



Midterm Status Report 2003 and Application for Continuation in 2004

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1. Research program

Research in organic farming 2000-2005 (DARCOF II)

2. Project title and number

II.6 Poultry Production Systems- Health and Welfare

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6. Project period (month, year)

Start of project: December 2000
End of project: June 2005

7. Midterm description of the project, its results and progress, and application for continuation in 2004

Project summary

The organic table egg production in Denmark has over the past 5-6 years increased from nought to 12 % of the marked egg, while the table chicken production is at its beginning.

Farmer's that want to produce organic table eggs is faced with several problems.

1. In free-range flocks, including organic systems, it has often been observed that the flock has started to perform feather pecking that ended with an unacceptable high rate of cannibalism.
2. Mortality due to infectious diseases might be high in organic production systems as the free range does not allow a biosecurity program that is known in e.g. the cage system and lack of knowledge on management and good farm practice in this new farm system is obvious

Basic research on organic table egg production was performed in the previous research program under DARCOF, which resulted in the Darcof report No. 11 from 2001. In this report a number of advises on how to rear the chickens are given, some thought on infectious diseases and some experiences from nutrition experiment is given as well. Comparison of a non-commercial breed with the ISA Brown was performed under short term condition in experimental condition showing large differences in production level in favour of the commercial breeds, but also they showed an unacceptable high cannibalistic performance that resulted in a mortality rate of 15% within 7 month. (The wording Breed is used in this report, but often it will be a cross of 2-4 lines/breeds why breeds or breed combination is sometimes seen in the literature)

The breeding stock used for table egg production have, through many generations, been selected for high performance based on their production capacity measured in individual cages. Little attention has been paid to their genetically based ability to behave well in large flocks of hens. The result of such a breeding policy is a high yielding hen, but she appears to have lost some of her ability to have suitable social relations when kept in large flocks.

The breed combination currently used in organic table egg production systems in Denmark is the ISA Brown, which is laying eggs with brown shells, has a high laying capacity and is available on the market as day old as well as pullets ready to lay. The drawback in using this breed for organic table egg production is the increasing evidence of feather pecking in larger flocks. Thus the question is: are there breeds available that are more suitable for organic production?

The Random Sample Test (RST) is the system used to compare the various breeding materials. The benefits of the RST is that the egg producers get the comparison of available breeds and could make their choice among these. Most RST-stations were supported by public funds, and managed by research institutes. As poultry breeding became more and more commercialised this arrangement was given up and the RST stations, have been closed one by another. This has followed the other major trend in world wide poultry breeding that the numbers of breeding companies have decreased and those left has becoming world wide which means that they show little interest for supplying breeding material specifically adapted to a comparatively small market for organic table production in Northern Europe. Recently at the 11th Poultry Conference in Bremen September 2002 some of the 4 transnational breeding companies admitted that they was starting to including the free range aspect into their breeding programme.

A small scale Danish Hatchery "Hellevad" has bred a New Hampshire line ever since 1960 under floor condition and with a mild selection pressure on laying traits. The Hellevad Hatchery also breed the female White Leghorn line from the former "Skalborg" breeding centre, which was known to perform well in floor systems. In Uppsala in Sweden the "Blommahønen" is under test

for laying, and in the Czech Republic the breeding company Dominant have strains of poultry which may be suitable for organic table egg production as they until recently were bred under floor condition.

Among the behaviour traits giving rise to particular welfare problems for the hen in organic production systems are feather pecking and cannibalism. We found and reported that the heritability for tendency to feather pecking, observed in 20-30 min. on each bird in standardised condition, had a size which was promising for use in a breeding programme.

Diseases constitute an enormous problem in organic farming systems. According to the annual report from The Danish Poultry Council (Anonymous, 1999) 4.8 and 9.4% died in a production period of 1 year in traditional battery cage or deep litter production systems respectively. However, in free-range organic production systems the mortality rate has been 14.9 % and has even been reported to be as high 50% in individual flocks. To date there has been no systematic studies on the reasons for this high mortality. Reports have indicated that a range of diseases are present in these systems, i.e., *Pasteurella multocida*, egg drop syndrome (Adenovirus), *E. coli* and *Histomonas meleagridis* (black head). Furthermore, due to the outdoor conditions and the large flock size (up to 5.000 animals) parasitic diseases are very common (Permin et al. 1999). Several studies have shown that all animals are parasitized at a stage in their life and that specially *Ascaridia galli*, *Heterakis gallinarum*, *Capillaria obsignata* and *Eimeria* spp. are common infections. Recent studies have shown that the interaction between for instance *Ascaridia galli* and *Pasteurella multocida* create *Pasteurella* carrier animals enhancing the zoonotic aspects of *Pasteurella*. *Ascaridia* eggs might also be able to transfer Salmonella to healthy animals (Chadfield et al. 1999). Many of these infections & aspects are not seen in conventional indoor systems due to the high level of management and biosecurity.

Under current Danish rules, breeds used in the organic table chicken production has to be slow-growing and the growth period must be at least 81 days. One of the major problems in organic broiler production is the high incidence of breast blisters, which in a recent Danish survey was 7% on average, with some farms having a 17% incidence. Breast blisters can become puss filled and painful to the touch, and the condition is worsened by contact with ammonia rich litter. In addition to these obvious welfare consequences, breast blisters also result in a quality downgrading of the carcass at the slaughterhouse. Perches are obligatory in organic broiler houses, but little is known about the relationships between breast blisters, perch availability and the use of perches and outdoor areas by broilers. Breed differences in the prevalence of breast blisters has also not been investigated. In order to ensure high welfare standards in organic broiler production it is also important to choose breeds which are robust and behaviourally suitable.

In this project major focus is on the laying hen in commercial, organic flocks.

Table A.1: Work package list (from application)

No.	Work package title	Participants*	Budget (1.000 DKK)	Start	End	Deliverable no(s):
1	Breed performances and welfare at farm level	<u>JBK</u> , PS, GS	1270	2001	2005	D1-D4
2	Studies on disease incidence and the significance of diseases and interaction in organic free-range poultry	<u>APE</u> , NME, JPC	1590	2001	2004	D5-D13
3	Genetics of feather pecking, and breed performance at experimental level	<u>PSO</u> , JBK, GS	1020	2000	2003	D14-D15
4	Breed performances and welfare of table chickens	<u>BLN</u>	660	2001	2002	D16-D17
5	Farmer compensation, experimental farms and consultancy.	<u>PSO</u>	850	2000	2004	
6	Co-ordination and management of the project	<u>PSO</u>	240	2000	2005	

- Responsible participants are underlined

Description of work

Workpackage 1

This work package will consist of a field study where a number of alternative breeds of laying hens will be compared to ISA Brown in organic production systems. On each of three farms installations will be place to ensure separate recordings of egg yield, feed intake and diseases/mortality and behaviour is possible. Each year in two or three years one flock of alternative birds as well as one flock of ISA will be established. Flock sizes of the alternative hens will be at least 500 hens. A representative sample of hens in each flock will be individually marked for the study of behaviour on an individual level.

- **Task 1.** The mangement system of the farm will be described and environmental conditions will be recorded. Production parameters will be recorded on flock basis for a laying period of 12 month: egg mass, egg quality, feed conversion..
- **Task 2.** Feather pecking behaviour, insidence of cannibalism, condition of integument is evaluated according to the methods routinely used by JBK
- **Task 3.** Morbidity and mortality (in cooperation with WP2)
- **Task 4.** General behavioural function (aggression, range behaviour, nesting)
- **Task 5.** Final evaluation and reporting.

Workpackage 2

The project is planned as a PhD-study, with an expected duration of 4 years. The project will include several phases as described below:

1) *Cross-sectional studies in selected poultry flocks* (1 year):

- **Task 6.** At a particular time during the production period animals will be collected and examined for the presence of viral, bacterial and parasitic diseases.

2) *Observational studies (cohort studies) in selected flocks* (1-2 years):

Based on the cross-sectional studies longitudinal studies will be carried out in selected flocks from time of hatching to slaughter (72 weeks).

- **Task 7.** Post mortems will be carried out on all dead animals
- **Task 8.** Causes of diseases (including zoonotic diseases) will be determined
- **Task 9.** The serological profile for selected diseases in selected flocks will be determined at beginning (and end) of the production period
- **Task 10.** Registration of the management system including elements of importance for the hygienic level and relate that to biosecurity
- **Task 11.** At pre-set times, i.e., 5, 30 and 72 weeks after start of production, clinical examinations of a representative number of animals in the selected flocks will be carried out
- **Task 12.** Describe the prevalence and importance of zoonotic diseases in organic poultry

3) *Experimental studies* (1-2 years):

- **Task 13.** In experimental studies the interaction between selected diseases will be studied in relation to genotype, disease manifestation, carrier status and behaviour

All studies will be carried out in the same farms as described by Wp1 and Wp3 but additional flock might be needed in order to satisfy statistically background for estimating the prevalence and incidence

Workpackage 3

This work package will focus on recording feather pecking behaviour and production parameters, as well as range behaviour and nesting behaviour, in experimental lines already selected divergently for feather pecking. The commercial breeding companies in Europe will be asked to suggest a suitable breed for organic egg production. they will be compared with a couple of non-commercial breed at the experimental "eco cottage" system at Foulum.

- **Task 14.** The 4th, 5th and 6th generations of the experimental lines will be produced in each of the years 2001 to 2003 according to the protocol used in the former project, which briefly is : evaluation of feather pecking tendency during 20 min. of each hen grouped with 30-40 other. Calculation of breeding values by means of an Animal Model (Sorensen and Kennedy, 1986) and using the DMU programme (Jensen and Madsen, 1993) selecting 30 females and 10 males for each of the lines which are reproduced as parent for the next generation. The corresponding control line is reproduced by random mating.
- **Task 15.** The 5th generation of parents will be used to produce about 450 experimental hens for test of individual production parameters in individual cages in order to estimate their breeding values for egg yielding trait. Full sisters of these will in another project (see section D for further explanation) be tested in a free range system.

- **Task 16.** Full sisters to these raised under Task 15 will be placed at a commercial farmer and the birds will be individually recorded for the trait related to feather pecking behaviour, laying pattern, their use of the outdoor facilities and on a flock basis their production potential. - Each of the European breeding companies offering breeding material for layers is asked to suggest a breed they consider as suitable for organic egg production. These breeds will be bought as hatching eggs and hatched together with a couple of non-commercial breeds and later on reared and kept for a full production period at the "Eco" cottage" at Research Centre Foulum. Each breed will be housed as 4 replicates each with 40 hens. The birds will be individually recorded for the trait related to feather pecking behaviour, laying pattern, their use of the outdoor facilities and on a flock basis their production potential. The health will be followed by the program outlined in WP2.
- **Task 17.** On the base of these recordings we will be able to estimate the success in reducing feather pecking behaviour in laying hens and we will also estimate the correlated responses to other trait of importance as other behaviour trait like cannibalism and egg laying trait.

Work package 4

Two different table chicken strains will be chosen based on the available information.

- **Task 18.** Sixteen groups of 65 broilers will be housed indoors for 6 weeks, after which 52 birds from each group will be moved to outdoor housing facilities. Comparisons will be made between the two strains in 8 of the groups, and between three different perch availability's (0, 7.5 and 15 cm per bird) within one of the strains in 12 groups. Four of the groups thus partake in both comparisons.
- **Task 19.** In both trials, perch use is recorded using video equipment, the use of outdoor areas is recorded by behavioral observations using a time sampling technique, and data on breast blisters, foot pad lesions, dermatitis and production parameters will be obtained at slaughter.
- **Task 20.** We expect the experiment to yield sufficient information to advice producers as well as legislators on the relative suitability of these strains for organic table chicken production under Danish conditions.
- **Task 21.** We expect to obtain knowledge that can contribute significantly to the alleviation of breast blisters in organic table chicken production.

Objectives and expected achievements

The objectives of the proposal is to obtain knowledge needed to improve the welfare of organic reared poultry and give the producer at better and less variable income. That will be carried out through investigating the problems related to management, production, health and their interactions using different breeds of laying hens and table chickens held in organic free-range system.

In particular:

- To create knowledge about the suitability of the existing breeding materials regarding table egg production under organic principles on farm level.
- To conclude investigations about the genetic mechanisms in laying hens, having influence on feather pecking and cannibalism, to an extent that commercial breeding companies can use this in their breeding programmes.
- To identify elements in the management and environments which will improve the welfare of the birds
- To investigate the incidence (occurrence) of diseases in organic table egg production systems and to relate disease prevalence and management system
- To investigate the interaction between diseases

- To develop strategies to improve disease prophylaxis in organic poultry production
- To examine the relationship between availability and use of perches in table chickens of different breeds and the time budget of the birds and the incidence of breast blisters as parameters for welfare.

C. Midterm results and progress

C.1 Description (summary) of main results and conclusions

WP 1) The contact and selection of three farmers that is willing to divide his facilities into two parts in order to keep two different strains of hens and record laying and feed intake separately is now in a firm pattern. The situation at the moment is as follow:

FARM 1 Situated in Vendsyssel. Contract established and agreement obtained that they should compare ISA Brown and LSL. After a period with much diseases the owner decided to stop with this flock already after 9 months, and we have agreed with him that no further research is done on this farm.

FARM 2 is situated in Vest Jylland. Agreement was obtained regarding the first batch to compare the breeds Hellevad and ISA Brown, each in a number of 3.000. They were hatched medio oktober 2001 and reared at Bredahl Fjerkræ and transferred to Farm 2 at the age of 16 weeks and the hen started to lay in februar 2002 and they were stopped 9 month later due to salmonella infection. The next batch consists of Lohmann Brown and Lohmann Tradition and they started rearing in October 2002 at Asta Bredahl and the were placed ultimo februar 2003. The third and last batch will consist of Hyline White and Hyline Brown. They will be placed as dayold at The Bredahls in october 2003.

FARM 3 is situated at the west coast of Vendsyssel. Agreement on Isa Brown and Hyline Brown in a number of 3.000 for each breed was obtained and they started rearing at Bredahl Fjerkræ primo March 2002 and were transferred to Farm 3 in June 2002 and run for a complete period. The next batch consists of Isa Brown and Lohmann Silver, they were hatched ultimo Feb 2003 and placed at Farm 3 medio june 2003. Agreement on the last batch is not done.

As substitute for Farm 1 we have made an agreement with a farmer in Mid-Jutland. That is termed Farm4 and he started ultimo march 2003 with Lohmann Silver and Babcock. The second and last batch will be placed in March 2004 and an agreement on Lohmann White and Lohmann Brown is almost done.

Protocols for the behavioural and clinical recordings involves visit four times during a batch in which the behavioural and welfare are recorded. The health is followed by post mortem investigation of all dead birds. If special diseases shows up a closer contacts in forms of visits etc. takes place. Production data is withdrawn from the E-control run by the Danish Poultry Council in which some detail data on the individual flock can be found. In addition we got the data from the Egg Packing unit regarding detailed data on quality of the eggs. It is planned to start the data handling and analysing in midle of 2004.

WP 2) One interaction study has been carried out between *Ascaridia galli* and *Salmonella* in chickens. The study has shown that the interaction between *Ascaridia galli* and *Salmonella* create *Salmonella* carrier animals enhancing the zoonotic aspects of *Salmonella*. At the moment two papers are in the process of being written.

Post mortem examinations of dead birds from Farm 1 were finished in July as the chickens were slaughtered at that time. The mortality reached 91% at Farm 1 due to outbreaks of *Pasteurella multocida* and *Erysipelothrix rhusiopathiae*. Molecular characterization of several isolates of above mentioned agents has been done and demonstrated establishment and spread of a successful clone of *P. multocida* spp. *multocida* and *E. rhusiopathia*, respectively. In addition, it was demonstrated that these two pathogens might cause severe losses in free-range chickens with a mortality rate as high as 91%. At the moment one publication is in the process of being written.

Cohort studies in 14 farms with layers have been started. In total 10 farms with organic production and 4 farms with deep litter production are included in the study. At the moment data are being collected from all the farms. In three of the organic farms in the cohort study a high mortality was initiated shortly after the start of the production period due to an outbreak of Histomoniasis. A high number of the chickens submitted for post mortem were concurrently infected with E.coli. In addition to the dual infection further investigations will be carried out on several of the isolates of E. coli in the near future (one publication is in the process of being written).

WP3. Feather pecking behaviour of generation 5 selection lines as well as the control line was recorded in February and March 2002. Recordings were made in mixed groups consisting of 10 high- and 10 low feather pecking line birds. The videotapes from three hours of behavioural observations were analysed during the summer and breeding values estimated in November, 2002. After selection, insemination and collection of hatching eggs, the sixth generation of pedigreed birds were hatched in January and February 2003 (three hatches). Rearing was done in mixed line groups in floor pens.

Clinical examinations of generation 5 adult hens revealed a higher body weight of the control line compared to both selection lines. Selection lines did not differ from each other with respect to body weight, but the level of feather pecking was significantly higher in the high-line, medium in the control and lowest in the low-line, as expected.

Task 15: Parents of generation 5 have produced chickens for task 15 and data on individual egg production and feed efficiency have been collected during spring, 2002. Data analysis showed that The selection for feather pecking is genetically correlated to feed efficiency and in particular to the need for maintenance and the two selected lines deviated in a 4 week test period by more than 10% regarding feed intake adjusted for egg production and a possible weight gain. The control line were intermediary in between the two selected lines. This is new knowledge and indicate that either the better covered plumage in the low feather pecking line save energy for keeping warm or are less active.

Task 16: Parents of generation 5 of selection lines as well as control line produced 1500 chickens for task 16. A contract with a commercial farmer was made and a complete rearing unit with 48 pens was been built. Chickens were placed in the unit in July 2002. Recordings of feather pecking, general activity, pecking to inanimate stimuli (string and feather bunch) and egg production has been done. As there is no access to outdoor area in the commercial unit, hens will be placed in the 'eco-cottages' for recording of range behaviour. This will be done in January-February, 2004, fulfilling this goal of task 16 in relation to the selected lines. With regard to individual laying pattern an electronic system for recording of individual laying pattern in loose housed layers has been developed. All 600 hens of selection lines and control line of generation 6 have been marked with an electronic transponder using leg-rings. Single bird nests (48) have been installed in the floor pens used for rearing (see above) and each nest has been equipped with an antenna. A special electronic device made for the experiment scans all nests during a 30 sec cycle and record

the number of any hen in a nest as well as the exact time of observation. Furthermore, a device monitoring egg production has been developed. An automatic recording of nest number, egg laying and date and time of egg laying are made. Finally these data will be merged to assess the individual nesting behaviour of all pedigreed birds.

With regard to the commercial breeds day-old chickens were placed in the 'eco-cottages' in July 2002. Eggs from 6 breeds were incubated, but due to low fertility/hatchability there was a shortage of chickens of one breed (Bovans Gold), resulting in only 5 breeds are being tested. Recordings of feather pecking, plumage condition and egg production are progressing as planned. The experiment will end ultimo October 2003.

WP4) Two simultaneous experiment were carried out from 9th of April to 2nd of July 2002. In the first experiment two strains were compared: i657, which is the strain conventionally used for organic table chicken production in Denmark, and Labresse, which is a dual-purpose strain of French origin. Both strains were kept according to the rules for organic table chicken production in Denmark (e.g. they had access to perches from day-old and roughage available from 3 days of age, outdoor access from 6 weeks of age and were slaughtered at 84 days of age). In the second experiment, only i657 birds were used. They were kept in 12 groups of 50, and had access to either 0, 7.5 or 15 cm of perch space per bird throughout the rearing period. In both trials, perch use was recorded using video equipment, the use of outdoor areas was recorded by behavioural observations using a time sampling technique, and data on breast blisters, foot pad lesions, dermatitis and production parameters were obtained at slaughter. This fulfills **Tasks 18** and **19**. Groups of i657 with 15 cm perch per bird used these more than groups with 7.5 cm perch per bird (19% vs. 8% of birds perching at midnight; $P < 0.001$). A significant association between access to perches and severe breast blisters (score 2) was found in the groups of i657, with odds ratios of 3.1 ($P = 0.031$) and 3.4 ($P = 0.020$) for 7.5 and 15.0 cm per birds, respectively, relative to the no-perch treatment. Labresse were more likely to develop breast blisters than i657 (odds ratio 3.5; $P < 0.001$), but used the perches significantly less (0.1 vs. 9.5 birds perching at midnight; $P < 0.001$) and weighed less (2011g vs. 2246g; $P < 0.01$) than i657. Males had a higher prevalence of breast blisters than females (odds ratio 12.2; $P < 0.001$), and this was most prominent in the Labresse strain (odds ratio 40.0; $P < 0.001$). Thus, in some broiler strains access to perches may be associated with an increase in the occurrence of severe breast blisters, but strain and sex of broiler chickens appear to have a much larger influence than access to perches on the prevalence of breast blisters.

Task 20: The prevalence of breast blisters was significantly higher in the Labresse strain (42%), which is currently not used for organic production in Denmark. The prevalence of breast blisters in the i657 strain, which is the most commonly used strain for organic production in Denmark, was approx. 16%, of which 7% would cause downgrading of the carcass and may be assumed to be uncomfortable for the birds. However, the latter was associated with the ability to perch, and a different perch design may alleviate the occurrence of severe breast blisters. Thus, i657 is the most suitable for organic table chicken production under Danish conditions of the two strains tested.

Task 21: The prevalence of breast blisters was significantly higher in males birds of both strains. Breast blister prevalence could thus be reduced by using only female birds in organic production, but this will have other implications for the organic concept in terms of sustainability, if no other use for male birds can be found. The possibility to perch is assumed to have a positive welfare effect on the birds, and the design of perches needs to be evaluated in relation to perch use and breast blisters.

C.2 Fulfilment of deliverables and milestones

(To be completed for each work package)

WP 1: Breed performance and welfare at farm level	Time schedule according to application	Deviations, if any*
Deliverables		
D 1. Production performances, egg quality and health of four breed	Running	
D 2. Feather pecking behaviour and integument of four breeds	Running	
D 3. Individual range behaviour of four laying breeds	Running	
D 4. Final report of WP1	June 2005	
Milestones		
Completed first egg production period on farms, All farms has completed.	Feb 2003	
Completed second egg production period on farms,	Feb 2004	
Completed third egg production period on farms,	Jun 2005	
Completed data analysis,	Jun 2005	

WP2: Studies on disease incidence and the significance of diseases and interaction in organic free-range poultry	Time schedule according to application	Deviations, if any*
Deliverables		
D 5. Cross-sectional studies on causes on mortality in free-range chickens in Denmark.	2002	Running until 2004
D 6. Longitudinal studies on the significance on diseases in free-range chickens in Denmark	2004	Running until 2004
D 7. Experimental investigations on the influence of <i>Dermanyssus gallinae</i> on sensitivity to selected diseases in free-range chickens in Denmark.	2004	Depending on the outcome of D5 and D6
D 8. Experimental investigations on the influence of <i>Dermanyssus gallinae</i> on the persistence of selected diseases in free-range chickens in Denmark.	2004	Depending on the outcome of D5 and D6
D 9. Investigations on haematological changes associated with dual infections with <i>Dermanyssus gallinae</i> and <i>Pasteurella multocida</i> / <i>E.coli</i> .	2004	Depending on the outcome of D5 and D6
D 10. Investigations on the significance of <i>Capillaria</i> spp. On production parameters and the persistence of selected disease agents in free-range poultry	2004	
D 11. Assessment of immune status of multiple disease infected poultry	2004	
D 12. Investigations on complement killing activity of in-bred lines of chickens used for free-range poultry production	2004	
D 13. Final report	2004	

WP3: Genetics of feather pecking	Time schedule according to application	Deviations, if any*
Deliverables		

D 14. Genetic parameters of traits related to feather pecking (realised heritabilities, etc.)	2004	
D 15. Phenotypic and genetic correlation between feather pecking and egg production, egg quality, feed conversion, body weight etc	2004	
Milestones		
Completed recording of feather pecking behaviour in generation 4	October 2000	
Completed selection and reproduction of gen. 4 and start of rearing of generation 5	January 2001	
Completed recording of feather pecking behaviour in generation 5	October 2001	
Completed selection and reproduction of gen. 5 and start of rearing of generation 6	January 2002	
Completed recording of feather pecking behaviour in generation 6	Aug 2003	
Plan to recording of test birds in cages and "Eco" cottage of generation 6		Dec2003
Completed calculation of genetic parameters	Aug 2004	
Completed report and papers,	June 2005	

WP4: Breed performance and welfare of table chickens	Time schedule according to application	Deviations, if any*
Deliverables		
D 16. Data analyses, Carried through	2002	
D 17. Final report and internationally reviewed article. Publication in British Poultry Science 44:161-169	2003	
Milestones		
Choose and hatch 2 table chicken breeds, experimental planning. Carried through	2002	
Experimental period and data collection. Carried through	2002	

D. Description of deviations and subsequent adjustments of plans

WP1 After considerable postponing of start due to difficulties to get the interested farm-ers the project were prolonged into 2005 in order to get 3 production periods on all farms. After this correction the project is running according to the new plan been approved by DARCOF in november 2002.

WP2 The project is running according to the plan and will be concluded with several publications underways in 2004. However, depending on the outcome of D5 and D6 the experimets might change to meet the overall objective of the workpage, namely to further investigate the most imprtant diseases in free-range poultry. So far Dermanyssus gallinae has not shown to be a major problem. Therefore the intention is to study Pasteurella mul-

tocida, *Erycipelotrix rhusiopathiae* and Blackhead infections. Details will follow.

The time schedule in WP3 is now running as planned and part of it is finished in some month ahead of the plan and a number of publication is at the drawing board.

WP4 is finished as planned and a publication is already in the literature

Project publications and other products

1. Articles in international, scientific journals with review procedures

Kjaer, J.B. & Sørensen, P., 2002. Feather pecking and cannibalism in free-range laying hens as affected by genotype, dietary level of methionine + cystine, light intensity during rearing and age at first access to the range area. *Appl. Anim. Behav. Sci.* 76, 21-39.**

Kjaer, J.B., Sørensen, P. & Su, G., 2001. Divergent selection on feather pecking behaviour in laying hens (*Gallus gallus domesticus*). *Appl. Anim. Beh. Sci.* 71, 229-239.**

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Permin, A., Christensen, J.P., Bisgaard, M. (2003). Consequences of concurrent *Ascaridia galli* and *Escherichia coli* infections in chickens. *Acta vet. Scandinavica* (submitted).*

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4. Oral presentations, public meetings, field days, etc.

Permin, A. Sygdomsproblemer i den økologiske konsumægsproduktion med vægt på parasitære sygdomme. Oplæg ved Nordisk Konsulent -og Veterinærmøde. Skeikampen 18-20 november 2001

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the Involved Pathogens. The Nordic Advisory- and Veterinary Seminar. Denmark. 21-23 November 2002

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5. Plan for further publications

From WP1 There will be to publication on respectively Production, productivity and mortality and welfare, feather pecking and reasons for mortality both of them in relation to the breeds used. For WP2 there are already mention a couple of publication from specific investigations. In addition there are planned to produce a paper on Incidences of various infectious diseases and there contribution to mortality and epidemiological views. In WP3 the test of 5 different hybrids will results in a publication in an applied journals and perhaps also in Organic magazines. Data from the selection experiments has already been published and further there are data on measure of individual feed intake and production which will be given at World's poultry congress in Turkey in June 2004 and a full length paper in a reviewed paper is in preparation. Three further paper in reviewed journals on topic coming out of the projects is planned. One is regarding activity measured by PID, another is the relation between E-coli infection and the frequency of laying of eggs outside nests and furthermore the feather pecking ontogeni and use of a Pecometer.

F. Scientific education

Nicoline Maag Eigaard was registered as a PhD student the 1st of December 2002. The study period is expected to be finished at the end of July 2005. The Royal Veterinary and Agricultural University has agreed to finance the last year of the PhD study. At present Nicoline has finished several Ph.D.-courses (a course in Statistics and 2 courses in Immunology). The theoretical and practical part of the Ph.D. course Poultry diseases is finished and at the moment Nicoline is writing up an examination paper to pass the final part of the course. A course in Veterinary epidemiology is expected to be finished before summer 2004. Furthermore Nicoline is teaching the veterinary students in poultry diseases as a part of the scientific education.

G. National and international cooperation

The interacting context with other projects on organic poultry production in Denmark was the topic of a 24 h workshop held in November 2001. In total it had 15 participants of which 8 came from DIAS, 3 from KVL, 3 from the Advisory Service organisations in Denmark and one from Danish Animal Welfare Society. Three of them had started a Phd study within the area of organic poultry production and 12 of the participants was involved in one of the following projects:

The present project (5)

Three non-darcof projects

- Improvement of Nutrition and Health in Organic Egg Production (1)
- Development of new poultry production systems (3)
- The outdoor areas for poultry (3)

A similar symposium is planned to take place in Spring 2004 to learn what we have experienced.

Research cooperation is established with one of the above mentioned project (Improvement of

Nutrition and Health...) in relation to Task 16, as half of the replicates is supported with roughage. Influence of using roughage on health and intestine environments is investigated and also a possible interaction with genotypes will be investigated.

The Project leader (PS) is **member of the Steering group** for the above mentioned project (The Outdoor areas for poultry) and had participated in meetings and one workshop so far.

In relation to the welfare in organic egg production in Denmark, the Ministry of Food, Agriculture and Fisheries, called experts to participate in **a working group to formulate a revised set of control measures, including animal welfare indicators**. These new control measures are to be included in the official control of organic egg production. Furthermore, we have held a 2-day training course on Foulum, including practical lessons on two commercial farms. All official controllants of licensed organic egg production units (approx. 12 persons) have participated. **Two persons from the project participated (A. Permin and J.B Kjær)**. The new control scheme has now been tested on most (>80%) of all commercial organic organic egg production farms in Denmark. Results from test are being analysed now, also under participation of project participants.

A EU-proposal entitled "A breeding programme for: Healthy and well-adapted laying hens in organic and free-range systems - for a rural and animal friendly egg production in Europe" was worked out during 2000 in a cowork with scientist from Germany, Austria, Switzerland, Denmark and Netherland, with a German co-ordinator and PS as the danish participant. The proposal failed to pass the evaluation of the EEC. In a next step it was tried to establish an expression of interest for "Organic Farm Animal Breeding" for the FP6 program as a Network of Excellence. Also this failed to be accepted by the EEC. A third initiative is started and will have its first meeting in October this year and will in its first be a discussion meeting in order to try to clarify the concept of what actually "organic breeding" do have of implication for the various species in order to try to get and understanding of the concept.

Nordic Gene Bank Animal has established a working group with the purpose to describe existing breeding stock of hens within the Baltic Sea that is suitable for free range egg production, organic egg production is considered to belong to this group. PS is chairman of the group and they will have a report finished in October 2003.

Critical reflection on the project

The broiler part of the project has been successfully completed and published. The strain differences in propensity to perch should not change the current choice of strain for organic broiler production, but may have implications for perch-design. However, this part of the project was relatively small, and the results could usefully be included in future investigations, where also product quality was assessed.

In the negotiation with the farmers on choice of breeds there has been some limitation in obtaining optimal solutions, as the farmers denied to take unknown breed unless they got a higher amount of guarantee, than the project was able to give. At the time of writing the application we were aware of this situation, but at the same time we were working with formulation of the EU proposal (see item G), that also would include similarly comparisons at farm level of various breeds in a number of countries. As these proposal failed to pass the EU-evaluation, the restriction in which breeds we were able to compare at farm level became more serious.

As a reaction to this we had the chance to use Research Center Foulum's Facilities in the "Eco Cottage" fully to test of the more rare breeds that is offered from breeding companies in Europe together with the Danish Hellevad and a Dual purpose breed. This has been made possible as another project has taken over to test the bird's mentioned as full sisters of generation 5 in Task 16.

8. Budget

A. Account for any change in budgets

B. Budget for the whole project (1.000 DKK)

Total consumption of funds from DARCOF and expected consumption this year and coming years

Year:	Consumption before 2003	Expected consumption 2003	2004	2005	Total
Man-months	50.0	27.5	11.0	2.0	100.5
Scientific personnel	43.5	20.5	11.0	2.0	76.0
Technical personnel	16.5	8.0	0		24.5

Year:	Consumption before 2003	Expected consumption 2003	2004	2005	Total
Salaries	1828	760	323	81	2992
Scientific personnel	1414	560	323	81	2378
Technical personnel	414	200			614
Other operational costs	494	290	73	18	875
Equipment					
Others (please specify)	200 66	400 33	53	50	888 99
Direct costs	2773	1483	449	149	4854
Indirect costs (20% of direct costs)	467	210	80	19	776
Total	3240	1693	529	168	5630

Comments:

9. Signatures and stamps

Name	Institute	Date	Signature
Head of project			

Appendix I. Detailed budget

A. Budget for each participating institute (1.000 DKr)

Name of Institute: Danmarks JordbrugsForskning

Year:	Consumption before 2003	Expected consumption 2003	2004	2005	Total
Man-months	39.0	13.5	4.0	2.0	58.5
Scientific personnel	27.5	7.5	4.0	2.0	41.0
Technical personnel	11.5	6.0	0.0		17.5

Year:	Consumption before 2003	Expected consumption 2003	2004	2005	Total
Salaries	1315	430	140	81	1.966
Scientific personnel	1039	280	140	81	1.540
Technical personnel	276	150			426
Other operational costs	338	182	38	18	566
Equipment					
Others (please specify)	385 66	400 33	53	50	888 99
Direct costs	2104	1045	231	149	3.529
Indirect costs (20% of direct costs)	333	122	37	19	511
Total	2437	1167	268	168	4.040

Comments:

A. Budget for each participating institute (1.000 DKr)

Name of Institute: Den Kgl. Veterinær og Landbohøjskole

Year:	Consumption before 2003	Expected consumption 2003	2004	2005	Total
Man-months	21	14	7		42
Scientific personnel	16	12	7		35
Technical personnel	3	2			7

Year:	Consumption before 2003	Expected consumption 2003	2004	2005	Total
Salaries	513	330	183		1.026
Scientific personnel	375	280	183		838
Technical personnel	138	50			188
Other operational costs	156	108	35		299
Equipment					
Others (please specify)					
Direct costs	669	438	218		1.325
Indirect costs (20% of direct costs)	134	88	43		265
Total	803	526	261		1.590

Comments:

B. Budget for each participating department (1.000 DKK)

Name of Institute and department: **DJF og Afd for Husdyravl og Genetik**
Workpackage 1+3+5+6

Year:	Consumption before 2003	Expected consumption 2003	2004	2005	Total
Man-months	9,5	2,5	1,0	1,0	14,0
Scientific personnel	9,5	2,5	1,0	1,0	14,0
Technical personnel					

Year:	Consumption before 2003	Expected consumption 2003	2004	2005	Total
Salaries	381	100	32	41	554
Scientific personnel	381	100	32	41	554
Technical personnel					
Other operational costs	70	35	8	8	121
Equipment					
Others (please specify)	385 66	400 33	53	50	888 99
Direct costs	902	568	93	99	1.662
Indirect costs (20% of direct costs)	92	27	9	9	137
Total	994	595	102	108	1.799

Comments:

Name of Institute and department: DJF, Afd for Husdyrsundhed og Velfærd

Workpackage 1 + 3

Year:	Consumption before 2003	Expected consumption 2003	2004	2005	Total
Man-months	16.5	11.0	3.0	1.0	31.5
Scientific personnel	9.0	5.0	3.0	1.0	18.0
Technical personnel	7.5	6.0			13.5

Year:	Consumption before 2003	Expected consumption 2003	2004	2005	Total
Salaries	512	330	108	40	990
Scientific personnel	324	180	108	40	652
Technical personnel	188	150			338
Other operational costs	140	147	30	10	327
Equipment					
Others (please specify)					
Direct costs	652	477	138	50	1.317
Indirect costs (20% of direct costs)	131	95	28	10	264
Total	783	571	166	60	1.581

Comments:

Name of Institute and department: **DJF og Afd. for Husdyrsundhed og Velfærd**
 Work package 4: Slagtekyllinger

Year:	Consumption before 2003	Expected consumption 2003	2004	2005	Total
Man-months	13.0				13.0
Scientific personnel	9.0				9.0
Technical personnel	4.0				4.0

Year:	Consumption before 2003	Expected consumption 2003	2004	2005	Total
Salaries	422				422
Scientific personnel	334				334
Technical personnel	88				88
Other operational costs	128				128
Equipment					
Others (please specify)					
Direct costs	550				550
Indirect costs (20% of direct costs)	110				110
Total	660				660

Comments:

C. Budget for co-financing from each participating institute (1.000 DKK)

Name of Institute:

Year:	Consumption before 2003	Expected consumption 2003	2004	2005	Total
Man-months					
Scientific personnel					
Technical personnel					

Year:	Consumption before 2003	Expected consumption 2003	2004	2005	Total
Salaries					
Scientific personnel					
Technical personnel					
Other operational costs					
Equipment					
Others (please specify)					
Direct costs					
Indirect costs (20% of direct costs)					
Total					

Comments: