Danish Research Centre for Organic Farming

Final Report

For DARCOF II research projects financed by grants from
The Directorate for Food, Fisheries and Agro Business
under the Danish Ministry of Food, Agriculture and Fisheries

1. Research program

Research in organic farming 2000-2005 (DARCOF II)

2. Project title and number

II8 Management in relation to health and food safety in organic pig production (MANORPIG)

3. Head of project

Jan Tind Sørensen Head of research Unit, Phd.
Dept. of Animal Health, Welfare and Nutrition
Danish institute of Agricultural Sciences

Participating institutes

Danish institute of Agricultural Sciences
Royal Veterinary and Agricultural University

Slutrapporten sendes elektronisk til Forskningscenter for Økologisk Jordbrug *foejo@agrsci.dk* senest 3 måneder efter projektets afslutning.

Slutrapporten vedlægges et dansk resumé.

5. Other project staff

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6. Project period (month, year)

Start of project: May 2001
End of project: April 2005

7. Final report

A. Project summary

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

No.	Work package title	Participants*	Budget (1.000 DKK)	Start	End	Deliverable no(s):
1	Non-medical parasite control in piglets	AR, HM	850.000 kr.	May 2001	July 2004	D1-D4
2	Development of a HACCP-system for control of diseases, zoonoses and animal welfare problems	JTS, MB	925.000 kr.	Jan 2002	Sept 2004	D5-D10
3	Development of strategies for pest management	HL, JL, MK	500.000 kr.	June 2001	May 2004	D11-D13
4	Project co-ordination and organisation of an advisory workshop	JTS	225.000 kr	May 2001	Dec 2004	D14

* Responsible participants are underlined

B. Objectives and expected achievements

C. Progress and results

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

WP1

Six farrowing paddocks were contaminated with *Ascaris suum* (round worm), *Trichuris suis* (whip worm) and *Oesophagostomum dentatum* (nodular worm) in the spring 2001. In June, the infection level of all paddocks was estimated using paddock samples and parasite naïve tracer pigs. In the beginning of July one litter of piglets was born on each paddock. Week 3 after farrowing, 1 piglet from each litter was slaughtered and examined for all 3 parasites. This procedure continued week 5, 7, 9, 11, 13, 15, and 19 or until no piglets were left on a paddock. In addition, blood and faecal samples were also collected. The piglets were weaned at the age of 7 weeks by removing the sow. Paddock infection level was followed throughout the experiment by collecting paddock samples and in November tracer pigs were again turned out on the pastures.

Relatively few *Trichuris* eggs reached infectivity during 2001, whereas infective *Ascaris* eggs started to appear in July and then increased steadily in number during late summer to autumn 2001. Infective larvae of *Oesophagostomum* were present from July until October at a low level. There was a high transmission rate of *Ascaris,* resulting in high worm burdens and an overall prevalence of 80 %. The highest numbers of small immature worms were found during the first 11 weeks. Thereafter the number seems to have decreased. In contrast, the number of larger established (adult) worms was fairly constant from week 9 to 19. This may indicate that while

there was a continuous uptake of infective eggs throughout the experiment, the pigs developed a partial immunity towards the parasite. This partial immunity prevented the establishment of the majority of incoming larvae but allowed the established adult worms to remain in the host. The adult population may have been derived from the eggs that were taken up in the beginning of the transmission period. The adult worms excreted an increasing number of eggs towards the end of the experiment, contaminating the pastures a second time that year. Overall, the results seem to confirm previous findings that a moderate neonatal exposure to infective *Ascaris* eggs may result in higher infection levels compared to situations where exposure to the parasite occurs later in life.

Transmission of *Trichuris* to the piglets was negligible. This was due to the very slow embryonation of these eggs. Normally, the majority of *Trichuris* eggs do not become infective until the second season after contamination. *Oesophagostomum* is transmitted as free-living larvae. The larvae may reach infectivity within as little as 21 days but are sensitive to desiccation. In the present study, survival of the larvae was poor and consequently, overall transmission rate was continuous but very low, and worms therefore accumulated very slowly in the pigs. At week 19 the pigs harboured a mean worm burden of only 442 (min=20, max=1060) worms/pig, of which most were adult and excreting eggs. In all, the results show that if infective parasite stages are present on the paddocks, piglets will ingest them very early in life due to their natural foraging behaviour.

The study on long-term infectivity of parasites on the contaminated paddocks (Task 2) took place by estimating paddock infection levels every spring and autumn of 2001, 2002, and 2003 using pasture samples and parasite uptake by tracer pigs. As part of task 3, half the paddocks were ploughed first in the winter of 2002 and again in the winter of 2003. The paddocks were re-sown in May after the tracer pigs had been on the paddocks.

Approximately one year after the farrowing paddocks were contaminated with parasites, only two of the three initial parasites had survived on the paddocks. All samples collected from May 2002 indicate that *Oesophagostomum* was no longer present. There was a considerable transmission of *Ascaris* by the end of 2001. However, overall *Ascaris* transmission levels continued to increase until the autumn of 2003 on the paddocks that were not ploughed. This indicates that heavily *Ascaris* contaminated pastures should ideally not be used for pigs for at least 2 to 3 years after the initial year of contamination. Though transmission of *Ascaris* transmission was noticeably reduced in 2002, the results were less clear in 2003 as transmission was reduced in the autumn but not in the spring.

The overall paddock infectivity levels for *Trichuris* were much lower than for *Ascaris* but this may reflect that initial *Trichuris* contamination levels in 2001 were lower. The transmission level of *Trichuris* increased over time indicating that eggs excreted in 2001 continued to develop throughout the 3 year trial. The highest transmission level was registered in November 2003 and, considering the longevity of Trichuris eggs, it is expected that the parasite will remain present on the paddocks in the following years. Ploughing reduced the transmission level of *Trichuris* considerably more than *Ascaris* throughout the trial. The reason may be that *Trichuris* eggs have a higher optimal temperature for embryonation than *Ascaris* and therefore do not develop well,

when ploughed deeper in the soil.

In conclusion, novel information on the development patterns, survival and transmission dynamics of the free-living stages of the 3 most common porcine helminths has been obtained within the project. The information is crucial for present and future recommendations to farmers on parasite control. The longevity of both *Ascaris* and *Trichuris* eggs has also confirmed that pasture rotation must still be considered to be one of the most important tools if intestinal parasites are to be controlled within a herd.

WP2:
An expert panel of 10 Danish and Swedish veterinarians and production advisers with experience in organic pig production has estimated the occurrence of health and welfare problems in organic herds and identified important risk factors. The experts have either completed a series of questionnaires or have participated in our advisory workshop in the spring 2003. According to the experts, welfare problems often arise due to insufficient access to water and wallowing facilities, especially as regards the sows. Poor body condition, reproduction problems, and stone chewing were regarded as other common problems for the sows together with leg disorders that might be under-estimated in outdoor herds due to difficulties diagnosing the problem in extensive production systems. Suckling piglets commonly experience welfare problems caused by crushing or trauma inflicted by the dam, insufficient disease treatment and care of weak piglets, disturbances and trauma from predators and unsuccessful nursings. Diarrhoea is a common health problem in weaned pigs.

Leg disorders have been selected as an important welfare problem for organic sows, while the most common welfare problems for suckling and weaned pigs have been identified as crushing/trauma and diarrhoea, respectively. Important risk factors for leg problems in sows were considered to be genetic factors affecting leg strength, diseases in legs and hooves, ground condition in outdoor areas and management in the mating area (trauma caused by increased social activity). Risk factors for crushing of piglets were related to the farrowing hut, bedding material, environmental disturbances and sow condition. The risk factors suggested for diarrhoea in weaned pigs were related to feed quality and hygiene of outdoor area, indoor pens and wallowing holes.

52 organic pig producers from Denmark, UK, the Netherlands, and Sweden have completed a postal questionnaire survey concerning health and welfare problems and associated risk factors in organic sow herds, particularly focusing on leg disorders, piglet mortality and weaning diarrhoea. The average size of the participants' herds was 88 sows, and 71 % were integrated herds. The predominant system for dry and lactating sows in Denmark, UK and Sweden was pasture, while most of the Dutch sows were housed indoor with outdoor access. The weaned pigs were housed indoor with outdoor access in Denmark, the Netherlands and to some extent in Sweden. In UK and to some extent in Sweden the weaned pigs were on pasture. The average age at weaning was lower in the Netherlands (41 days) than in the other countries (52-54 days).

23 % of the farmers stated that they frequently observed leg problems in their sows. Hoof injury was the most frequently observed leg problem in the sows, but leg or hoof

disorders were the culling reason in only a few cases. 55 % of the farmers perceived they had a problem with piglet mortality, and 17 % of the herds, mostly Dutch, reported a piglet mortality of more than 20 %. The most common cause of death was crushing of piglets by the sow. In addition to that, piglets that were weak at birth and shortage of milk in the sow caused piglet mortality in many herds. 21 % of the farmers were concerned with weaning diarrhoea, but it seemed to be mainly a Danish and Dutch problem. Respiratory diseases were considered a problem by 44 % of the farmers, especially from the Netherlands. Arthritis was perceived as a problem by 26 % of the farmers, and endoparasites were concerning 21 % of the farmers. Diarrhoea seemed to be the major cause of death in Danish weaned pigs, while the Dutch weaned pigs were more likely to die from respiratory diseases. The English farmers reported that mortality in weaned pigs caused by insufficient feed intake was a bigger problem than infectious diseases.

In general the farmers appreciated improvements of the production facilities as the method most likely to improve animal health in the herd, but also optimisation in the care of the animals were likely to improve herd health. Breeding programmes focusing on disease resistance and better surveillance of the production, as for example a CCP management tool were alternative options. In spite of the CCP management tool not being the farmers' first choice of control method, 50 % of the farmers would be interested in applying such a tool in their herd. If the tool were of use in marketing organic pigs, it would be an extra incentive. Many Danish and Dutch farmers seemed interested in using the tool in their herds. The herds from Denmark and the Netherlands were generally bigger than the English and Swedish herds, and the CCP management tool may indeed be more suited to herd health management in larger herds.

WP3

The answers given in the questionnaire survey by 158 farmers have been analysed. The farmers were asked questions about what they considered problems arising from the natural environment. They were also asked to describe how they offered fodder and water, which types of huts they used etc. The surroundings should be described regarding factors that were thought to influence the natural fauna, such as e.g. distance to hedgerows, forests, streams and watercourses.

The results of the survey showed that

- Rats and smaller rodents (mice and voles), foxes and hares were the most frequently occurring mammals in the fields with pigs
- The farmers considered rats and foxes as causing the most important (pest) problems

Occurrence of rats is reported significantly more frequently in organic pig farming than in traditional pig farming in open fields. Factors significantly positively correlated with occurrence of rats and smaller rodents:

- Occurrence of foxes
- Stacks of hay and straw in the fields
- Use of automatic feeding systems
- Use of open water trays

A distance of less than 100 m from pig fields to hedgerows was significantly positively

correlated with occurrence of rats. Occurrence of smaller rodents and occurrence of birds of prey were two significantly positively correlated factors. Use of drinking cups was significantly positively correlated with occurrence of rats. Special shelters for the pigs exclusively made of bales of straw did not give a significant positive correlation with occurrence of rodents.

These results indicate factors that are practicable as preventive measures against rodents. Regarding direct control methods the farmers reported traps, shooting, and cats and dogs as their most frequent non-chemical ways of controlling rodents. Activities such as mucking out the huts and moving the huts often, keeping fodder in rodent-proof containers, avoiding fodder spillage, and avoiding feeding stations for game animals nearby are reported by the farmers as useful elements in a strategy for reducing rodent problems.

Ecology of rodent pest problems has been studied at two farms on Zealand with regular trapping sessions over a period of two years (2001-2003), capture-recapture studies and telemetric work to investigate rodent movements. The captures yielded a total of 1247 small mammals, belonging to 8 rodent and 2 shrew species. The most commonly trapped animals in the traps were wood mice *Apodemus sylvaticus* and field voles *Microtus agrestis*. The commensal Norway rat *Rattus norvegicus* and house mouse *Mus musculus* constituted 8% resp. 4.6% of the trapped animals. Rats were trapped throughout the farm area, along fencelines and field edges as it was not possible to trap within the fields where pigs were active.

Eleven rats were followed using telemetry in different seasons, in order to test a number of hypotheses about their movements and home ranges (this work was carried out as part of an M.Sc.-study). Telemetry observations confirmed that rats' activity was highest along the field edges. Rats used burrows under feeding and water trays only as temporary hiding places during fouraging, but did not use them as permanent nesting sites. The latter were found in the field edges or in the vegetation outside the fields. Moving feeding trays to another place in a fold, increased the rats' home ranges, but rats remained active in their original activity centres and did not immediately include the new location of the feeding trays in their home range. Rat densities were lower and their home ranges significantly larger in winter than in summer.

These results suggest that feeding trays should be placed far from the field edges. Despite visible rat activity near feeding trays, rat control should be undertaken in the field edges. An optimal timing for this would be immediately after feeding trays are moved, i.e. when an important food source suddenly disappears from the rats' home ranges and when the rats thus may be more likely to feed from other sources. The edges near the original location of the field are good locations for this. Rodent control should start in the beginning of winter, before rats start increasing their home ranges.

[Her anføres resultater og konklusioner, samt resultaternes aktuelle anvendelighed og fremtidige perspektiver, herunder beskrives resultaternes eventuelle markedsmæssige potentiale og samfundsøkonomiske bidrag. Endvidere skal det anføres i hvilket omfang resultaterne har ført til nye kompetencer, fastholdelse af projektmedarbejdere, givet grundlag for nye projekter o.lign.]

C.2 Fulfilment of deliverables and milestones

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WP1Non-medical parasite control in piglets	Time schedule according to application	Deviations, if any*
Task		
1.Parasites in piglets on contaminated farrowing pastures	May 2001- Dec. 2001	
2. Long-term infectivity on naturally contaminated pastures	Nov 2001- Mar 2004	
3.Comparison of longterm infectivity of continous grass and on ploughed/new grass	Nov 2001- Mar 2004	
Deliverables		
D1. International journal paper on neonatal helminth infections submitted	June 30 2002	Submission: September 2005
D2. National publication on neonatatal helminth infections	Aug 31 2002	June 2003
D3. International journal paper on long-term helminth infectvity of continuous and ploughed pastures submitted	April 2004	Submission: October 2005
D4 National publication with recommendations for organic farmers on pasture management in non-medical control of helminth infections	Feb 28 2004	June 2004
Milestones		
M1 Experiment on helminth infections in piglets on contaminated pastures completed	Dec. 2001	
M2 Experiment on long-term survival of infective helminth stages on continuous and ploughed pastures completed	Dec. 2003	

WP2Development of a HACCP and a systematic operation programme for control of diseases, zoonoses and animal welfare problems	Time schedule according to Progress Report 2003	Deviations, if any*
Task		
4.Development of a protocol for critical control points	Jan 02 – Oct 2003	
5.Development of a HACCP programme	May 03 – Oct 04	
6.Conducting an international questionnaire farm survey targeting organic pig producers	May 03- Dec 04	Sep – Nov 04
7.Evaluation of a CCP protocol as a management tool	Nov 2003- Sep 2004	Nov 04 – Mar 05
8.Evaluation of a HACCP as a decision support system	Nov 2003 – Dec 2004	Nov 04 – Mar 05
Deliverables		
D5.An informative publication on health and welfare problems in organic sow herds	Sept 2003	
D6. A report on HACCP principles applied in livestock research and production in Europe	Aug 2004	July 2004 *

D7. A scientific journal paper on risk factors for health and welfare problems in organic sow herds	Nov 2004	Summary of results in enclosed document Submission of paper in Nov 2005
D8. A report on HACCP systems developed for leg problems, weaning diarrhoea, Salmonella and welfare problems on organic pig farms (focus changed slightly from application)	Dec 2004	July 2004*
D9. A report on how farmers have perceived the applicability of the CCP protocol as a management tool (focus changed slightly from application)	Dec. 2004	Summary of results in enclosed document
D10. The HACCP system is described for implementation on the Internet	Dec. 2004	Not completed
Milestones		
M3. A CCP monitor protocol is available	Nov 2002	Nov 2003
M4. A questionnaire survey focusing on monitoring of health and welfare problems in organic sow herds has been carried out	May 2004	Nov 2004
M5. Prototype HACCP systems developed for leg problems, weaning diarrhoea and crushing of piglets are available	August 2004	Not completed
M6. An evaluation of the HACCP system as a management tool is completed (former M5)	Oct. 2004.	April 2005

* D6 has been changed to a scientific journal paper on health management in organic sow herds using a HACCP concept

WP3 Development of strategies for pest management in selected production systems	Time schedule according to application	Deviations, if any*
Task		
9.Indentification of pest-supporting factors	Jun-Nov 2001	
10.Ecology of pest problems	Oct 2001- Mar 2004	
11. Identification of pest control tools	Apr-Jun 2004	
Deliverables		
D11. A list of factors which are known to increase pest problems in open air pig farms to be incorporated in risk analysis and decision support systems	Feb 28 2004	Oct. 2003
D12. An annotated list of non-pesticide-based pest control tools for use in outdoor pig systems	May 31 2004	Dec. 2003
D13. An international journal paper on the ecology of wild rodents in outdoor pig farm systems submitted	May 31 2004	March 31 2005
Milestones		
M7. Questionnaire results analysed	Nov 2002	Sept 2003
M8. Ecology field work finalised	Jan. 2004	
M9.Potential control techniques listed	Sept 2004	

WP number and title WP4 Project co-ordination and organisation of an international workshop	Time schedule according to application	Deviations, if any*
Task		
12.Organisation of a advisory workshop	Jan-Dec. 2002	April 2003
13.Co-ordination	May 2001- Dec 2004	
Deliverables		
D14. A workshop report	Jan 2003	May 2003
Milestones		
M10. An advisory workshop	Dec 2002	April 23 2003

[Deliverables er forskellige former for offentligt tilgængelige produkter (artikler, rapporter, informationsmøder etc.) og det skal angives, hvilken form for produkt der er tale om. Milestones er væsentlige trin i forskningsprocessen. Der skal angives et tidspunkt for både deliverables og milestones (milestones ligger typisk tidligere end deliverables). Ændringer i deliverables og milestones forsyne med en notits om, at de er ændret i forhold til ansøgningen, og hvorfor de er ændret. Alle deliverables og milestones skal stå i rapporten, og de, der er passeret, mærkes af som udførte, eller der angives en ny dato. Større afvigelser kommenteres i D.]

D. Description of deviations and subsequent adjustments of plans

WP1: D1 has been split into 2 papers in order to deal with the large quantity of obtained data. D3 has been delayed in order to decide if additional data from a follow up study could be finalised in time to be included in the paper. As this is not the case only data resulting from the current project will be included. The paper will be submitted in October 2005.

WP2: The international questionnaire farm survey (Task 6) scheduled for the spring 2004 has been carried out but in a reduced form. The questionnaires have been translated to English, German, Dutch, and Swedish, and posted to organic pig producers in Denmark, Sweden, UK and the Netherlands. We could not get access to any producer lists from Germany, in stead the German questionnaires were forwarded to a group of German organic pig husbandry advisers. However, the consultants have failed to supply any questionnaires from Germany and therefore the data are based on the questionnaires returned from Denmark, UK, Sweden and the Netherlands We failed to receive questionnaires from German farmers. A summary of the results from the questionnaire is given in the enclosed report and a manuscript is in preparation. The questionnaire included an evaluation of HAACP type decision support and the results are summarised in the enclosed report. However, the results could not be a basis for a scientific publication on its own. D9 is therefore not completed. The value of D10 was linked to an on-farm evaluation of the HACCP-based system. Since this was given up in 2003, it was not possible to complete this deliverable. D10 should have been erased in the status report from 2003.

The deliverable D6 has been changed to a scientific journal paper on health management in organic sow herds using a HACCP concept. The paper also included a description of the content of the HACCP-based system, which we have developed, and consequently included the information intended for D8. D8 was therefore not published as an independent deliverable.

[Her skal der kun stå en kort forklaring på de afvigelser der er anført i C.2, og en beskrivelse af de ændringer i planerne det har givet anledning til. Der skal ikke gives resultater eller konklusioner]

E. Project publications and other products

[Produkter under 1 skal kopieres fra Organic Eprints. Dette gælder også for produkter, som kun delvist er finansieret af FØJO. Listen fra Organic Eprints kan findes på hjemmesiden http://www.okoforsk.dk/projekt/index.html under "Project publications" på de enkelte projekter.]

[Produkter under 2 er mundtlige præsentationer og andet, som ikke skal kunne findes i Organic Eprints]

1. Products from Organic Eprints archive

Bonde, M. and Sorensen, J.T. (2004) Heard health management in organic pig production using a quality assurance system based on Hazard Analysis and Critical Control Points. *NJAS Wageningen Journal of Life Sciences. Rodent control strategies in organic farming.* 52(2):pp. 133-143.

Bonde, Marianne Kjær and Sørensen, Jan Tind (2004) Velfærds- og sundhedsproblemer i økologisk sohold: forekomst, risikofaktorer og kontrolmuligheder, in Sørensen, Jan Tind, Eds. *Produktionsstyring med fokus på husdyrsundhed og fødevaresikkerhed i økologiske svinebesætninger: Rapport fra workshop afholdt på Hotel Bygholm Park 23. april 2003*. FØJO Intern rapport no. 54, chapter 2, page pp. 7-18. Forskningscenter for Økologisk Jordbrug.

Bonde, Marianne and Sørensen, Jan Tind (September 2003) Control of health and welfare problems in organic sow herds. Online at <http://www.darcof.dk/enews/sep03/haccp.html>. Newsletter from Danish Research centre for Organic Farming (DARCOFenews) September 2003, No. 3

Bonde, Marianne and Sørensen, Jan Tind (22. October 2003) Kontrol af sundheds- og velfærdsproblemer i økologiske sobesætninger [Management of health and welfare problems in organic sow herds]. Online at <http://www.foejo.dk/enyt2/enyt/okt03/haccp.html>. Nyhedsbrev fra Forskningscenter for Økologisk Jordbrug (FØJO enyt) · Oktober 2003 · nr. 5

Lodal, Jens; Knorr, Mette and Leirs, Herwig (2004) Strategier til giftfri bekæmpelse af rotter og mus, in Sørensen, Jan Tind, Eds. *Produktionsstyring med fokus på husdyrsundhed og fødevaresikkerhed i økologiske svinebesætninger: Rapport fra workshop afholdt på Hotel Bygholm Park 23. april 2003*. FØJO Intern rapport no. 54, chapter 4, page pp. 27-34. Forskningscenter for Økologisk Jordbrug.

Mejer, Helena and Roepstorff, Allan (2004) Alternativ kontrol af indvoldsorm hos svin, in Sørensen, Jan Tind, Eds. *Produktionsstyring med fokus på husdyrsundhed og fødevaresikkerhed i økologiske svinebesætninger: Rapport fra workshop afholdt på Hotel Bygholm Park 23. april 2003*. FØJO Intern rapport no. 54, chapter 3, page pp. 19-26. Forskningscenter for Økologisk Jordbrug.

Mejer, Helena and Roepstroff, Allan (2003). Non-medical control of parasitic worms in pigs. Online at <http://www.darcof.dk/enews/jun03/parasit.html> Newsletter from Danish Research centre for Organic Farming (DARCOFenews) · June 2003 · No. 2.

Mejer, Helena and Roepstorff, Allan (2003). Ikke-medicinsk kontrol af indvoldsorm i grise. Online at http://www.foejo.dk/enyt2/enyt/aug03/orm.html. Nyhedsbrev fra Forskningscenter for Økologisk Jordbrug (FØJO enyt) · August 2003 · nr. 4

Mejer, H. 2004. Pløjning virker mod nogen indvoldsorm (2004). Online at http://orgprints.org/00003228/. Økologisk jordbrug 315, 10.

Articles not yet available on Organic e-print

Mejer, H., and Roepstorff, A. 2005. *Oesophagostomum dentatum* and *Trichuris suis* infections in pigs born and raised on contaminated paddocks. Submitted and draft version uploaded to Organic e-print but not released on site as the paper has not yet been published.

Mejer, H., and Roepstorff, A. 2005. *Ascaris suum* infections in pigs born and raised on contaminated paddocks. Submitted and draft version uploaded to Organic e-print

but not released on site as the paper has not yet been published.

Mejer, H., and Roepstorff, A. 2005. Survival of the free-living stages of porcine helminths in relation to ploughing. To be submitted in October 2005. The draft version will be uploaded to Organic e-print but not released on site as the paper has not yet been published.

Leirs, H., Lodal, J. & Knorr, M., 2004. Factors correlated with the presence of rodents on outdoor pig farms in Denmark and suggestions for management strategies. Netherlands Journal of Agricultural Sciences 52(2), 145-161.

Meerburg, B.G., Bonde, M., Brom, F.W.A., Endepols, S., Jensen, A.N., Leirs, H., Lodal, J., Singleton, G.R., Pelz, H.-J., Rodenburg, T.B. & Kijlstra, A., 2004. Towards sustainable management of rodents in organic animal husbandry. Netherlands Journal of Agricultural Sciences 52(2), 195-205.

2. Other products (oral presentations, public meetings, field days, etc.)

Bonde, Marianne. Health management in organic pig production. Oral presentation at Seminar “Rodent control strategies in organic pig and poultry production systems”, Wageningen, NL, May 26-28 2004

Bonde, M. & Sørensen, J.T., 2005. Health and welfare problems in European organic sow herds. Report from project II8 Management in relation to health and food safety in organic pig production, concerning deliverables D7 and D9 29/09/2005

Leirs, H., 2004. Factors affecting the presence of rodents in outdoor pig farms in Denmark. (In collaboration with J. Lodal and M. Knorr). Seminar “Rodent control strategies in organic pig and poultry production systems” May 26-28 2004, Wageningen, The Netherlands.

Lodal, J., 2004. Possible strategies for rodent control in outdoor pig farms. (In collaboration with H. Leirs and M. Knorr). Seminar “Rodent control strategies in organic pig and poultry production systems” May 26-28 2004, Wageningen, The Netherlands.

Mejer, H. Alternative control of intetinal worms in Danish pigs. 1st Annual Congress of the EU integrated Project QualityLowInputFood and 17 Soil Association Annua Conference, Newcastle, UK, 6-9 January 2005.

Mejer, H., Roepstorff, A. & Eriksen, E. Transmission af parasitter i grise som er født og opvokset på friland. Markvandring på KVL´s forsøgsgårde, 6 juni 2002.

Roepstorff, A. ”Parasitter i lange baner: Parasitter i moderne husdyrproduktion”. Foredrag ved KVL´s Kandidatkonference 2002, 23 august 2002.

Sørensen, J.T. Health management in organic pig production. Workshop on organic pig production, Horsens, April 24-25 2003.

Mejer, H. Non-medical parasite control in pigs. Workshop on organic pig production, Horsens, April 24-25 2003.

Bonde, M. Development of a HACCP for control of diseases, zoonoses and welfare problems in organic sow herds. Workshop on organic pig production, Horsens, April 24-25 2003.

Lodal, J., Knorr, M. & Leirs, H. Development of strategies for pest management with focus on rodents. Workshop on organic pig production, Horsens, April 24-25 2003.

* 25-75% financed by DARCOF
** 5-25% financed by DARCOF

F. Scientific education

Helena Mejer are conducting the Ph.D. project "Management and alternative crops as means of reducing the parasite loads in organic swine production systems" by July 1, 2001, funded by the DARCOF projects MANORPIG and PROSBIO, as well as co-financed by DARCOF.

Iver Munch Skadborg is finalising an M.Sc. (Agronomy) thesis, based on the telemetry observations of rats in WP3.

G. National and international cooperation

The project group has participated in an international seminar on research in organic pig production organised by DARCOF 24-25 April 2003 in Horsens, Denmark.

The participants from KVL and DIAS are involved in a large international EU-IP project on organic agriculture (acronym: QualityLowInputFood) with activities on organic pig production in 2004-2006.

In February-March 2004 Scientist Marianne Bonde DIAS carried out study tours to visit selected European research groups working on development of HACCP based systems for on farm use in livestock production. The visits included research institutes, universities and associations in the UK, Netherlands and Germany. Further, a Danish network of researchers working with livestock health and welfare research applying HACCP principles has organised a seminar series June – October 2004 discussing HACCP in livestock research.

H. Critical reflection on the project

[Her gives der en kritisk refleksion over projektets planer, forløb og resultater. Det kan rumme refleksioner over det videnskabelige håndværk med hensyn til fx metodevalg, prøvbarhed og udførelse; over eventuelle ændringer i relevans som følge af ændringer i omverdenen eller som følge af den læring der er sket i projektet; samt over aspekter af forskningsudvikling, især i relation til FØJOs mål om at udvikle tværgående og relevant forskning (og hvad der evt. kunne gøres bedre). Her diskuteres endvidere væsentlige justeringer af projektet som følge af afvigelser fra planen (fra C.2 og D) og andre væsentlige ændringer.]

Before the project was started, it was discussed how best to monitor the survival of parasite eggs and larvae on the contaminated paddocks. Traditionally, there are 2 very different approaches to this problem. One method is to rely on the detection of eggs and larvae in soil and vegetation samples and subsequent visual evaluation of development stage and viability using a microscope. This is relatively easy and a reasonable number of samples can be processed by one person within a few days. However, the method has several shortcomings. Firstly, it is not possible by hand to collect samples that are truly representative of what a pig would pick up through their normal grazing and especially rooting behaviour. One reason for this is that the eggs and larvae are not uniformly distributed on the paddocks. A further problem is that it is not possible to determine if the eggs are fully infective through visual examination. An egg with a fully developed larva still need time to mature before it is truly infective. It may therefore be preferable to monitor paddock infectivity by examining the worm burdens of tracer pigs that have stayed on the infected paddocks. Though this approach does not yield information on the relative distribution of different development stages and there is a natural variation between pigs, the tracer method gives a truer picture of the actual transmission potential of the paddocks. Unfortunately, the method is expensive in terms of animals and man-hours. Overall, the 2 approaches give different results, that by themselves are incomplete, and it was therefore decided that both approaches were necessary in the present project to ensure maximum level of obtained knowledge.

In the project application we have chosen to focus on leg disorders, weaning diarrhoea and selected welfare problems However since planning of the project new information and experience on animal health and welfare problems in organic sow production has emerged. Piglet mortality may be a major health/animal welfare problem, which has been included in task 4 and 5.

The farm study planned as task 6 has been changed to a questionnaire survey on large European organic pig farms. The change was due to difficulties recruiting Danish organic pig farms for a one-year study. Thus the focus of WP2 has become more international. We believe that the change will enhance the research quality of WP2.

During the process of analysing the questionnaire responses and through contact with the organic farmers, it has been possible to identify three groups of farmers regarding their views on pest control. One group uses pesticides if these are allowed in organic farming while a second group does not use pesticides and if they need control pests they prefer traps and other non-chemical methods. A third group denies killing wild animals whether they are pests or not. These different groups have to be born in mind when the issue is how to control pest animals in organic farming.

Rats are often in focus as transmitters of diseases and this is justified by the highly commensal life style of the rats. It has been considered also to include smaller rodents in the telemetry studies because very few rats seemed to be present in the study fields at the beginning of the field work. Fortunately, I 2003 a sufficient number of rats were found to be present in the fields of farm G, and, therefore,the telemetric part of the study could be finished as planned with rats.

8. Budget

A. Account for any change in budgets

B. Budget for the whole project (1.000 DKK)

Year:	Original budget	Consumption before 2004	Consumption 2004	Consumption 2005	Total
Man-months	56	44,5	9,5	2	56
Scientific personnel	42,5	35	9,5	2	46,5
Technical personnel	13,5	9,5	0	0	9,5

Year:	Original budget	Consumption before 2004	Consumption 2004	Consumption 2005	Total
Salaries	1.611	1273	343	73	1689
Scientific personnel	1.333	1071	343	73	1487
Technical personnel	278	202	0	0	202
Other operational costs	503	346	52	26	424
Equipment	0	0	0	0	0
Others (please specify)					
Direct costs	2114	1619	395	99	2113
Indirect costs (20% of direct costs)	386	287	80	19	386
Total	2500	1906	475	118	2499

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: Royal Veterinary and Agricultural University, Centre for Experimental Parasitology

Year:	Original budget	Consumption before 2004	Consumption 2004	Consumption 2005	Total
Man-months	23	7	3½	0	22½
Scientific personnel	18	6	3½	0	18½
Technical personnel	5	1	0	0	4

Year:	Original budget	Consumption before 2004	Consumption 2004	Consumption 2005	Total
Salaries	573	458	115	0	573
Scientific personnel	483	376	115	0	491
Technical personnel	90	82	0	0	82
Other operational costs	135	107	28	0	135
Equipment	0	0	0	0	0
Others (please specify)	0	0	0	0	0
Direct costs	708	565	143	0	708
Indirect costs (20% of direct costs)	142	113	29	0	142
Total	850	678	172	0	850

Comments:

B. Budget for each participating department (1.000 DKK)

Name of Institute and department: **Dept. of Animal Health, Welfare and Nutrition, DIAS**

Year:	Original budget	Consumption before 2004	Consumption 2004	Consumption 2005	Total
Man-months	24	16,5	9,5	2,0	28
Scientific personnel	19	15,5	9,5	2,0	27
Technical personnel	5	1	0	0	6

Year:	Original Budget	Consumption before 2004	Consumption 2004	Consumption 2005	Total
Salaries	774	586	193	73	852
Scientific personnel	660	540	193	73	806
Technical personnel	114	46	0	0	46
Other operational costs	185	56	24	26	106
Equipment	0	0	0	0	0
Others (please specify)					
Direct costs	959	642	217	99	958
Indirect costs (20% of direct costs)	191	128	44	19	191
Total	1150	770	261	118	1149

Comments:

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

Name of Institute: Danish Pest Infestation Laboratory

Year:	Original budget	Consumption before 2004	Consumption 2004	Consumption 2005	Total
Man-months	9	8	1	0	9
Scientific personnel	5,5	4,5	1	0	5,5
Technical personnel	3,5	3,5	0	0	3,5

Year:	Original budget	Consumption before 2004	Consumption 2004	Consumption 2005	Total
Salaries	264	229	35	0	264
Scientific personnel	190	155	35	0	190
Technical personnel	74	74	0	0	74
Other operational costs	183	183	0	0	183
Equipment					
Others (please specify)					
Direct costs	447	412	35	0	447
Indirect costs (20% of direct costs)	53	46	7	0	53
Total	500	458	42	0	500

Comments: