrier pens at the end of the season. The pheasants spent most of their time walking or standing although providing barriers increased perching, but reduced preening. Provision of sight barriers had no effect on the incidence of courtship and mating, but did reduce aggressive interactions such as pecking and chasing. Both egg production per pen and the numbers of rejected eggs were not significantly affected by the presence of the barriers. By contrast, fertility was significantly higher (3% on average) and persisted for longer in the barrier pens, particularly towards the end of the laying season. Embryonic mortality was unaffected by the presence of the barriers but hatchability was significantly higher (2.7% on average), which was associated with higher levels of fertility. This study provides baseline data on the behaviour of breeding pheasants under these husbandry conditions. Barriers may improve pheasant welfare by reducing potentially harmful aggressive interactions, without affecting activity patterns or reproductive behaviour. Establishing sight barriers in breeder pens for pheasants would also appear to offer significant commercial advantages through increases in fertility and hatchability. A full report of the study will be published in British Poultry Science in 2011.

Is Astroturf a good dust bathing substrate for hens? (Thurs 17:00)

G.M. Alvino, G.S. Archer, J.A. Mench

Animal Science, University of California, Davis, CA, USA

jamench@ucdavis.edu

Furnished cages for laying hens often contain an Astroturf (AT) pad on to which feed may be delivered. We evaluated AT and AT plus feed to determine if they elicit dust bathing. Laying hens (N = 30; 34 wk old) without prior substrate exposure were singly housed in cages. Groups of 10 hens were provided with sand (SAND), AT, and AT with 200g of feed added daily (ATF) using a 3x3 Latin Square design, with each of the three treatment periods (PERIOD) lasting 20 days. Treatment orders were: SAND – ATF – AT; ATF – AT – SAND; AT – SAND – ATF. Dust bathing (DB) was recorded for 8-9 d/PERIOD, from 1100 – 2200 h. During PERIOD 1 hens given SAND DB significantly more in the substrate (mean = 16.83 ± 2.63 min/observation day) than those given ATF or AT (4.91 ± 2.26 and 2.97 ±1.34, respectively). They also DB less on wire (1.94 ± 0.80) than did ATF and AT (10.44 ± 2.21 and 14.88 ± 3.65, respectively). During PERIOD 2, hens given SAND DB more on substrate (12.59 ± 4.15) than AT (1.68 ± 1.29), with ATF hens intermediate (6.10 ± 2.47). However, there were no treatment differences in the amount of time spent DB on wire (pooled mean = 11.30 ± 1.67). During PERIOD 3 there were no treatment differences in total time DB on either wire (12.12 ± 1.78) or substrate (3.92 ± 1.40). The findings suggest that AT does not provide an adequate DB substrate, even with feed. They also suggest that exposure to AT or ATF as a DB substrate might even be aversive to hens, since even when SAND was provided the proportion of bouts performed on wire rather than in the sand actually increased from 0.41 to 0.75 to 0.89 across the treatment periods.

Use of covered and open outdoor ranges by laying hens of different flock sizes (Thurs 17:15)

S.G. Gebhardt-Henrich, E. Fröhlich

Centre for Proper Housing of Poultry and Rabbits, Burgerweg 22, CH-3052 Zollikofen, Switzerland

sabine.gebhardt@bvet.admin.ch

Most laying hens in Switzerland have access to covered and open outdoor ranges due to direct payments. Hens have to cross the covered range to get to the open range. For flock sizes of thousands of hens individual use of these areas has been unknown, so far. Visual inspections of large flocks have indicated that only few hens might use outdoor ranges. After attaching RFID tags to a subsample of 4 small (about 2,000 hens), 4 medium (about 6,000), and 4 large (up to 18,000) flocks, individual ranging behaviour was monitored for about three weeks. Flat antennae were placed in front of and behind each pophole. Neither management nor structural modifications were performed. For each tagged hen entries and exits into the covered and the open outdoor ranges were recorded. During data collection hens were between 9 and 15 months old. During the entire data collection 90.4% (STD=7.07) of the hens were recorded in the covered and 70.6% (STD=14.9) in the open ranges at least once. There was no significant influence of flock size. However, most hens did not visit the ranges every day. The percentage of days when hens entered the covered range was negatively correlated with the size of the flock (median = 79%, min. = 27, max. = 91, $r = -0.66$, $N = 10$, $P = 0.04$). Hens in big flocks were less likely to spend more than 66% of the days in the open range ($\chi2 = 7.97$, $df = 2$, $P = 0.02$), they spent less time in the open range ($\chi2 = 8.77$, $df = 2$, $P = 0.01$) and they left the house less often ($\chi2 = 6.51$, $df = 2$, $P = 0.04$). Thus, flock size correlates negatively with outdoor range use but there is large variation within the same flock sizes.

A field study of access to day light, ammonia, plumage condition and mortality in loose housed laying hens in south east Sweden (Fri 10:00)

Jenny Yngvesson[1], Johanna Gustafsson[2], Charlotte Berg[1], Irja Larsson[3], Stefan Gunnarsson[1], Kristina Odén[4]

[1]Dept of Animal Environment and Health, Swedish University of Agricultural Sciences (SLU),P.O.B. 234, SE-532 23 Skara, Sweden

[2]Fullösa Berget, SE-533 96 Götene, Sweden

[3]County Board of Östergötland, Veterinary unit, SE-581 86 Linköping, Sweden

[4]Swedish Board of Agriculture, SE-551 82 Jönköping, Sweden

jenny.yngvesson@slu.se

Conventional (non-furnished) cages were banned in Sweden in 1999, and since 2009 no hens are housed in conventional cages. On January, 1st 2011 Sweden had 6.5 million hens, housed in organic systems (11.5%), loose housed (53.3%) or in furnished cages (35.2 %). In Sweden older barns with single tiered litter system commonly do not have a mechanical manure removal system. Windows for access to daylight is a legal requirement, but windows can be covered. The aim of this study was to survey the health and welfare of laying hens in the county of Östergötland, south-east Sweden. Animal welfare inspectors collected data from 81 (of 140) commercial loose housed layer flocks during 2007. Data regarding buildings, housing systems, environment and clinical health of the birds were recorded. Of the flocks included, 66% were housed in single-tiered litter system, 17% in furnished cages and 17% in multi-tier systems. Of the 23 flocks with windows used for daylight, 30% had damaged plumage, compared to the 58 flocks without windows for day-light, of which 50% had damaged plumage. Hence, day-light does not seem to lead to more plumage damage here. Nine flocks had developed cannibalism, of which three had access to daylight and six did not. The atmospheric ammonia levels were significantly ($p<0.05$) higher (24.6 ppm) in barns without a mechanical manure removal system, compared to houses with mechanical manure removal (15.1 ppm). Furthermore, flocks exposed to aerial ammonia levels exceeding 25 ppm, showed significantly higher mortality (3.7%) when inspected, compared to flocks were the ammonia level was below 25 ppm (1.9%; $p<0.05$). To conclude, daylight access had no significant negative effect on plumage condition. Barns without a manure removal system had higher aerial ammonia levels than barns with such a system, and flocks where ammonia levels exceeded 25 ppm showed increased mortality.

The effect of keel fractures on egg production parameters, mobility and behaviour in individual laying hens (Fri 10:15)

M. A.F. Nasr[1,2], J Murrell[1], L.J. Wilkins[1], C.J. Nicol[1]

[1]Department of Clinical Veterinary Science, University of Bristol, Langford House, Langford, BS40 5DU, UK

[2]Department of Animal Wealth Development, Zagazig University, Egypt

Mohammed.Nasr@bristol.ac.uk

In alternative systems, the majority of laying hens fracture their keel bones during the laying cycle. It is not easy for a farmer to identify hens with fractures and hen survival rate seems high. Thus the effect of both recent and healed fractures on bird welfare is unclear. We aimed to investigate the impact of these keel bone fractures on hens' production and behaviour. Egg production, mobility and behaviour of Lohmann hens without keel fractures (n= 26) were compared with that of old healed fractures of varying severity (n= 76). In addition, the keel bone strength and body temperature around the fracture site was measured for each group. Hens with no fractures laid more eggs than hens with fracture (94.51±1.39 vs 89.10±1.58; t= 2.57; P= 0.01) and had a higher egg quality score (derived from measures of egg weight, egg surface area, shell weight, shell percentage and shell density). Hens without keel fractures had the highest keel area temperature (37.90±0.17˚c vs 37.29±0.12˚c; t= 2.95; P= 0.006), strongest keel bones, directly below the manubrial spine (28.53±1.06 kg vs 26.38±0.61 kg; t= 1.77 P= 0.08) and at the mid lateral surface (15.07±0.55 kg vs 12.64±0.31 kg; t= 3.91; P= 0.000), accessed perches (50 and 100 cm height) more frequently, and took a shorter time to negotiate a walkway obstacle test (9.41±2.15s vs 16.74±2.11s; t= -2.43; P= 0.019) and to fly down from raised perches of different heights as 50cm height (9.33±2.02s vs 33.63±9.18s; t= -2.58; P= 0.01), 100cm (25.90±6.94s vs 80.10±11.99s; t= -3.91; P= 0.000) and 150cm height (78.70±24.50s vs 127.78±12.57s; t= -1.82; P= 0.07). Hens without keel fractures were better in all investigated parameters than hens with keel fractures, indicating a detrimental effect of fractures on both welfare and economic return.

Posters (alphabetical by first author)

1. Stress response of egg-type chickens to different intensive housing systems in humid tropics

O.M.Alabi[1], D.O.Adejumo[2], F.A.Aderemi[1], A.A.Adewumi[3]

[1]Department of Animal Science and Fisheries Management, Bowen University,P.M.B.284, Iwo, Osun-State, Nigeria

[2]Department of Animal Science, University of Ibadan, Nigeria

[3]College of Agriculture, Osun-State University, Ejigbo Campus, Nigeria.

femiatom@yahoo.com

Housing of animals in confinement is being campaigned against as a callous act because animals are not allowed to move about and are not able to exhibit some natural behaviour. Chickens meant for commercial table egg production are typically confined inside conventional cages or kept on deep litter for maximum productivity, automation of devices and ease of general bird management. Stress response of two commercial strains of egg-type chickens on three different intensive housing systems was investigated. 108, 17-weeks old Super Black hens(SBL) and 108,17-weeks old Super Brown hens (SBR) were randomly allotted to three different intensive housing systems of Partitioned Conventional Cage (PCC), Extended Conventional Cage (ECC) and Deep Litter System (DLS) in a randomized complete block design with 36 hens per housing system each with three replicates. The experiment lasted 37 weeks. Parameters measured included total white blood cell counts (WBC), differential leukocytes while heterophil-lymphocyte ratios (H/L) were calculated. Housing system had significant ($p<0.05$) effect on the differential leukocyte counts but not ($p<0.05$) on WBC counts. The H/L ratios were also significantly ($p<0.05$) affected by the housing systems. Hen housed inside PCC (control) had the highest value of H/L ratio with the least from those housed on DLS. Meanwhile, the parameters investigated were not significantly ($p>0.05$) affected by strain. Higher values of H/L recorded by hens housed in PCC is an indication of physical stress which may be attributed to cage fatigue.

2. Effect of water quality on growth performance in broilers

Z. Ali[1], F. Khattak[2]

[1]31 Shirley Road, Manchester, M8 0WB, England

[2]Avian Science Research Centre, SAC, West Mains Road, Edinburgh, Scotland

drzulfiqar188@hotmail.com; Farina.Khattak@sac.ac.uk

The quality of drinking water is often overlooked as an important factor limiting productivity especially in alternative poultry systems. For both existing and alternative poultry farming systems, regular water testing can reveal hidden problems and enable the farmers to take steps to address the problems and maximize returns. The current study was conducted to assess water quality from 9 farms and evaluate the effect of the waters on the growth performance of broiler chicks. Water was collected from nine different poultry farms (A-I). Water analysis revealed that the total dissolved solids (TDS) were 284, 603, 398, 2200, 1970, 420, 470, 480, and 779 ppm, whereas pH was 7.9, 8.4, 7.9, 7.6, 7.9, 8.0, 7.8, 8.5, 7.5 and Na was 4.6, 30, 76, 110, 117, 129 176, 267 and 370 ppm respectively for farm A, B, C, D, E, F, G, H and I respectively. Subsequently, 720 Hubbard broilers were used to test the effect of the waters on growth performance. At day-old the chicks were allocated to 9 treatments with 8 replicates and 10 chicks per replicate. The birds were fed the same corn-soya based broiler diets for 35 days. .Body weight, feed intake and water consumption were recorded weekly. There were differences in body weight, weight gain, feed intake and FCR values ($P < 0.001$). These differences where more prominent ($P<0.05$) during first 21 days of age. The overall growth performance was consistently better when birds were drinking water from source A, C, F, G and I. The results suggest that water quality affects growth performance and that the optimum performance can be achieved if the water pH and TDS range is between 7.5 to 8.0 and 284 to 779ppm respectively

3. Influence of the supplementation with Pediococcus acidilactici on zootechnical performances of free range laying hens

F. Alleman[1], H. Eutamène[1], J.F. Gabarrou[1], A. Micault[1], E. Chevaux[2], V. Demey[2]

[1]Ecole d'Ingénieurs de Purpan, 75, voie du TOEC, BP 57611, 31076 TOULOUSE cedex 3, France

[2]Lallemand SAS, 19 rue des Briquetiers, BP 59, 31702 Blagnac cedex, France

abien.alleman@purpan.fr

The objective of the study was to measure, in free range layers, the effects of supplementation with the probiotic Pediococcus acidilactici MA 18/5M (PA) on their production performance.The trial compared the performances of two groups of 3000 Bovans type layers at the beginning of laying. The layers were housed in experimental free range housing facilities, measuring 700 m ² and divided in 2 symmetrical parts. Animals were 18 weeks old on their arrival and 48 weeks at the end of the study (i.e. 30 weeks of observation). Control (C) hens were fed a basal diet, whereas for the treatment group (T), the basal diet was supplemented with PA at 100 mg /kg feed (or 109 Colony Forming Units/kg feed). Addition of PA to diets for free range layers positively affected their performance. The laying rate was significantly ($p<0.01$) higher for T compared to C (91% vs 88%respectively), as was the exported egg mass ($p<0.01$) (382 vs 367 g/hen/week respectively). In addition, a tendency towards lower egg yolk cholesterol levels was observed.The addition of Pediococcus acidilactici MA 18/5M to free range layers diet significantly improved their zootechnical performances.

4. Newcastle Disease control in Singida, Tanzania

B. Bagnol[1], H. Msami[2], R. Costa[3], M. Young[3], R. Alders[1]

[1]International Rural Poultry Centre, KYEEMA Foundation; The University of Witwatersrand; Tufts University.

[2]Central Veterinary Laboratory, Tanzania

[3]International Rural Poultry Centre, KYEEMA Foundation

bagnolbrigitte@icon.co.za; R.Pym@uq.edu.au

Five villages in Singida district in Tanzania were selected to implement a community-based Newcastle disease (ND) control program in collaboration with Ministry of Livestock and Fisheries Development (MLDF) and the International Rural Poultry Centre (IRPC) of the KYEEMA Foundation. Vaccination campaigns were carried out in January, May and September 2010 using I-2 thermotolerant vaccine produced by Central Veterinary Laboratory (CVL). A baseline survey was carried out in November 2009 and replicated in November 2010 after three campaigns. It was designed to collect data on poultry production, the volume of flock consumption and sale of poultry products as well as on knowledge about ND control and nutrition. The sampling methodology is described in Bagnol (2009) and is a two stage sampling method with an initial selection of 15 clusters in the 5 villages and then a random selection of 10 households per cluster. Questionnaires were conducted with men and women who were over 16 years old. Because chicken raising is one of the only livelihood strategies available as an alternative to agriculture the majority of the households (around 70%) vaccinated regularly. The high percentage of households keeping chickens, the large size of the flock (between 15 and 17 birds), and the dynamic poultry trade makes Singida the number one region in the country in terms of village poultry trading. The paper analyses the impact of N D control. In this very poor region village chicken raising is a business and an important livelihood strategy which is encouraged by political leadership. This unique situation explains the very high adoption of Newcastle disease prevention and its high impact on people's livelihood.

Bagnol, B (2009). Strengthening rural livelihoods and food security through improving village poultry production in Malawi, Mozambique, Tanzania and Zambia. Chitopa/Newcastle Disease. Mission in Tanzania. Maputo: Kyeema.

5. Using poultry for the improvement and development of diet and income of rural families in Chiapas, Mexico

M. A. Chanona Farrera

9 Norte Poniente #1176 Colonia Vista Hermosa c.p. 29030, Mexico

operavicola@hotmail.com

Government has recognized smallholder poultry production as an effective tool in poverty reduction in rural families. The objective was to develop smallholders into medium-size poultry producers in twenty eight of the poorest counties of Chiapas, México at three levels: 1) Backyard farm. 11,000 families received a basic package (20 pullets, 2 feeders, 2 drinkers,6 plates and 45 m of netting), plus training in poultry management with emphasis on Newcastle vaccination, nesting differentiation, brooder management, and feed supplementation. Families increased their egg consumption from 3 to 6 eggs/week/person, meat from 1 to 2 chickens/week/family, and their incomes increased, while bird mortality reduced from 60 to 20%. 2) Small family farm. Selected backyard producers were supported to expand to 50 hens with ongoing training and assistance, with attention on: a wider vaccination program, lighting, feeding, avoiding mixing hens with other birds, preventing poultry from leaving the farm. There was no difference in egg and poultry meat consumption compared with backyard, but incomes increased. 3) Farm. Some 76 farms were built and fully equipped with two flocks of 400 hens, each with 10 female staff. Staff were trained in production, marketing, organization, administration and record keeping. Barred Plymouth Roc k and Rhode Island Red birds were used. Egg production peaked at 85%; but peak lay was also the major cause of mortality. Most staff depended on technical assistance, didn't understand bio-security terms and didn't like team work. Most eggs were sold, with a staff allowance of 30 eggs/week. In conclusion, Newcastle vaccine reduced mortality, but it was noted that performance was more irregular in backyard flocks. Backyard and family farms are more sustainable and empower women. In large farms it was complicated to create collaborations and confidence within staff. These three approaches improve social stability and reduce migration.

6. Effect of simulated agroforestry structures on performance and range use of organic meat chickens

A.C. Fanatico[1], J.A. Mench[2], G.S. Archer[2], Y. Liang[3], V.B. Brewer[4], C.M. Owens[4], A.M. Donoghue[5],

[1]Sustainable Development Program, Appalachian State University, Boone, NC, USA

[2]Animal Science, University of California, Davis, CA, USA

[3]Department of Biological and Agricultural Engineering, University of Arkansas, Fayetteville, AR, USA

[4]Department of Poultry Science, University of Arkansas, Fayetteville, AR, USA

[5]USDA Agricultural Research Service, Poultry Prouction an Product Safety Research Unit, Fayetteville, AR, USA

jamench@ucdavis.edu

Chickens provided with access to range often do not fully use the range area. The U.S. organic standards require that chickens be given outdoor access, but do not stipulate how the range area should be configured. We evaluated whether providing constructed enrichments that simulated complex agroforestry structures would increase range use by meat chickens. Slow-growing Delaware chickens were raised in floor pens (n = 17/pen) in naturally ventilated houses; a pophole in each pen allowed daily access to a grass-covered range (3.1 x 30.5 m). Feed and water were provided indoors and 15.2 m from the house. The birds were randomly assigned to one of two treatments: No enrichment (control; NENR) and Enrichment (ENR). There were 4 pens per treatment. In the ENR treatment there were roosts made of plastic pipe or screened shelters 7.6 m and 22.9 m from the house and overhead shade panels 15.2 - 21.3 m from the house. The number of birds in each quadrant of the range was counted every 7 min three times daily (0900-0945 h, 1300-1345 h, and 1600-1645 h) when the birds were 7 and 10 wk of age. There was no difference in weight gain between treatments ($P > 0.05$). On average, only 12% of birds used the range at any given time. The percentage of birds on range varied throughout the day, with range use higher in the morning (20%) and early evening (12%) than mid-day (5%). Overall, most birds using the range (80%) were observed in the quadrant nearest the house (0 – 7.6 m). However, in the ENR treatment more birds (16%) were observed in the third quadrant (15.2 – 22.9 m from the house) than in the NENR treatment (4%). This indicates that adding enrichments to the range encouraged birds to use the range more evenly.

7. The effect of range access during rear on feather pecking at lay

A.M. Gilani, C.J. Nicol, T.G. Knowles

School of Veterinary Science, University of Bristol, Langford House, Langford, BS40 5DU, UK

Anne-Marie.Gilani@bristol.ac.uk

Previous work on the effects of environment on feather pecking in commercial systems conducted at the University of Bristol concluded that improving range use was one of the most promising ways to reduce feather pecking (Lambton et al., 2010). However, adult birds may be reluctant to use the range if they have not experienced it when young. The current (ongoing) study investigates whether providing pullets with range access during rear decreases the risk of feather pecking at lay. Thirty four commercial laying hen flocks were recruited from 29 organic and conventional farms. Of these flocks, 17 had range access during rear while the other 17 were reared indoors. Flocks were visited at the age of 35 weeks. During the visit gentle and severe feather pecking were scored during four 10 minutes observation periods per flock. The percentage of the flock with plumage damage was estimated by scoring 100 birds per flock. Flocks reared with range access (N=11 to date) had an average of 0.1 (+0.15) gentle feather pecks/bird/10min and 0.2 (+0.6) severe feather pecks/bird/10min and an average of 37% (+31%) of the flock showed feather damage. Flocks reared without range (N=13 to date) had an average of 0.2 (+0.3) gentle feather pecks//bird/10min and 0.3 (+0.5) severe feather pecks/bird/10min and an average of 64% (+38%) of the flock showed plumage damage. In May 2011 data collection from the remaining 10 flocks will be completed and statistical analysis on the full dataset performed.

Lambton, S.L., Knowles, T.G., Yorke, C., Nicol, C.J. (2010) The risk factors affecting the development of gentle and severe feather pecking in loose housed laying hens. Applied Animal Behaviour Science 123: 32–42.

8. New designs to facilitate a transition to sustainable poultry husbandry

A.P.H.M. Janssen[1], A.P. Bos[1], H.J.E. van Weeghel[1], P.W.G. Groot Koerkamp[1,2]

[1]Wageningen UR Livestock Research, Lelystad, The Netherlands

[2]Department of Agrotechnology, Wageningen University, The Netherlands

bram.bos@wur.nl; arni.janssen@wur.nl

Achieving sustainability in animal production is a multi-dimensional challenge. Any new system for growing poultry has to meet very different requirements, ranging from animal welfare and economics, to citizen preferences, landscape and local and global environment. We present the results of a design project in poultry production ('Tasteful Broilers'), aimed at the development of integral sustainable designs for poultry husbandry. An interactive and structured design process was followed (Groot Koerkamp and Bos, 2008), in which the needs of a set of key actors is the starting point, and functions rather than solutions are the primary unit of analysis. In this way, the participants in the project were able to synthesize a wide range of seemingly conflicting requirements. The two resulting concept-designs make plausible that very high levels of animal welfare can be paired to a low environmental footprint, while addressing important societal demands. Economical feasibility was attained by recombination of functions, and by rethinking the product and (parts of) the chain. Key innovations are amongst others: separated functional areas, frequent removal of manure and litter cleansing, space and energy reuse by keeping multiple ages at the same time, dust reduction by use of natural ventilation and plants, and the substitition of soy by grass(products). Additionally, new products are presented that may facilitate the economical valorisation of poultry meat from these systems in the market, by integrating instrinsical and extrinsical attributes. Finally, we will report how the interactive design process contributed to appropriation by private actors and how public-private R&D may proceed after the project's finish.

Groot Koerkamp, P.W.G. and Bos, A.P. (2008) Designing complex and sustainable agricultural production systems; an integrated and reflexive approach for the case of table egg production in the Netherlands. NJAS, 55: 113-138.

9. Keel bone deformities in laying hens

S. Käppeli, S.G. Gebhardt-Henrich, E. Fröhlich

Center for Proper Housing of Poultry and Rabbits, Burgerweg 22, CH-3052 Zollikofen, Switzerland

susannak@gmx.ch; sabine.gebhardt@bvet.admin.ch

Several studies have shown a high prevalence of keel bone deformities in alternative housing systems of laying hens. In an experimental study, we assessed the impact of perch material, a vitamin D feed additive (Hy•D), and genetics on keel bone pathologies. The study consisted of two experiments. In the first experiment, 4000 Lohman Selected Leghorn hens were raised in aviary systems until 18 weeks of age, half of them got Hy•D throughout the study. Afterwards, the hens were moved to a layer house with eight pens equipped with two different commercial aviary systems. Every 6 weeks, the keel bones of 10 randomly singled out animals per pen were palpated and scored. In the second experiment, we used 2000 Lohman Brown (LB) hens and 2000 female Lohman Brown parent stock (LBPS) hens. Half of them got Hy•D throughout the study. During the laying period, the hens were kept in 24 identical floor pens, but equipped with different perch material (plastic or metal). No keel bone deformities were found during the rearing period. During the laying period, deformities gradually appeared and reached a prevalence of 35% in the first and 43.8% in the second experiment at the age of 65 and 62 weeks, respectively. In the first experiment, neither Hy•D nor the aviary system had any significant effect on the prevalence of keel bone deformities. In the second experiment, LBPS had significantly fewer moderate and severe deformities than LB hens, and metal perches were associated with a higher prevalence of keel bone deformities as compared to plastic perches. The parent stock layed more, but smaller eggs than LB. Again, Hy•D did not affect the prevalence of keel bone deformities. However, the significant effect of breed affiliation strongly indicates a sizeable genetic component which may provide a basis for targeted selection.

10. Influence of nest site and nipple drinkers in front of nests on laying hen behaviour in aviary systems

T.L. Lentfer, S.G. Gebhardt-Henrich, E.K.F. Fröhlich

Swiss Federal Veterinary Office, Center for Proper Housing: Poultry and Rabbits, Burgerweg 22, CH-3052 Zollikofen, Switzerland

tine.lentfer@bvet.admin.ch

In laying hen barns with aviary systems two nest sites can be distinguished: either at the walls of the house or integrated into the aviary blocks. Integrated nests are often equipped with nipple drinkers in front of the nests. The aim of the study was to investigate whether the different nest sites cause behavioural differences and if the presence of nipple drinkers has an effect. 4,500 LSL hens, randomly assigned to 20 pens along a corridor, were housed in groups of 225 birds in a laying hen barn. Each pen was equipped with a BOLEGG Terrace® aviary and four Vencomatic®-Classic-Sidebelt-Nests (two facing the corridor and two facing the outdoor run). Ten pens had integrated nests (five with nipple drinkers and five without) and ten pens had wall-placed nests (five with nipple drinkers and five without). The number of eggs per pen was recorded separately for nest-eggs and mislaid-eggs every day. Nest platforms were filmed and behaviour of 25 week-old hens was analysed. The number of mislaid eggs did not differ between the nest sites from begin of lay until 25 weeks of age. Integrated nests facing the corridor or the outdoor run were equally used but in pens with wall-placed nests hens showed a preference for nests facing the corridor. Due to this imbalance, the number of hens on nest platforms depended on the interaction between nest site, nipple drinker equipment and side of the pen (facing corridor or outdoor). Most hens stood in front of wall-placed nests with nipple drinkers facing the corridor. Thus, number of agonistic interactions was higher at wall-placed nests compared with integrated nests facing the corridor ($F_{1,16}=7.28$, $P<0.05$). Wall-placed nests were inspected more often ($F_{1,32}=22.83$, $P<0.0001$). In front of integrated nests and nests with nipple drinkers hens were significantly less active. Different nest sites and nipple drinkers in front of nests influence behaviour of laying hens in aviary systems.

11. Quantitative vs. qualitative dietary restriction: is there a preference among broiler breeders?

K. Morrissey[1]; T.M. Widowski[1]; S. Leeson[1]; V. Sandilands[2]; H. Classen[3]; S. Torrey[1,4]

[1]Department of Animal and Poultry Science, University of Guelph, Guelph, ON, Canada

[2]Avian Science Research Centre, Scottish Agricultural College, Auchincruive, Ayr, Scotland

[3]Department of Animal and Poultry Science, University of Saskatchewan, Saskatoon, SK, Canada

[4]Agriculture and Agri-Food Canada, Guelph, ON, Canada

kmorriss@uoguelph.ca

Broilers grow extremely quickly, rendering the breeding stock incapable of maintaining healthy body weights when fed ad-libitum during rearing and breeding stages. Therefore, broiler breeders are severely feed restricted, commonly causing stereotypic behaviour indicative of chronic hunger. Alternative diets reduce stereotypic behaviour, but bird preference should be included in their evaluation. Because alternative housing systems can accommodate for increased welfare, feeding regimes that can do the same should not be overlooked. This study investigated preferences of broiler breeders given the choice between quantitatively (control) or qualitatively restrictive (CaP/SBH) diets. The CaP/SBH diet consisted of the control diet diluted with 40% soybean hulls (SBH) and 5% appetite suppressant (calcium propionate, CaP). Thirty-seven pullets were tested. To control for the effects of rearing diet, 17 were reared on the control diet and 20 were reared with CaP/SBH. Birds were trained to associate each diet with a colour (blue or red) and a location (left or right). All diet/colour/location combinations were tested. Following four days of training, each pullet was tested over four days using a Y-maze. Data were analyzed using a mixed model (SAS 9.2). Overall, no dietary preference was revealed, indicating fibre dilution may not be aversive. However, this does not support our hypothesis that opportunities to eat more would be preferred. There was an effect of rearing diet on colour choice ($P = 0.0393$), as control-raised birds chose blue more often and CaP/SBH-raised birds chose red more often. However, on an individual basis, 17 pullets were consistent in their choice of diet/colour/location combination over all four testing periods. Seven others were consistent on the second through fourth testing periods. This suggests that certain birds have preferences, but are quite individual. Alternatively, the training regime may not have been sufficient to cause an association between the feed and its satiating properties.

12. The effects of local cereals, feed processing and enzyme supplementation on broilers

N.G.A.Mulyantini

Fakultas Peternakan - Universitas Nusa Cendana, Penfui Kupang, NTT - Indonesia

ngamulyantini@yahoo.com.au

This study was conducted to compare the effects of diets (commercial vs *Tamarindus indica* vs *Ipomoese batatas*), feed processing (pelleted vs mash) and enzyme addition (with or without enzymes) on broiler performance up to 42 days of age. A total of 480 mixed sex broiler chicks were used in a completely randomised design of treatments. The experiment consisted of 12 dietary treatments in a 3x2x2 factorial design. Each treatment was replicated 4 times with 10 chickens per treatment. The result are shown below. The results reconfirmed the beneficial effects of feed processing and enzyme supplementation on broiler chick's performance.

Parameter	Diets	Without enzyme	With enzyme	Mean ± SEM
Weight gain (g/bird)	Commercial pellet	863±29^{ac}	998±28^{c}	931±28^{c}
	Commercial mash	767±29^{a}	817±28^{a}	792±28^{a}
	Ipomoea batatas (IB) pellet	989±29^{c}	1024±28^{b}	1007±28^{c}
	Ipomoea batatas (IB) mash	892±28^{ac}	1001±28^{b}	947±28^{bc}
	Tamarindus indica (TI) pellet	764±27^{a}	796±28^{a}	780±28^{a}
	Tamarindus indica (TI) mash	678±27^{a}	688±28^{a}	683±28^{a}
	Mean	***853±27*** ^{a}	***915±28*** ^{b}	***884±28***
Feed consumption (g/bird)	Commercial pellet	1851±60 ^{a}	1970±60^{b}	1911±60 ^{b}
	Commercial mash	1782±60 ^{a}	1792±63^{a}	1787±62 ^{a}
	IB pellet	2028±63 ^{c}	2160±60 ^{b}	2094±62 ^{b}
	IB mash	1997±60 ^{c}	2127±60 ^{b}	2062±60 ^{b}
	TI pellet	1821±60 ^{a}	1824±60a	1823±60 ^{a}
	TI mash	1679±60 ^{a}	1680±60a	1680±60 ^{a}
	Mean	***1891±60*** ^{a}	***1970±60*** ^{b}	***1931±60***
Feed conversion ratio	Commercial pellet	2.14±0.04 ^{a}	1.97±0.04 ^{b}	2.06±0.04 ^{b}
	Commercial mash	2.32±0.04 ^{a}	2.19±0.04 ^{b}	2.26±0.04 ^{b}
	IB pellet	2.05±0.04 ^{a}	2.11±0.04 ^{b}	2.08±0.04 ^{b}
	IB mash	2.24±0.04^{a}	2.12±0.04 ^{b}	2.18±0.04 ^{b}
	TI pellet	2.38±0.04 ^{a}	2.29±0.04 ^{b}	2.34±0.04 ^{b}
	TI mash	2.48±0.04 ^{a}	2.44±0.04 ^{b}	2.46±0.04 ^{b}
	Mean	***2.23±0.04*** ^{a}	***2.17±0.04*** ^{b}	***2.20±0.04***

Values followed by the same superscripts in each parameter are not significantly different at the 5% level

The author wishes to thank the DIKTI DP2M for financially supporting this project (Project no. 310/SP2H/PP/DP2M/V)

13. Probiotic supplementation on Ipomoea batatas basal diet on performance, carcass quality and plasma parameters of broilers exposed to heat stress

N.G.A.Mulyantini

Fakultas Peternakan - Universitas Nusa Cendana, Penfui Kupang, NTT – Indonesia

ngamulyantini@yahoo.com.au

The aim of this experiment was to study the benefits of probiotics as a feed additive on local diets for broiler chickens exposed to heat stress. The experimental design used was a completely randomized design in a 2 x 2 x 2 factorial design, two diets (local vs commercial), heat (heat stress vs not), and probiotics (with vs without). A total of 400 broiler chickens were allocated into 8 treatments. Each treatment was replicated 5 times with 10 chickens per treatment. Body weight, weight gain, feed intake and feed conversion ratio were calculated per week. Carcass weight, abdominal fat, cholesterol level and blood pH were measured at the end of the experiment. At 6 weeks of age, 80 samples (10 chickens from each treatment) were killed to analyze the quantity and quality of the carcasses. Dietary probiotics had significant effects on weight gain ($P<0.01$) and feed conversion ($P<0.01$) and also reduced abdominal fat ($P<0.05$) and blood cholesterol ($P<0.05$) significantly. Commercial feed gave significantly better performance ($P<0.05$) than local feed, but in terms of carcass quality, local feed gave lower abdominal fat and lower cholesterol level ($P<0.05$) than commercial feed. It could be concluded that providing dietary probiotics could improve broiler performance and carcass quality under heat stress conditions.

The authors wish to thank the DIKTI DP2M for financially supporting this project (Project no. 310/SP2H/PP/DP2M/V.

14. Thevetia peruviana in poultry diets

J.Olupona[1], J.Atteh[2]

[1]Federal College of Animal Health and Production Technology Institute of Agricultural Research and Training, P.M.B. 5029 Ibadan, Nigeria

[2]Department of Animal Production, University of Ilorin, Nigeria

olupy2008@yahoo.com

Thevetia peruviana is an evergreen flowering shrub widely grown as ornamental shrubs or hedges. They are cultivated throughout tropical and subtropical regions of the globe, common in the southern United States. The plant has medicinal use and is highly nutritious, but raw thevetia cake is toxic to broilers (Atteh et al 1994). Currently, there is no human dietary or commercial demand for the seed. Studies at our station have shown nutrient composition of *thevetia peruviana* is comparable to soybean (crude protein (47.50%), fat (0.08%), crude fiber (5.20%), calcium (0.23%), phosphorus (0.53%)). However, cysteine and lysine are limiting amino acids when compared to chick amino acid requirements. Fatty acid profiles showed that the seed has high palmitic (20.39%), oleic (48.90%), and linoleic (19.27%) acids. Antinutritive factors reported include thevetin A (40.48g/kg), and thevetin B (97.70g/kg) which have detrimental effects on performance of poultry. Some processing methods were applied to detoxify thevetia seeds. These included fermentation, ensiling in urea, and acid hydrolysis. The rationales behind the methods are described. Increasing the dietary level of thevetia cake reduced daily feed intake and weight gain and increased the feed-to-gain ratio ($P<0.05$). Feed was better utilized by birds fed diets supplemented with fermented thevetia diet compared to those fed diets supplemented with raw thevetia cake ($P<0.05$). The studies showed that all the methods have the potential to reduce the negative effects of these antinutritive factors, though low palatability of thevetia cake reduced the feed intake of birds and also the processed thevetia still contain a residual toxic compound which result in depressed growth rate and feed conversion ratio. There is need for further improvements before it can become useful for poultry feed.

Atteh, J.O, Ibiyemi, S.A and Ojo, A.O (1995). Response of broilers to dietary levels of thevetia cake. Journal of Agricultural Science 125,307-310.

15. Acute phase proteins and lysozyme in ISA brown and Bianca di Saluzzo hens kept in free range conditions

G. Salamano[1], E. Mellia[1], A. Schiavone[2], M. Tarantola[2], S. Nurisso[3], M.S. Gennero[1], L. Doglione[1]

[1]IZS Veterinary Medical Research Institute, via Bologna 148 10154 Turin Italy
[2]Department of Animal Production, Epidemiology and Ecology, Faculty of Veterinary Medicine, University of Turin, via Leonardo da Vinci 44 - 10095 Grugliasco Italy

[3]C.I.S.R.A., University of Turin, via Leonardo da Vinci 44 - 10095 Grugliasco Italy

mariasilvia.gennero@izsto.it; germanasalamano@gmail.com

There is a need for knowledge on the effects of alternative housing conditions on laying hens which have been selected for production traits. Moreover saving biodiversity is very important in order to maintain genetic resources and permit adaptation to unforeseen breeding requirements in the future. Alpha-1 acid glycoprotein (AGP) and haptoglobin are positive acute phase proteins (APP) whose concentrations increase in response to a challenge. A number of studies indicate that APP may be used to assess stress in farm animals. APP and lysozyme are natural immunity factors. The aim of this study was to investigate whether the exposure of two different genotypes of hens to free range (FR) conditions was associated with serum AGP, haptoglobin and lysozyme changes over time. Blood was taken from fourteen ISA brown layers and from fourteen hens of an Italian breed (Bianca di Saluzzo) after 15 days (T1), 2 months (T2) and 4 months (T3) upon arrival at the new accommodation. All birds were kept in the same ground area and had identical feeding and care management. Haematology profiles were within the normal range of reference. As for ISA brown AGP (mg/ml), haptoglobin (mg/ml) and lysozyme (µg/ml) concentrations on T1 (0.34, 0.12, 6.33 respectively) and T2 (0.28, 0.11, 6.87) were similar, whereas on T3 (0.70, 0.39, 10.69) were significantly higher ($p<0.01$). Italian breed did not display any variation over time (T1: 0.29, 0.12, 7.36; T2: 0.27, 0.13, 7.06; T3: 0.3, 0.15, 7.19). A possible explanation of this time trend could be that the Italian breed is particularly adapted to FR rearing conditions, while ISA brown has been selected as a cage-adapted hen. APP and lysozyme could be useful tools to select the genotype with better capability to adjust to the type of housing.

This research was supported with Italian "cinque per mille" tax funding.

16. Improving slow growing parents for alternative broiler production systems

M. Sarica[1], U.S. Yamak[1], M.A. Boz[2], S. Kamanlı[3]

[1]Ondokuz Mayis University, Agricultural Faculty, Department of Animal Science, Samsun, Turkey

[2]Bozok University, Agricultural Faculty, Department of Animal Science, Yozgat, Turkey

[3]Poultry Research Institute, Ankara, Turkey

msarica@omu.edu.tr; usyamak@omu.edu.tr

Broiler production has increased worldwide in the past 20 years, and it is expected to continue in the future. Also, there are many advances in producing acceptable products according to the changes of consumer demands and alternative breeding systems. Consumers expect to pay more money for products produced in semi-intensive, extensive, free-range and organic systems. The use of the fast growing meat-type chickens in these production systems causes physiological and metabolic problems. Also, delaying slaughter age can lead to insufficient use of genetic capacity. Slow growing chickens are more suitable for organic and free-range breeding systems and reach to 2.2-2.5 kg live weight about in 80-120 days. In Turkey, consumer demand for organic products is increasing; production branches accrue and studies are performed on chicken meat and eggs. Also, slow or medium growing chickens will be preferred in organic and free-range meat chicken productions. In parallel with the improving consumer demands and alternative production systems, the only way of having these genotypes, which are used in this system and not available in Turkey, is to import them from abroad. The development of slow growing genotypes with basic breeding techniques will offer an expansion for the sector. Presence of animal material which can be used for this expansion is an advantage for our country. Heavy egg lines imported from Canada to Poultry Research Institute will be used for this purpose. In this study, sire and dam parent lines of the slow growing genotypes were developed by using two heavy layer lines, Barred Plymouth Rock (BAR) and Rhode Island Red (RIR), and fast growing ROSS parents. ROSS x RIR and ROSS x BAR crosses had higher live weights (2936 and 2938 g) and better feed conversion ratios (2.393 and 2.376) than RIR x ROSS and BAR x ROSS crosses (2773 and 2764 g live weight, 2.453 and 2.476 Feed conversion ratio) at slaughter age (84 days) ($P<0.01$).

17. Use of probiotics to reduce reproductive tract infections in free-range hens

S. Shini[1], A. Shini[1], P. Blackall[2]

[1]School of Veterinary Science, University of Queensland, Gatton 4343 QLD, Australia

[2]Queensland Alliance for Agriculture and Food Innovation, University of Queensland, Gatton 4343 QLD, Australia

s.shini@uq.edu.au

Free range accounts for approximately 15% of Australia's commercial egg production. Although this system allows hens to express full behavioural repertories, hens held under free-range conditions are exposed to various microbial agents that can influence the bacteria present in their intestinal and reproductive systems, resulting in a wide range of disease problems. Pathologies such as oophoritis, salpingitis, peritonitis, salpingo-peritonitis and metritis are frequently encountered at onset and during the laying period, subsequently causing health problems and reduced egg production. One key problem facing free-range egg industry is that there are virtually no suitable medications for use against infections of the reproductive tract. Therefore poultry scientists and producers are looking to developing healthy alternatives to antibiotics, and probiotics have often been proposed as a natural choice. The objective of this study was to explore the ability of commercial probiotics for laying hens applied in drinking water for 4 weeks before the start of lay in reducing the occurrence of reproductive tract pathologies in laying hens, and improving hen general health and performance. The results demonstrated that the use of probiotics in the drinking water (n=6 flocks, n = 3 control flocks) significantly reduced ($P<0.01$) the occurrence of reproductive tract pathologies (22% vs. 44% of birds necropsied) and decreased ($P<0.01$) mortality of hens (1.3% with probiotics compared to 3.8% without). Egg production was also increased ($P<0.01$) at peak of lay (90% vs. 75%). The results of this study provided some initial evidence that the manipulation of bacterial communities by administration of a probiotic could be a useful approach to control and prevent reproductive tract infections in hens kept in free-range.

This project was supported by the Australian Poultry CRC.

18. Yields of two strains of broilers reared on pasture

D.P. Smith, R. Thanissery

Department of Poultry Science, Scott Hall, Room 236, North Carolina State University, Raleigh, NC, USA 27695

doug.smith@ncsu.edu; rthanis@ncsu.edu

Pastured broilers in the US are typically slower growing Freedom Rangers (FR) and faster growing Cornish-crossed (CX), although little yield data has been collected from this production method. In each of two trials, 40 FR and 40 CX were obtained at 1 day of age and brooded together for 21 days, then transferred to pasture with water and supplemental feed (n=160). Birds were removed from feed and water, humanely slaughtered, and processed at 83 days for FR birds and at 64 and 71 days for CX birds in Trials 1and 2, respectively. Although strain and age were confounded, it was necessary to obtain similar market weights. Carcasses were chilled overnight in ice water slush, cut into wings, legs, thighs, boneless skinless breast fillets and tenders, and frame (remaining carcass and breast skin). Parts and breast meat yield percent was calculated using chilled carcass weight as the denominator and multiplying by 100. Data were analyzed by trial due to significant trial and trial by strain effect. In Trial 1, FR strain had significantly ($P< 0.05$) higher live weight (2819 vs. 2615 g), thigh yield (18.3 vs. 16.6%), and frame yield (35.1 vs. 33.7%) than CX strain, respectively; FR strain had lower carcass yield (65.7 vs. 71.7%) and fillet yield (14.6 vs. 18.0%) than the CX strain. In Trial 2, the FR strain had significantly lower live weight (2838 vs. 3098 g), and lower fillet yield (14.9 vs. 21.2%) and tender yield (4.5 vs. 5.5%) than the CX strain. The FR strain had higher yields for wing (12.0 vs. 10.9%), leg (14.8 vs. 13.9%), and frame (35.8 vs. 30.4%) than the CX strain. Data indicate older FR are similar to CX birds for most processed parts yields at similar market weights, but consistently have lower breast meat yields than CX carcasses.

19. Microbiology of two strains of pasture-raised broilers

D.P. Smith[1], R. Thanissery[1], S. Kathariou[2], R.M. Siletzky[2]

[1]Department of Poultry Science, North Carolina State University, Raleigh, NC, USA, 27695

[2]Department of Food, Bioprocessing, and Nutrition Sciences, North Carolina State University, Raleigh, NC, USA, 27695

doug.smith@ncsu.edu; rthanis@ncsu.edu

Two predominant strains of pastured broilers grown in the US are slow-growing Freedom Rangers (FR) and fast-growing Cornish-crossed (CX). Limited microbiological data are available for broilers grown on pasture but new federal regulations for poultry in interstate commerce require testing for E. coli, Salmonella, and Campylobacter. Therefore these two strains were grown and processed to assess carcasses for the required microbiological profile. In each of two replicate trials, 40 FR and 40 CX broilers were obtained at day 1 of age and brooded together for 21 days, then transferred to common pasture with water and supplemental feed. At 83 days and 68 days (to obtain similar market weights between the two different strains) the FR and CX birds, respectively, were removed from feed and water, humanely slaughtered, and processed through evisceration. Twenty pre-chill carcasses from each replication and strain were randomly chosen and sampled for Escherichia coli and Salmonella via whole carcass rinses and ceca were sampled for Campylobacter (one set of ceca were lost during processing in the first experiment). E. coli means were significantly ($P < 0.05$) higher in CX birds (log 3.7) than FR birds (log 3.4) although differences would be of little practical importance. Salmonella incidence was 90% for CX broilers which was significantly higher than the 65% incidence for FR broilers. No difference in Campylobacter incidence was observed (100% for CX vs. 90% for FR carcasses). At market weight the FR broiler carcasses had slightly lower numbers of E. coli and a lower incidence of Salmonella than the younger CX birds. Results indicate that the slower growing FR broilers, even when mixed with birds with higher numbers of E. coli and and a higher incidence of Salmonella, either inherently resist colonization or benefit from the longer residence on pasture.

20. Influence of front curtain design on nest choice of laying hens

K. Stämpfli, T. Buchwalder, B.A. Roth, E.K.F. Fröhlich

Centre for Proper Housing: Poultry and Rabbits, FVO, Burgerweg 22, CH-3052 Zollikofen, Switzerland

karin.staempfli@bvet.admin.ch

Group nests in alternative housing systems for laying hens fulfil mostly a hen's need for seclusion and protection. Although nests are built according to welfare guidelines, there are differences between nest types such as design of front curtains, which could have an impact on laying behaviour. Usually, front curtains are in one piece and have an opening in the middle, which fits approximately the width of one hen. This may lead to an unsettled laying behaviour and conflicts between hens as they need to cross each other for nest access. The aim of this study was to investigate the effect of front curtains, in one piece (OP) or sliced in stripes (ST), on the hens' nest preference and laying behaviour. We predicted that hens prefer nests with sliced curtains as they could do nest inspections and enter/leave the nest on its whole width. Thus, conflicts should be reduced and more settled laying behaviour is expected. Eight pens each with 20 white laying hens (LSL) were equipped with two roll-away nests (0.54m2), one with OP and one with ST curtains. The laying behaviour was recorded for two days. Data were analysed with repeated measures ANOVA. More nest visits were counted in ST-nests (OP 57.81±3.06; ST 68.75±3.06; p=0.039), more nest entries/exits were done on the whole width of the nest. In ST-nests (OP 3.88±0.97; ST 14.50±3.49; p=0.002). We did not find a difference in number of hens, egg number, aggressive behaviour and number and duration of sitting bouts between both nests. Hens seem to value seclusion and protection provided by front curtains more than its design. However, the higher number of nest visits and nest entries in the ST-nest through the curtains indicate that hens enter/leave the nest on its overall width when given the possibility to do so. Thus, sliced curtains provide more opportunities to do nest inspections.

21. Survey of egg producers on the introduction of alternative housing systems for laying hens in Flanders (Belgium)

F.A.M. Tuyttens[1], B. Sonck[1], M. Staes[1], S. Van Gansbeke[2], T. Van den Bogaert[2], B. Ampe[3]

[1]Animal Sciences Unit, Institute for Agricultural and Fisheries Research (ILVO), Scheldeweg 68, 9090 Melle, Belgium

[2]Dept. of Agriculture and Fisheries, Sustainable Agricultural Development Division, Burg. van Gansberghelaan 115A, 9820 Merelbeke, Belgium

[3]Dept. of Physiology and Biometrics, Faculty of Veterinary Medicine, Ghent University, Salisburylaan 133, 9820 Merelbeke, Belgium

Frank.tuyttens@ilvo.vlaanderen.be

A survey among all Flemish egg producers (60% response) about the EU-ban on conventional cages confirmed that Belgium is among the slower countries to adopt alternative housing. Rapid changes are expected in order to comply with the 2012 deadline. During 2010, conventional cages were the dominant housing system (56% housing units, 67% hens), followed by floor housing (33% housing units, 15% hens) and aviary (10% housing units, 15% hens). Colony and furnished cages were rare. Future- and market-oriented production was the most important reason for choosing a certain type of alternative system. The amount of labour and profitability were indicated as being more important among producers planning to build an alternative system compared with those with such a system in use already. A quarter of producers with conventional cages had detailed plans to convert to alternative systems (mostly aviaries, then colony cages, furnished cages and floor housing) by 2012. Many older farmers indicated that they would stop farming; others found it more profitable to delay the conversion as long as possible. Apart from hen welfare, producers expressed negative opinions (relative to conventional cages) about non-cage systems, and to a lesser extent, furnished cages. However, users of alternative systems reported being quite satisfied, except for the amount of labour and hen health. Housing system had several effects on user satisfaction: positive effect of flock size, negative effect of experience with conventional cages and of outdoor area on hen health. Although not all opinions are supported by evidence, such surveys provide feedback about the success of alternative systems in practice. This is valuable to further improve these systems and to producers who have yet to convert. Moreover, producer attitude may determine the extent to which legally imposed changes in husbandry environment result in the intended improvement of hen welfare in practice.

22. Designing for a transition towards sustainable egg production

H.J.E. van Weeghel[1], P.W.G. Groot Koerkamp[1,2], A.P. Bos[1], A.P.H.M. Janssen[1]

[1]Wageningen UR Livestock Research, Lelystad, The Netherlands

[2]Farm Technology Group, Wageningen University, The Netherlands

ellen.vanweeghel@wur.nl

The current Post-Industrial age confronts society with a complex challenge to transform to a more sustainable animal-based food production. The single focus on efficient production (low input, high output) since World War 2 has yielded undesirable side-effects on environmental, social as well as economical sustainability values. In the Dutch modern poultry sector there are concerns, amongst others, about ammonia, odour and dust emissions, animal welfare, human and animal health, husbandry scale and the continuity of the farmers business. 'Well-Fair Eggs' is a project on system innovation that works on designs for integral sustainable egg production. Applying a reflexive interactive design process in which the needs of the laying hen, farmer, consumer-citizen and environment are taken as the starting point, and that scrutinizes the functions of the system. Key-stakeholders within and effected by the egg production chain were actively involved through a participatory design process. Not only did these stakeholders contribute to the integral nature of the designs, participation also increased ownership of and commitment to the results, and the promises therein. We present the results of the system analysis, the participatory design methodology and the final designs of integral sustainable laying hen husbandry. Results show that high level of animal welfare can be combined with a low environmental footprint and a very high product quality standard. Innovative integrated solutions that circumvent trade-offs were identified and are, amongst others, 1) the separation of different functional areas (a dust bath unit that separates dust bathing from foraging behaviour), 2) the rearing of day-old chickens on the layer farm (eliminating transport stress and minimizing healthcare costs), and 3) inclusion of egg processing on the layer farm (farmer is flexible to produce for either the table egg market or the egg product market, in this way still productive laying hens can be kept longer).

23. On-farm mortality and losses in transit for end-of-lay hens from different housing systems in the UK

C.A. Weeks, S.N. Brown, G. Richards, L.J. Wilkins, T.G. Knowles

School of Veterinary Sciences, University of Bristol, UK

claire.weeks@bristol.ac.uk

There have been no recent large-scale surveys of mortality in commercial laying hens. As part of a study of the fitness of end-of-lay hens to travel, we have collated from the five main slaughter plants the 2009 data routinely collected by UK government agencies for laying hens at slaughter. This includes information on the food chain information (FCI) form submitted by farmers, which gives the on-farm mortality levels for the flock. Some of the data were not recorded, but we believe we have obtained a good cross-sectional representation of a large proportion of the UK national flock. The recorded on-farm mortality levels averaged 8.3% with significantly ($p<0.05$) higher levels in both free-range (9.5%, n=961 flocks) and barn systems (9.4%, n=63) than in flocks housed in furnished or conventional cages (5.4%, n=373). These levels of mortality on farm are higher than for smaller surveys of willing participants such as the overall mean of 6.8% reported for 26 flocks kept in 4 systems (Sherwin et al, 2010), but differences between systems are similar. The housing system from which they were depopulated did not influence the number of birds dying in transit, which averaged about 0.25%. However the proportion of hens arriving at the plant with traumatic injuries (i.e. fractures and bruises) was significantly ($p<0.05$) higher for those depopulated from cage systems (0.13%) than from either barn (0.027%) or free-range (0.029%) systems.

This work is funded by Defra (AW0941).

Sherwin, C. M. , Richards, G. J. and Nicol, C. J. (2010) Comparison of the welfare of layer hens in 4 housing systems in the UK British Poultry Science 51: 488-499.

24. Uptake of different types of intervention aimed at reducing injurious pecking on commercial free-range laying hen farms in the UK

C.A. Weeks, M. Friel, S.L. Lambton, D.C.J. Main, J.L. McKinstry, M. Petek, C.M. Sherwin, J. Thierstein, J. Walton, C.J. Nicol

School of Veterinary Sciences, University of Bristol, UK

claire.weeks@bristol.ac.uk

The overall aim of the project is to reduce the levels of injurious pecking in commercial flocks of free range hens by transferring scientific knowledge into practice. For 45 treatment flocks we provided each farm with tailored ongoing management advice on reducing injurious pecking (IP), which was monitored throughout and compared with data from 45 control flocks where no advice was provided. Treatment farms were encouraged to adopt more of the forty or so potential interventions associated with a reduced risk of IP, although all farms were already using some. The range of uptake of these varied (interim results from 31 flocks). Most producers (70-80%) achieved a more uniform and unmixed flock of pullets at placement. Almost half provided a more seamless transition and kept the pullets on their rearing ration for a few days. Uptake of knowledge regarding changes in feed type, chain feeder runs etc. was high (50-100%). Farmers appeared less likely to achieve improvements to the range such as the provision of extra shelter or drainage (25-57%) and only 1 in 5 gave earlier access to range (in part due to severe weather). None of the 3 farmers who used nestbox lights was willing to turn them off. As IP is considered redirected foraging behaviour, considerable effort was directed towards improving litter quality and foraging opportunities, including providing absorbent litter, breeze blocks and compressed alfalfa; thus uptake was high (50-93%). Fear of floor eggs meant only 4 of 10 producers asked were willing to give pullets early access to litter but most who did make the change were enthusiastic about the benefits. Analysis is ongoing to assess the effectiveness of the advisory package in improving bird welfare.

This project was supported by the Tubney Charitable Trust and we are grateful to all the co-operating producers.