Midterm Status Report 2003 and Application for Continuation in 2004

For 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

II.9 Resource use, environmental impact and economy in organic pig production systems

3. Head of project

John E. Hermansen

4. Participating institutes

Danish Institute of Agricultural Sciences (Department of Agroecology, Animal Health and Welfare, Agricultural Engineering), Danish Research Institute of Food Economics, and The National Committee for Pig Production.

5. Other project staff

Jørgen Eriksen, Department of Agroecology, DIAS
Merete Studsnitz, Department of Animal Health and Welfare, DIAS
Karin Strudsholm, Department of Agroecology, DIAS
Bent Hindrup Andersen, Department of Agricultural Engineering, DIAS
Niels Tvedegaard, Danish Research Institute of Food Economics
Vivi Aarestrup Moustsen, The National Committee for Pig Production

6. Project period (month, year)

Start of project: 1.8.2001
End of project: 31.12.2004

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

A. Project summary

In Denmark, the organic pig production is very scarce today and needs to be developed in order to fulfil the expected potential hereof. In relation to this there is a need to develop new systems in which the pig production is more integrated into land use in order to fulfil the expectation to the organic pig production from different stakeholders and probably also in order to make the production economical feasible.

In the preliminary work for this research initiative, two in principle different systems have been suggested as alternatives to the dominant way of production of organic pigs today. Today, the sows are outdoors on pasture whereas the growing pigs are indoors with access to an outdoor run of limited size. The two alternatives are characterised by either mobile huts, which can be moved in an appropriate way in the crop rotation allowing the pigs to forage, or by establishment of decentralized, strategically positioned fixed units, where the pigs have easy access to the surrounding area.

However, such a development raises several questions, which are being addressed in this project. The project has three work packages (WP). The first WP focuses on grazing strategies for sows and growing pigs. Through two experiments, it is expected that we can 1. Propose alternatives to ringing of sows in the effort to maintain sward quality, and 2. Propose appropriate strategies of combining grazing and barn feeding for growing pigs.

The second WP focuses on the environmental impact of different grazing regimes. In the before mentioned experiments with sows and growing pigs, the level and spatial variation in nutrient load of the grazing areas will be determined (N, P and K) and the distribution between N-losses as leaching, ammonia volatilization and denitrification will be estimated. Furthermore, different pig production systems will be assessed in relation to nutrient losses through strategic sampling on the area grazed. Hereby it is expected that strategies for improved nutrient utilisation and an acceptable environmental load of nutrients in organic pig production can be proposed.

The third WP includes an overall assessment of different pig production systems within a life cycle assessment (LCA) framework and also including economic considerations. Suitable LCA indicators will be selected and data will be collected from commercial organic farms as well as from experimental units. Through modelling a range of systems will be assessed not only including the actual systems already present but also 'future' relevant systems improved with the knowledge obtained in other WPs in this project.

Table 1: Work package list (from application).

No.	Work package title	Participants*	Budget (1.000 DKr)	Start	End	Deliverable No:
1	Strategies for grazing systems in organic pig production	<u>KSU</u>, MS	1,147	Oct 2001	April 2004	D1.1-D1.3
2	Nutrient load and environmental consequences of pigs on grassland	<u>JE</u>	1,036	Jan 2002	Aug 2004	D.2.1-D2.3
3	System assessment in an LCA perspective and co-ordination	<u>JHE</u>,NT, KSU, BHA,VAM	1,317	Aug 2001	Dec 2004	D3.1-D3.5
Total			3,500			

* Responsible participants are underlined

B. Objectives and expected achievements

The overall perspective of the project is to create knowledge, which can support the development of organic pig production in Denmark. This implies knowledge on how the system at farm level can be constructed so that the production is economically feasible for the farmer and at the same time respects the farmers' and the consumers' perception of the organic ideals as well as societal goals for environmental impact of animal production. The objectives are, during experiments, farm studies, and modelling:

- to identify optimal strategies for growing pigs at pasture combined with a possible barn fed period in relation to growth, nutrient load at the pasture and an appropriate utilisation of the farm buildings,
- to identify appropriate strategies for keeping sows on pasture without being ringed in relation to sward quality and risk of nutrient losses,
- to quantify the risk of nutrient losses in a range of grazing systems with particular focus on 'improved' grazing strategies,
- to assess different systems in relation to production efficiency, resource use, and environmental impact within an LCA framework,
- to propose an economically and environmentally viable future strategy for organic pig production in Denmark.

C. Midterm results and progress

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

WP1: Strategies for grazing systems in organic pig production

Two experiments have been completed according to the application.

The first experiment concerns investigation of different strategies for combined grazing and barn kept growing pigs in relation to growth rate, behaviour and meat quality and was carried out at the organic experimental station, Rugballegaard. Five replicates with a flock size of ten pigs balanced in live weight and sex was used. At weaning at an age of 7-8 weeks (app 19 kg live weight) piglets born in an outdoor system were distributed on five treatments as follows:

1. Piglets were moved indoor at weaning and fed ad libitum until slaughter.
2. Piglets stayed on pasture and were fed restrictively with concentrates until 40 kg live weight, followed by ad libitum feeding in a barn pen.
3. Piglets stayed on pasture and was fed restrictively with concentrates until 80 kg live weight, followed by ad libitum feeding in a pen.
4. Piglets stayed on pasture until slaughtering and were fed restrictively in the whole period.
5. As treatment 4, but the growers were fed ad libitum until slaughtering.

The first replicate started January 2002 and the fifth and last replicate was completed April 2003, so that the seasonal variation is expected to be covered by the design. All finishers in the five replicates are now slaughtered.

In the field each experimental unit (group of ten pigs) was allocated to a 'new' piece of land, differing in size according to the expected nutrient load from the pigs. The stocking rate in the field was calculated to cause an excretion of 280 kg N per hectare. To ensure a good distribution of the manure and thereby the environmental load from the pigs on the pasture, the huts, troughs and water supply were moved in a routine.

All pigs were individually weighed at weaning, at transmission and at slaughtering. The pigs in treatment 1 were also weighed when pigs in treatment 2 and 3 were moved indoor to estimate the compensatory growth. At the same time points, the social and aggressive behaviour were registered for all treatments. At slaughter the carcass were evaluated for lean percentage and back fat. Furthermore, as a result of additional funding outside FØJO, the colour, the tenderness and the fatty acid composition of the *Longissimus Dorsi* was measured.

Table 1 shows the pig "flow" in the different treatments and in Tables 2 and 3 the effect of treatment on daily gain and carcass traits are given.

It appears that outdoor reared and ad libitum feed pigs had slightly (but significant) lower growth rate and an increased feed consumption per kg gain. The outdoor pigs, which were fed restrictively, had a lower daily gain according to the period of restricted feeding (treatments 2, 3 and 4), but interestingly, no significant differences in feed consumption per kg gain appeared. Considering the growth in different periods, the pigs transferred to the farm at 40 or 80 kg's had a significant lower growth rate when they were kept outdoor and a significant higher growth rate when they were kept indoor compared to the pig kept indoor all the period.

Table 3 shows that carcass traits were significantly affected by the treatments. The lean percentage in central piece and in total carcass as well as back fat are strongly correlated within treatments. It appears that pigs reared outdoor in the entire period or until 80 kg's of live weight (treatment 3, 4 and 5) had a significantly higher lean percentage and a lower back fat than the indoor reared pigs. In particular the outdoor pigs which were fed restrictively in the entire period had better carcass traits. Since problems with too low lean percentage are significant in Danish organic pig production the results are very interesting in that respect.

In fact the results show that by keeping the growers outdoor in a significant period of their lives, while fed restrictively, the carcass characteristics can be improved without impairing feed consumption compared to indoor reared pigs, but that the production period will be extended by approx 10%.

Table 1. Age, live weight and warm carcass weight for pigs of different treatments; means.

Treatment	Indoor, Ad lib	Indoor from 40-100 kg	Indoor from 80-100 kg	Outdoor, restricted	Outdoor, Ad lib
Number of pigs at insertion	49	49	49	49	49
Number of dead pigs	1	4	4	1	1
Initial age, days	53	53	53	52	52
Initial body weight, kg	18.3	18.5	18.9	18.3	18.3
Final body weight, kg	95.2	99.3	95.5	94.0	98.5
Warm carcass weight, kg	74.1	77.6	74.3	73.1	76.9

Table 2. Performance traits for pigs in different treatment groups; LS means +/- S.E., and P values for significance of differences between treatments.

Treatment	Indoor, Ad lib	Indoor from 40-100 kg	Indoor from 80-100 kg	Outdoor, Restricted	Outdoor, Ad lib	P-value
Age at slaughtering, days	156^{a} (1.3)	161^{b} (1.4)	170^{c} (1.3)	177^{d} (1.3)	160^{b} (1.3)	0.0001
Daily gain, g/day	767^{a} (8.3)	729^{b} (8.8)	673^{c} (8.6)	632^{d} (8.4)	739^{b} (8.4)	0.0001
Feed conversion, MJ ME /kg gain.	37.25^{a} (1.7)	40.20^{ab} (1.7)	39.86^{ab} (1.7)	35.95^{a} (1.7)	42.3^{b} (1.7)	0.05

a, b, c, d: LS-means with different suffice differ significantly (P< 0.05)

Table 3. Carcass traits for pigs in different treatment groups; LS means +/- S.E., and P values for significance of differences between treatments.

Treatment	Indoor, Ad lib	Indoor from 40-100 kg	Indoor from 80-100 kg	Outdoor, Restricted	Outdoor, Ad lib	P-value
Lean percentage, total	57.5[a] (0.4)	57.6[a] (0.4)	60.4[b] (0.4)	61.9[c] (0.4)	59.8[b] (0.4)	0.0001
Backfat	17.6[a] (0.4)	18.4[ad] (0.5)	15.9[b] (0.4)	14.7[c] (0.4)	16.5[ab] (0.4)	0.0001
Lean percentage, central piece	61.9[a] (0.5)	61.4[a] (0.6)	65.4[d] (0.5)	67.3[e] (0.5)	64.2[d] (0.5)	0.0001

The second experiment concerns environmental impact and pasture damage without nose-ringing of sows including treatments with ringed sows. The study was carried out on a private farm and included three treatments for pregnant as well as lactating sows:

1: pasture with nose-ringed sows at a moderate daily stocking rate over a 20 weeks period
2: pasture with un-ringed sows at a stocking rate as above
3: pasture with un-ringed sows with the double stocking density over half the period (10 weeks) (field change)

The stocking density estimated per year is the same in the three treatments, but in treatment 3 the sows admittance to the field was limited to one half from May until June and to the second half from July until September. This treatment is called field change. All three treatments included pregnant (2 replicates) as well as nursing sows (3 replicates). Pregnant sows were housed in groups of five, whereas nursing sows were housed in single farrowing pens. The experiment started in May and the last observations and samplings were completed in September 2002.

The behaviour of the sows was registered once a week. Rooting behaviour, grazing, level of activity and location of the sows were recorded in zones in the fields corresponding to the zones where the grass cover were measured by telemetry in July and in September. Input-output of plant nutrients in the pens were recorded.

Figure 1 shows the mean incidence of grazing and rooting behaviour.

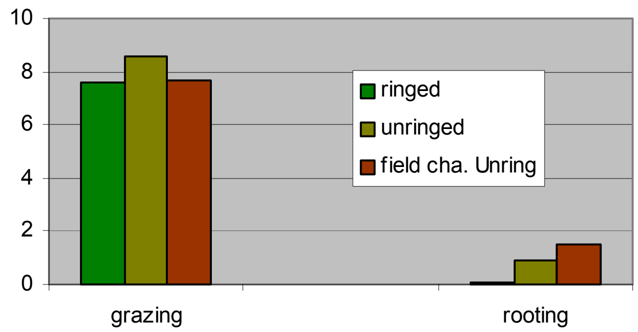

Figure 1. Mean incidence of grazing- and rooting behaviour per hour.

It appears that the incidence of grazing did not differ between treatments whereas rooting was increased in treatments with unringed sows. The results on grass cover and risk of leaching is further elaborated in WP-2.

WP2: Nutrient load and environmental consequences of pigs on grassland

Environmental impact of growing pigs on pasture

In the experiment on outdoor growing pigs at Rugballegaard (see WP1) soil samples have been collected and grass cover evaluated each time pigs were transferred from the field to housing or slaughterhouse. Grid points were established for every 5x5 m in the 10 m wide paddocks and similarly points were established outside the paddocks for every 5 m as a reference. In each point soil samples were collected to 40 cm by pooling 8 soil cores. A total of 948 soil samples have been analysed for content of mineral N, exchangeable K and extractable P to determine the level and the distribution of nutrients within the paddocks. Figure 2 shows an example of the results.

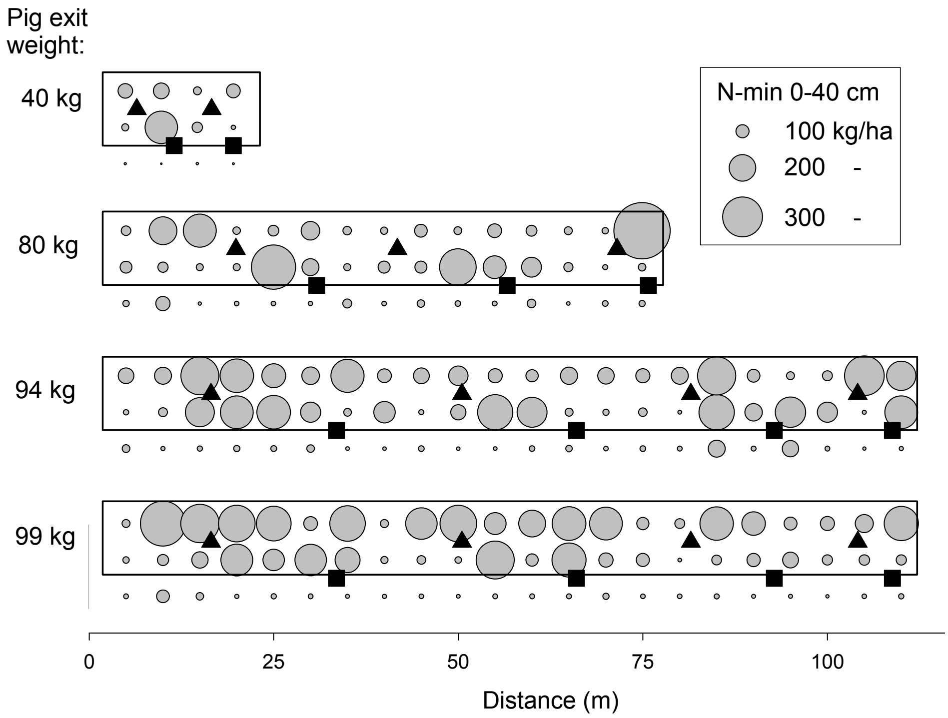

Fig. 2. Bubble plot of inorganic soil nitrogen (0-40 cm) in- and outside the four paddocks in replicate 4 of the experiment on growing pigs. Each paddock contained one hut (▲) and one feeding trough (■) that was moved every four weeks (from right to left). Here are shown all positions throughout the experiment.

The results still need more thorough analysis, but preliminary interpretation indicate that 1) the content of soil nitrogen is considerably raised compared to the soil outside the paddocks, 2) despite considerable variation within the paddocks N is distributed throughout, and 3) there appears to be some relation between N excretion and huts and feeders.

Grass cover in all points was originally planned to be a visual inspection but was instead carried out using automatic measurements of spectral reflectance from which a relative vegetation index (RVI) can be calculated. We consider this a huge improvement as the data seems very reliable, more precise and the subjective and individual nature of visual determination is avoided. Generally, it has been difficult to maintain a grass cover in the paddocks. In the spring of 2003 all paddocks were ploughed and oats put in. The growth of the crop has been determined in all grid points using spectral reflectance measurements.

Environmental impact and pasture damage without nose-ringing of sows

In the experiment established at a private farm (see WP1) spectral reflectance of grass cover have been determined during summer grazing and at the end of the experiment to determine the influence of nose-ringing and animal density in paddocks with pregnant and lactating sows (see Table 4 for treatments). At the end of grazing, soil sampling was carried out in sub-units of each paddock for analysis of mineral N, exchangeable K and extractable P to determine the level and the distribution of nutrients within the paddocks.

Table 4. Experimental treatments

	Treatments	Pregnant sows			Lactating sows		
		Grps/pen	Sows/pen	Area (m²)	Grps/pen	Sows/pen	Area (m²)
1	+ ring	2	5	1820	2	1	328
2	− ring	2	5	1820	2	1	328
3a	− ring	1	5	910	1	1	164
3b	− ring	1	5	910	1	1	164

In Fig. 3 are seen some results on grass cover. This was best maintained where lactating sows were ringed. Without the ring grass cover was reasonably maintained where a high density, but short time period of grazing took place. In Fig. 4 is shown the relationship between grass cover and soil mineral N in many points in the paddocks. In paddocks with lactating sows high contents of soil N was found even when the grass cover was good, probably because of N deposition exceeding the uptake capacity of the grass. In paddocks with pregnant sows there was a significant relationship and the soil mineral N-content was very low even at grass cover below 60%.

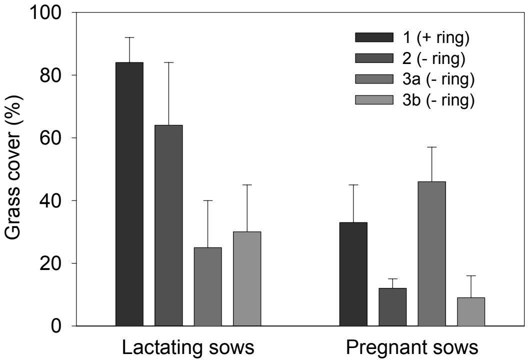

Fig. 3. Grass cover in paddocks in the autumn. Error bars: SE.

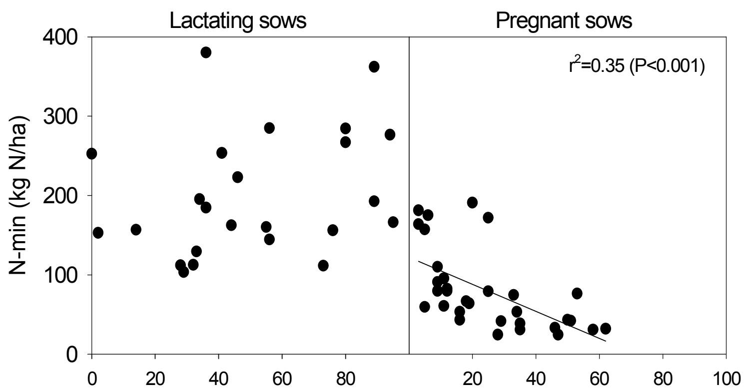

Fig. 4. Relationship between grass cover and soil mineral N content in localized areas of the pad-

Determination of grass cover and soil sampling strategy has been co-ordinated with animal behaviour studies. Data on nutrient balances of each paddock, grass cover, soil nutrient content in localised areas and animal behaviour will be related with the intention of a joint publication.

Characterization of environmental impact of different production systems

Following the end of the above experiments, nutrient surpluses will be calculated and related to the recovery of the mineral nutrient found in the paddock and the grass cover. In a number of different systems strategic sampling will be carried out to identify critical points. Focus will be on continuous use of permanent grassland for sows and the effect of a permanent path from indoor housing to the field.

WP3: System assessment in an LCA perspective and co-ordination

The activities in this WP is strongly related to development projects in which different systems are investigated and sought improved. The overall idea is to be able to compare different solutions as regard environmental impact and economic competitiveness.

These include systems where sows are kept on grass and finishers in barns with an outdoor run, systems based on a one unit pen (strategically placed units where the pigs (sows and finishes) have easy access to the surrounding area) and systems where sows as well as finishers are kept in the crop rotation all year round. The particular tasks in this WP is to make the environmental evaluation by the LCA concept and to investigate the sensibility in economic performance in the different systems.

The concept of LCA has been consolidated through the project leaders participation in another project "Life cycle assessment of basic foods" and the necessary protocol for colleting the relevant input-output data has been established. Data are being obtained from different sources at the moment through participation in several other projects regarding organic pig production. In this way the basis for carrying out LCA's and economic for systems widely differing in resource use (including land use and buildings) are established. No results however are available now.

A forum has been established where practitioners, slaughterhouses, advisors and researchers can discuss the progress and perspectives in the range of research and development projects in progress at the moment (see G). This forum is also valuable in suggesting what new systems, which should be evaluated in this WP.

In April 2003 a joint Danish and Swedish workshop was organised on behalf of DARCOF. The overall aim was to exchange information on current projects related to organic pig production. 16 projects or subprojects were presented (appendix 1) and 42 persons participated in the workshop.

C.2 Fulfilment of deliverables and milestones

WP1: Strategies for grazing systems in organic pig Production	Time schedule according to application	Deviations, if any*
Deliverables		
1 – Paper on rooting by unringed pregnant sows	Dec 03	
2 - Paper on comparison of four strategies for grazing/housing of weaners and finishers	Dec 03	
3 – Project report on proposed optimal strategies for pigs grazing management to be used in system analyses	Jan 04	

Milestones		
1 – Design of experiments concluded in the entire project group (including determination of the relevant stocking rate and feeding strategies to be used for different groups of pigs)	Dec 01	
2 – Completion of experiment covering activity 1	June 03	
3 – Completion of experiment covering activity 2	June 03	

- *Deviations are to be further discussed at C3*

WP2: Nutrient load and environmental consequences of pigs on grassland	Time schedule according to application	Deviations, if any*
Deliverables		
1 – Paper on the nutrient losses related to different strategies for keeping growing pigs on grassland.	Feb 04	
2 – Paper on the effect of nose-ringing of sows on pasture damage and nutrient utilazation.	March 04	
3 – Estimates of nutrient losses from grassland in different outdoor pig production systems to be used in system analyses.	April 04	

Milestones		
1 – Enviromental guidelines for keeping growing pigs on pasture have been developed and published	Sept 04	
2 – Environmental recommendation for nose-ringing of sows have been developed and published	Sep 04	

** Deviations are to be further discussed at C3*

WP3: System assessment in an LCA perspective and co-ordination	Time schedule according to application	Deviations, if any*
Deliverables		
1 – Report on relevant indicators for an LCA assessment	Feb 02	December 03
2 – Paper on LCA and economics of different systems	Oct 04	
3 – Report on future proposed systems	Nov 04	
4 – Annual status report for the project	Nov 01,02,03	
5- National meeting with advisors and producers/producer organisations interested in organic pig production	Nov 04	
Milestones		
1 - A set of indicators discussed in national and international fora and agreed upon in the project group	March 02	
2 - Co-operation with the farmers established and recording scheme developed	Sept 01	Dec 01
3 – Conceptual model developed	Dec 02	June 03
4 - A series of analyses carried out	Sept 04	

** Deviations are to be further discussed at C3*

D. Description of deviations and subsequent adjustments of plans

The conceptual work regarding LCA have been delayed. This will, however, have no influence on the overall work plan and for finalizing the project according to the original plan.

E. Project publications and other products

1. Articles in international, scientific journals with review procedures

Eriksen J., Petersen S.O. & Sommer S.G. (2002): The fate of nitrogen in outdoor pig production. Agronomie 22: 863-867. **

2. Papers presented at congresses, symposiums, etc.

Hermansen, J.E., Larsen, V.A. & Andersen, B.H., 2002: Development of organic pig production systems. Presentation at ”Perspectives in Pig Science” Conference, Nottingham, September 2002, 15 pp.**

Hermansen, J.E., 2001: Organic livestock production systems and appropriate development in relation to public expectations. Paper presented at 52nd EAAP meeting, Budapest, August 2001, p. 219.

3. Reports, articles in agricultural journals, etc.

Studnitz, M., 2002: Nytter trynering overhovedet? UdendørsNyt nr.2, side 8.

Studnitz, M., 2002: Forsøg med slagtesvin. UdendørsNyt nr.2, side 10-11.

Studnitz, M., 2002: Har søers rodeintensitet indflydelse på udvaskning? Landsbladet Svin nr. 8, side 32.

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

Eriksen, J. & Petersen, S.O. Poster at field day in Foulum 13 June 2002: "Miljøbelastning ved søer på friland"

Eriksen, J., Strudsholm, K. & Studnitz, M. (2003) Environmental impact of outdoor pig production. Oral presentation at Nordic workshop on research in organic pig production, 24-25 April. Horsens.

Hermansen, J.E., 2001: Rammer og udfordringer for frilands- og økologisk svineproduktion. Økologisk og udendørs svineproduktion. Hvor står vi? Temamøde på Danmarks JordbrugsForskning den 21. august 2001. Intern Rapport nr. 145. P. 4-8**.

Strudsholm, K., Studnitz, M., 2002: Poster at field day Rugballegård.

Studnitz, M., 2002: Ved naturvidenskabsfestivalen og Åbent hus arrangement den 28. september på stand ved HSV.

F. Scientific education including visiting scientist

During a period of 3 month in 2002 Cecile Cornou from France was be employed in the project as part of her preparation for application PhD.-grant. Cecile Cornou has a M.Sc. in Agricultural Science (2002) with main focus on system analysis, statistics and economy.

G. National and international cooperation

National collaboration

In relation to the heading of a development project concerning organic pig production, the project leader for PIGSYS has organised a support group with a wide range of stake holders. These include:

- Central Advisory Service (Erik Nørgård)
- The Organic Agricultural School (Simme Eriksen)
- Organic Pig Producers Council (LØK) (Fie Graugård, Poul Skovgård, Tove Seerup)
- The Animal Protection Agency (Pernille F. Johnsen)
- Slaughterhouses Handling Organic Pigs (Karsten Dejbjerg (Danish Crown), Ulrich Kern-Hansen (Hanegal))
- Plant Directorate (Kim Boesen)
- Danish Slaughterhouses (Henrik B. Lauritsen)
  as well as project participants (researchers) in different projects.

The overall idea is to discuss prospects and constrains for the development of organic pig production with a special emphasis on the primary production. This includes demand for new knowledge on the detailed level as well as on new production systems which to a higher degree than at present can comply with the expectation of consumers and other stake holders. This is expected also to give important input to the overall analysis which is going to take place in PIGSYS.

Below is given research and development projects outside FOEJO funded projects which are discussed in the support group

- New organic pig production system (2001-2004)
- Concept for huts on protected – deep litter based areas for combined farrowing sows and weaners (2002-2004)
- Optimised welfare for organic pig production in tent systems as well as farrowing huts (2002-2004)
- Entire male production – influence on welfare aspects and risk for boar taint (2002-2004)

H. Critical reflection on the project

The project group finds that the background, the perspective and the way the work is carried out is sound and valid in relation to some important challenges which exists for the development of organic pig production.

On the other hand, the aspects in focus has been very much investigated within the context of the way organic pig production takes place to day. At the April workshop the question was raised if it really will be possible to think of a competitive organic pig production in this context. It was proposed to consider systems which were not based on an optimised pig production, but where the role of pigs in the system was optimised. In others words there is a need to consider systems where the free range element (for the sake of the pigs) are implemented in a way whereby the pigs at the same time exert a positive influence on other parts of the system. Following that line more focus need to be put on the different capabilities of the pigs i.e. to root for land cultivation and picking up essential nutrients and to interact with other livestock to reduce parasite burden.

8. Budget

A. Account for any change in budgets

Due to delay in the work concerning LCA, 1 man-month has been postponed from 2003 to 2004.

B. Budget for the whole project (1,000 DKK)

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

Year:	Consump-tion before 2003	Expected consumption 2003	2004	2005	Total
Man-months					
Scientific personnel	14	16	17		47
Technical personnel	11	6	1		18

Year:	Consump-tion before 2003	Expected consumption 2003	2004	2005	Total
Salaries					
Scientific personnel	493	546	868733		1772
Technical personnel	256	148	25		429
Other operational costs	168	305	150		623
Equipment					
Others (please specify)	40	30	30		100
Direct costs	957	1029	938		2924
Indirect costs (20% of direct costs)	191	206	188		585
Total	1148	1235	1126		3509

Comments:

9. Signatures and stamps

Name	Institute	Date	Signature
Head of project			

Appendix I. Detailed budget

A. Budget for each participating institute (1,000 DKK)

Name of Institute: DIAS

Year:	Consump-tion before 2003	Expected consumption 2003	2004	2005	Total
Man-months					
Scientific personnel	11.5	14	14		39.5
Technical personnel	11	6	1		18

Year:	Consump-tion before 2003	Expected consumption 2004	2005	2006	Total
Salaries					
Scientific personnel	406	474	623		1503
Technical personnel	256	148	25		429
Other operational costs	146	289	130		565
Equipment					
Others (please specify)	40	30	30		100
Direct costs	848	941	808		2597
Indirect costs (20% of direct costs)	170	186	162		520
Total	1018	1129	970		3117

Comments:

Name of Institute: FØI

Year:	Expected consumption before 2003	Expected consumption 2003	2004	2005	Total
Man-months Scientific personnel Technical personnel	2.5	2	3		7.5

Year:	Expected consumption before 2003	Expected consumption 2003	2004	2005	Total
Salaries Scientific personnel Technical personnel	87	72	110		269
Other operational costs	22	16	20		58
Equipment					
Others (please specify)					
Direct costs	109	88	130		327
Indirect costs (20% of direct costs)	21	18	26		65
Total	130	106	156		392

B. Budget for each participating department (1,000 DKK)

Name of Institute and department: DIAS, PVJ

Year:	Consump-tion before 2003	Expected consumption 2003	2004	2005	Total
Man-months					
Scientific personnel	2	2.5	5		9.5
Technical personnel	4	3			7

Year:	Consump-tion before 2003	Expected consumption 2003	2004	2005	Total
Salaries					
Scientific personnel	84	111	234		429
Technical personnel	99	76			175
Other operational costs	16	183	60		259
Equipment					
Others (please specify)					
Direct costs	199	370	294		863
Indirect costs (20% of direct costs)	40	74	59		173
Total	239	444	353		1036

Comments:

Name of Institute and department: DIAS, JBS

Year:	Consump-tion before 2003	Expected consumption 2003	2004	2005	Total
Man-months					
Scientific personnel	5.5	5.5	7		18
Technical personnel	4	3	1		8

Year:	Consump-tion before 2003	Expected consumption 2003	2004	2005	Total
Salaries					
Scientific personnel	198	196	279		673
Technical personnel	91	72	25		188
Other operational costs	110	70	40		220
Equipment					
Others (please specify)	40	30	30		100
Direct costs	439	368	374		1181
Indirect costs (20% of direct costs)	88	73	74		235
Total	527	441	448		1416

Due to delay in the work concerning LCA 1½ man-month has been postponed from 2002 to coming years.

Name of Institute and department: DIAS, HSV

Year:	Consump-tion before 2003	Expected consumption 2003	2004	2005	Total
Man-months					
Scientific personnel	4	3	1		8
Technical personnel	3	0	0		3

Year:	Consump-tion before 2003	Expected consumption 2003	2004	2005	Total
Salaries					
Scientific personnel	124	94	33		251
Technical personnel	66	0	0		66
Other operational costs	20	20	10		50
Equipment					
Others (please specify)					
Direct costs	210	114	43		367
Indirect costs (20% of direct costs)	42	23	9		74
Total	252	137	52		441

Name of Institute and department: DIAS, JBT

Year:	Expected consump-tion 2003	2004	2005	Total
Man-months Scientific personnel Technical personnel	2	2		4

Year:	Expected consump-tion 2003	2004	2005	Total
Salaries Scientific personnel Technical personnel	73	77		150
Other operational costs	16	20		36
Equipment				
Others (please specify)				
Direct costs	89	97		186
Indirect costs (20% of direct costs)	18	20		38
Total	107	117		224

C. Budget for co-financing from each participating institute (1,000 DKK)

Name of Institute:

Year:	Consump-tion before 2002	Expected consumption 2002	2003	2004	2005	Total
Man-months Scientific personnel Technical personnel						

Year:	Consump-tion before 2002	Expected consumption 2002	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: