

**Midterm Status Report 2002 and  
Application for Continuation in 2003  
And  
Application for project extension**

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

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1. *Research program*

Research in organic farming 2000-2005 (DARCOF II).

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2. *Project title and number*

Development of sustainable production systems for apples. FØJOII-DJF-2.

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3. *Head of project*

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6. *Project period (month, year)*

Start of project:	September 2000.
End of project:	December 2004.

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7. *Midterm description of the project, its results and progress, and application for continuation in 2003*

## A. Project summary

Organic growers estimated a yield reduction of at least 86 percent compared to conventional production in a questionnaire. The organic growers only expect 14 percent of a conventional yield. The estimation was based on production of the most common conventional grown varieties. The main reason for this low productivity is lack of control measurements against diseases and pests, especially apple scab (*Venturia inaequalis*). In Denmark most organic pesticides are not registered. Copper, for example, has not been on the market for 7 years.

The challenge is to find methods to increase the yield and fruit quality in an unsprayed organic apple orchard.

### **WP 1: Early testing of new resistant selections.**

This work package is terminated now after agreement with the board of DARCOF.

### **WP 2: Reducing apple scab infection risk using cultural methods.**

*Cover crop:*

The following cover crops are established in 1994:

1. A permanent grass mixture of *Festuca rubra* and *Poa pratensis*.
2. Clover grass mixture of *Trifolium repens* and *Lolium perenne*.
3. Annual cover crop of *Lolium multiflorum* and *Trifolium resupinatum*, sown every year in July. The soil has been kept black from April to July.

Fruits produced on trees managed with a grass alleyway and thereby a lower nitrogen supply to the trees obtained the best coloration. A lower nitrogen supply, especially during fruit development results in more red fruits. 14 tons fruits from the grass cover crop had more than 75 percent red surface as average for 1999 and 2000; whereas only 8 tons fruits grown in the clover grass or the annual cover crop had more than 75 percent red surface.

The apple scab infection was more numerous on apples grown in the annual cover crop, which gave the largest supply of nitrogen to the trees. This was the case although the level of total nitrogen in the leaves was within the optimum level for fruit production.

The fruits were graded into marketable and discarded fruits on the basis of the severity of the disease and pest damages. Overall the fruits from the permanent cover crops had the highest percentage of marketable fruits. Even though the gross yield was bigger from trees grown in the annual cover crop, the crop of marketable fruits was at the same level for the three alleyway management systems due to different levels of pest attack. In 2001 the amount of marketable fruits was 30 percent higher for apples grown in grass compared to the clover grass and annual cover crop.

The varieties Otava, Prima and Florina produced the biggest yields. Vanda had the biggest fruits.

The resistance to apple scab was broken down in most varieties. The varieties: 'Florina', 'Vanda', 'Retina' and 'Redfree' was less infected by apple scab. Only Florina was still fully resistant.

### **Plans for 2002-2003.**

Write a scientific article about this trial, hopefully for 'Nature'.

Public open day the 5<sup>th</sup> of October 2002.

Some of the trees are used in Darcof: VII.10. Organic food and health.

Some of the trees will in 2003 and 2004 be used in Darcof: VII.5. Control of scab in organic apple growing. Therefore this trial is not removed, but will stay for longer time than expected in the application. We also work on an EU-application where material from these trees might be relevant.

### **Cultural techniques 1 and 2.**

As the cover crop trial shows an increasing infection of diseases with an increasing nitrogen level and a tendency to a lower yield with lower nitrogen the goal is to find the optimum level of nitrogen in the soil and plants in relation to the disease infection.

To investigate this, two new trials have been planted in April 2001. Since the aim is to investigate the apple scab infection in relation to soil treatment the non-resistant varieties 'Discovery' and 'Ingrid Marie' was chosen. They can be infected by apple scab, but are recommended for organic production because they are less susceptible. The trees have been well established in very dense planting systems. Due to problems buying uniform plant material we had to establish one-year-old trees. The optimum would have been two-year-old trees. Therefore it was decided to give the trees one year of optimal growth conditions (drip irrigation and no weed competition) before we established the fertiliser treatments. In spring 2002 the 6 fertiliser treatments were established.

In the variety 'Discovery' all soil treatments are replicated 3 times and combined with 4 rootstocks and three planting densities. Each plot comprise 4 trees, in total 874 trees have been planted. Rootstocks: M9, B9 (early terminal bud development), M26 and MM106 (Late terminal bud development). Planting distances: 0.6m, 0.9 m and 1.2 meter.

In the variety 'Ingrid Marie' all soil treatments are replicated 4 times and combined with 4 rootstocks and three planting densities. Four trees constitute a plot, and in total 1120 trees have been planted. Rootstocks: M9, B9 (early terminal bud development), M26 and MM106 (Late terminal bud development). Planting distances: 0.6m, 0.9 m and 1.2 meter.

The trials are now fully established. The trees grew well 2002 and are now ready for cropping in 2003. We expected a small yield in 2002, but as 2002 was a warm summer with many insects infestation we lost most of the crop to apple saw flies.

### **Plans for 2002 and 2003.**

The 22<sup>nd</sup> of October 2002 I am the organiser of a Nordic seminar with the title: Organic production of fruits and berries.

The 21<sup>st</sup> of November I give a talk at the Danish Organic Congress, about intensive organic apple production.

The 28-29 November I will participate in the organic EUGROF meeting at Frick. I am the chairman of a section.

In 2003 fruit quality will be analysed with focus on the soil treatments and the planting distances on rootstock M9.

To be updated on current research activities on organic fruit production, Hanne Lindhard Pedersen will visit relevant institutions through Europe during summer 2003.

Focus will be on fruit quality and methods used to determine organic quality.

The data collection in the trials generally follows the plan from the application. Some of the trees are in 2003 and 2004 to be used in Darcof: VII.5. Control of scab in organic apple growing.

### Conclusions from report about rootstock effect on shoot termination (D2).

1. If organic growers wish a very vigour rootstock it is recommended to try A2 as it has a very early development of terminal bud.
2. M9 and B9 are potential rootstocks for organic production also because they have early terminal bud development.
3. MM106 has the latest terminal bud development and maybe it should not longer be recommended for organic production.
4. Combinations of varieties and rootstocks are important for the terminal bud development. Combination relevant for organic production has not been tested.

### Plans for 2003.

There are data in the report useable for a scientific article. This is planned to be written in 2003.

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

No.	Work package title	Participants*	Budget (1.000 DKK)	Start	End	Deliverable no(s):
2	Reducing apple scab infection risk using cultural methods.	<u>Hanne Lind-</u> <u>hard Pedersen</u> Marianne Bertelsen	1.350	2000	2004	D1, D2, D3, D4, D5, D6, D7, D8, D9.

Responsible participants are underlined

### Description of work packages from the application:

#### WP2: Reducing apple scab infection risk using improved productivity.

Start date:	September 2000
Responsible person:	HLP
Contributing persons:	MB
Person-months:	Scientist 8, technician 17.

#### Objectives:

2. Reducing apple scab infection risk using cultural methods.

#### Description of work:

Cover crops and soil management is currently investigated in an organic apple trail. The trail consists of the best scab resistant varieties selected in 1993. The effects of cover crops on nitrogen supply, tree growth, fruit quality and infections of pest and diseases are investigated. Cover crops are important as fertilisers in an organic specialised plant production where animal manure is not available. The trees are planted in 1994 and have been cropping for 3 years. Before final conclusions can be made at least another 2 years of cropping are necessary. The work that has been going on for three years is continued 2-3 more years. Keeping this trail running is also important to continuity in the organic apple research and to ensure

that there are apples present in the first years of this project.

Knowledge about shoot termination on different apple rootstocks as well as yield and leaf density differences is important in respect to apple scab infection risk. At the research group for fruit and berries these data are present from former rootstock work but the data has not been processed. This data is going to be analysed and used for following research.

To optimise the organic apple production a new modern orchard is established where the effect of fertilising, rootstocks, planting distances and root pruning on infections of apple scab, yield and fruit quality are investigated.

The production is optimised using the temporary results of the just described cover crop trail. The weak grass mixture of *Festuca rubra* and *Poa pratensis* are sown in the alleyways to delay apple scab infections. Irrigation, high-density plantings and use of sulphur to control the most severe apple scab infections risks will also be used. The apple scab-warning program RIMpro is used to pick the most severe ascospore discharges for control.

As we cannot expect the resistances of the apples scab resistant varieties to keep, we need to employ other culture techniques than resistant varieties to reduce the risk of apple scab. To investigate the effect of culture techniques on apple scab infections we choose non-resistant but less susceptible varieties previously recommended for organic production. This trail is planted in the winter 2000/2001. When the orchard starts cropping the older cover crop trail is cleared.

#### **Method:**

##### Cover crops:

The 10 most promising resistant apple varieties in 1993 were selected and their value in an organic production is being evaluated. The varieties are: 'Delorina', 'Florina', 'Otava', 'Prima', 'Redfree', 'Retina', 'Rewena', 'Saturn' (Sa15/4), 'Vanda', 'X6398'. The yield and fruit quality including the variety susceptibility to other pest and diseases are investigated.

All varieties are planted in 3 different cover crops.

1. A permanent weak grass mixture of *Festuca rubra* and *Poa pratensis*.
2. A permanent mixture of white clover and grass (*Trifolium repens* and *Lolium perenne*).
3. Annual cover crop sown every year in early July (*Lolium multiflorum*, *Trifolium resupinatum*). The soil is kept mechanically clean from April to 1<sup>st</sup> of July.

The soil in the tree row is kept free of weed using mechanical cleaning. No fertiliser is supplied.

Temporary results shows that even though the annual cover crop gives the highest supply of nitrogen, the best growth and a slightly higher yield of well-coloured unblemished fruit is achieved in trees grown in a permanent weak grass cover crop.

##### Cultural techniques 1:

In the organic research area of the Institute, an irrigated apple orchard with alleyways of *Festuca rubra* and *Poa pratensis* will be established.

The early variety 'Discovery' recommended for organic apple production is selected.

Planting distances between the trees in the rows of 0.8, 1.0 and 1,2 meter are combined with the following rootstocks: J9, M26, MM106 in plots of 4 trees repeated 3 times.

All the combinations of rootstocks and planting distances are combined with 6 methods of keeping the tree row clean and fertilise the trees.

Treatments in the tree row:

- 1: Mowed grass in the tree row.
- 2: Mechanical cleaning without manure

- 3: Mechanical cleaning and poultry manure
  - 4: Mechanical cleaning and compost.
  - 5: mechanical cleaning and slurry
  - 6: 20 cm of wheat straw.
- Total tree use: 648.

#### Cultural techniques 2:

The Danish variety 'Ingrid Marie' is recommended for organic production. Root pruning as a method of reducing the tree growth and thereby the risk of apple scab infections are tried in the variety 'Ingrid Marie'. The root pruning is combined with 3 rootstocks, 3 planting densities and 3 treatments in the tree row.

Planting distances between the trees in the rows of 0.8, 1.0 and 1,2 meter are combined with the following rootstocks: M9, J9 and MM106 in pots of 8 trees repeated 3 times. 4 trees in a plot are root pruned prior to full bloom.

All the combinations of rootstocks and planting distances are combined with 3 methods of keeping the tree row clean and fertilise the trees.

Treatments in the tree row:

- 1: Mechanical cleaning without manure
  - 2: Mechanical cleaning and poultry manure
  - 3: mechanical cleaning and slurry
- Total tree use: 648.

#### **The following data are collected:**

Tree growth, leaf samples and soil samples to investigate the nitrogen content and supply. Percentage of water in the upper 50 cm of the soil surface to show the water use of cover crop and the tree supply. Visual control of pests and predators are carried out after flowering to see the effect of cover crops and the insect's populations. Powdery mildew and fruit tree canker is removed and the number of infections per tree is noted. Yield, fruit size, and fruit colour is recorded after grading. Skin damage caused by pest and diseases is evaluated on 25 fruits per tree.

## **B. Objectives and expected achievement**

The overall objective is to reduce the infection risk of apple scab in organic apple orchards using culture techniques.

The expected achievement is to increase the Danish production of high quality organic apples.

#### **The principal objectives are:**

1. To find the best combination of nitrogen supply, use of rootstocks and planting distance to prevent apple scab infections and improved productivity.

WP 2: Reducing apple scab infection risk using cultural methods.

#### **Expected achievement:**

**WP 2:** The effect of cover crops on nitrogen supply and infections of fungal diseases will be investigated.

The organic apple production is optimised by investigating the effect of cultural meth-

ods on tree growth and susceptibility of apple scab. During the project period annual field days will be carried out. Results will be published in relevant agricultural magazines.

### **Project summary (from application)**

For several fruit crops, organic production is extremely difficult because of the high quality demands of the product. In Denmark, only about 5% of the fruit production area are grown organically, and there has been a slight decrease during the last 5 years. The reason for the decrease in the apple area is that the control of apple scab (*Venturia inaequalis*) has been very difficult the last 5 years.

The use of cultural methods to reduce the apple scab infection is stressed in Denmark where the use of organic pesticides is limited compared to other countries in the world.

The overall objective in this project is to reduce the infection risk of apple scab in organic apple orchards using culture techniques. The expected achievement is to increase the Danish production of high quality organic apples.

The objectives are 1. To find new resistant varieties suitable for the Danish climate through a close co-operation with the big breeding program in France. 2. To find the best combination of nitrogen supply, use of rootstocks and planting distance to prevent apple scab infections and improve productivity.

## **C. Midterm results and progress**

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

Organic growers estimated a yield reduction of at least 86 percent compared to conventional production in a questionnaire. The organic growers only expects 14 percent of a conventional yield. The estimation was based on production of the most common conventional grown varieties. The main reason for this low productivity is lack of control measurements against diseases and pests, especially apple scab (*Venturia inaequalis*). In Denmark most organic pesticides are not registered. Copper, for example, has not been on the market for 7 years.

The challenge is to find methods to increase the yield and fruit quality in an unsprayed organic apple orchard.

#### *WP 2: Reducing apple scab infection risk using cultural methods.*

#### **Cover crop:**

The following cover crops are established in 1994:

1. A permanent grass mixture of *Festuca rubra* and *Poa pratensis*.
2. Clover grass mixture of *Trifolium repens* and *Lolium perenne*.
3. Annual cover crop of *Lolium multiflorum* and *Trifolium resupinatum*, sown every year in July. The soil has been kept black from April to July.

Fruits produced on trees managed with a grass alleyway and thereby a lower nitrogen supply to the trees obtained the best coloration. A lower nitrogen supply, especially during fruit development results in more red fruits. 14 tons fruits from the grass cover crop had more than 75 percent red surface as average for 1999 and 2000; whereas only 8 tons fruits grown in the clover grass or the annual cover crop had more than 75 percent red surface.

The apple scab infection was more numerous on apples grown in the annual cover crop, which gave the largest supply of nitrogen to the trees. This was the case although the level of total nitrogen in the leaves was within the optimum level for fruit production.

The fruits were graded into marketable and discarded fruits on the basis of the severity of the disease and pest damages. Overall the fruits from the permanent cover crops had the highest percentage of marketable fruits. Even though the gross yield was bigger from trees grown in the annual cover crop, the crop of marketable fruits was at the same level for the three alleyway management systems due to different levels of pest attack. In 2001 the amount of marketable fruits was 30 percent higher for apples grown in grass compared to the clover grass and annual cover crop.

The varieties Otava, Prima and Florina produced the biggest yields. Vanda had the biggest fruits.

The resistance to apple scab was broken down in most varieties. The varieties: 'Florina', 'Vanda', 'Retina' and 'Redfree' was less infected by apple scab. Only Florina was still fully resistant.

The most common pest that damaging the fruits where different species of tortrix and sawflies. Codling Moth was no problem. Apple scab, fly Speck and Sooty blotch was the most serious diseases. Flyspeck and sooty blotch especially developed the last two years.

### **Conclusion.**

In an unsprayed organic apple orchard the best fruit quality based on fruit colour and the lack of pest and disease damage was obtained in trees grown in an alley way system which gave a nitrogen supply in the lower end of the optimum range.

The varieties: 'Florina', 'Vanda', 'Retina' and 'Redfree' was less infected by apple scab. The resistance to apple scab was broken down in most varieties

### **Plans for 2002-2003.**

Write a scientific article about this trial, hopefully for Nature.

Public open day the 5<sup>th</sup> of October 2002.

Some of the trees are used in Darcof: VII.10. Organic food and health.

Some of the trees will in 2003 and 2004 be used in Darcof: VII.5. Control of scab in organic apple growing. Therefore this trial is not removed, but will stay for longer time than expected in the application. We also work on an EU-application where material from this trees maybe relevant.

### **Cultural techniques 1 and 2.**

As the cover crop trial shows an increasing infection of diseases with an increasing nitrogen level and a tendency to a lower yield with lower nitrogen the goal is to find the optimum level of nitrogen in the soil and plants in relation to the disease infection.

To investigate this, two new trials have been planted in April 2001. Since the aim is to investigate the apple scab infection in relation to soil treatment the non-resistant varieties 'Discovery' and 'Ingrid Marie' was chosen. They can be infected by apple scab, but are recommended for organic production because they are less susceptible. The trees have been well established in very dense planting systems. Due to problems buying uniform plant material we had to establish one-year-old trees. The optimum would have been two-year-old trees. Therefore it was decided to give the trees one year of optimal growth conditions (drip irrigation and no weed competition)

before we establish the fertiliser treatments. In spring 2002 the 6 fertiliser treatments were established.

*Variety: Discovery.*

*Soil treatments in the rows:*

1. Mechanical cleaning, no fertiliser
2. Mechanical cleaning, fertigation with water and biovinasse, product from beer industry (allowed for organic production).
3. Mechanical cleaning, poultry fertiliser (allowed for organic production).
4. Mechanical cleaning, poultry fertiliser and drip watering.
5. Mechanical cleaning, fertigation with water and liquid manure.
6. 20 cm straw from wheat.

In the variety 'Discovery' all soil treatments are replicated 3 times and combined with 4 rootstocks and three planting densities. Each plot comprise 4 trees, in total 874 trees have been planted. Rootstocks: M9, B9 (early terminal bud development), M26 and MM106 (Late terminal bud development). Planting distances: 0.6m, 0.9 m and 1.2 meter.

*Variety: Ingrid Marie.*

*Soil treatments in the rows:*

1. Weed in the tree row.
2. Mechanical cleaning, no fertiliser
3. Mechanical cleaning, poultry fertiliser (allowed for organic production).
4. Mechanical cleaning, poultry fertiliser and watering.
5. Mechanical cleaning, poultry fertiliser, root pruning.
6. Mechanical cleaning, Agrigro (fertiliser allowed for organic growing).

In the variety 'Ingrid Marie' all soil treatments are replicated 4 times and combined with 4 rootstocks and three planting densities. Four trees constitute a plot, and in total 1120 tree have been planted. Rootstocks: M9, B9 (early terminal bud development), M26 and MM106 (Late terminal bud development). Planting distances: 0.6m, 0.9 m and 1.2 meter.

The trails are now fully established. The trees grew well 2002 and are now ready for cropping in 2003. We expected a small yield in 2002, but as 2002 was a warm summer with many insects infestation we lost most of the crop to apple saw flies.

Data collected:

Trunk diameter was collected just before establishment of the treatments. Infections of fruit tree canker and apple scab on leaves late season. Leaf samples from every plot.

### **Conclusion:**

The trails are now fully established. The trees had a fine growth in 2002 and are now ready for cropping in 2003.

### **Plans for 2002 and 2003.**

The 22<sup>nd</sup> of October 2002 I am the organiser of a Nordic seminar with the title: Organic production of fruits and berries.

The 21<sup>st</sup> of November I give a talk at the Danish Organic Congers, about intensive organic apple production.

The 28-29 November I will participate in the organic EUGROF meeting at Frick. I am

the chairman of a section.

In 2003 fruit quality will be analysed with focus on the soil treatments and the planting distances on rootstock M9.

To be updated on current research activities on organic fruit production, Hanne Lindhard Pedersen will visit relevant institutions through Europe during summer 2003. Focus will be on fruit quality and methods used to determine organic quality.

The data collection in the trials generally follows the plan from the application. Some of the trees are in 2003 and 2004 to be used in Darcof: VII.5. Control of scab in organic apple growing.

#### **Conclusions from report about rootstock effect on shoot termination (D1).**

1. If organic growers wish a very vigour rootstock it is recommended to try A2 as it has a very early development of terminal bud.
2. M9 and B9 are potential rootstocks for organic production also because they have early terminal bud development.
3. MM106 has the latest terminal bud development and maybe it should not longer be recommended for organic production.
4. Combinations of varieties and rootstocks are important for the terminal bud development. Combination relevant for organic production has not been tested.

#### **Plans for 2003.**

There is data in the report useable for a scientific article. This is planned to be written in 2003.

## C.2 Fulfilment of deliverables and milestones

<b>WP2</b> <b>Reducing apple scab infection risk using cultural methods.</b>		
<b>Deliverables</b>		
D1. Report about rootstock effect on shoot termination	Apr. 2001	Spring 2002
D2, D5, D6, D7. Annual reports	Sep. 2001, 2002, 2003 and 2004.	
D3. National article cover crop	Mar. 2002	
D4. International article cover crop	April 2002	Autumn 2002
D8. National publication cultural techniques and fruit quality	Dec. 2004	
D9. International publications cultural techniques, effects on yield, external and internal fruit quality	Dec. 2004	
<b>Milestones</b>		
M 1. Planing of new trail	Winter 2000/2001	Spring 2001
M 2. Report on terminal bud development	Spring 2001	Spring 2002
M 3. Data analysing	Winter every year	
M 4. Growers and consultants are informed yearly about the results in annual reports and field days.	Every year in February and September.	
M 5. National article about cover crop effects	Spring 2002	
M 6. International article about cover crop effects	Spring 2002	Authum 2002
M 7. Visiting scientist at FiBL and study tour through Europe.	Summer 2003	
M 8. Planning and execution of fruit quality analyses	Autumn 2003	
M 9. Execution of fruit quality analyses	Autumn 2003	
M 10. National article about cultural practises and fruit quality.	Winter 2004	
M 11. International article about cultural practises, effects on yield, external and internal fruit quality	Winter 2004	

## D. Description of deviations and subsequent adjustments of plans

### WP 1

#### Early testing of new resistant selections.

This work package has been cancelled.

### WP2

#### Reducing apple scab infection risk using cultural methods.

**D1, M2.** The report about rootstock effect on shoot termination has been one year later than expected, due to an overload of work for the project leader in 2001. The report was written in the beginning of 2002 instead. The report is now finished. The delay has no effect on the rest of the project.

There is data in the report suitable for a small international publication. This publication will be written spring 2003.

**D4, M6.** The international article about cover crops is delayed about 6 month. The article will be submitted for publication in the autumn of 2002. The data from the cover crop trial has already been presented at ECO-FRU-VIT. 10<sup>th</sup> International Conference on Cultivation technique and phytopathological problems in Organic Fruit-Growing and Viticulture. Germany February 2002. The talk formed basis for several interesting discussions and caused general interest.

#### **Enlargement of WP2. Special focus on fruit quality.**

In 2003 fruit quality will be analysed with focus on the soil treatments and the planting distances on rootstock M9.

Methods:

Fruit quality measurements will includes the following:

Mineral analyses, Fruit firmness, Sugar, Starch, Colour and Fruit weight.

Fruit maturity will be monitored, and the streif-index calculated in the control treatment in the last three weeks prior to normal harvest and from this the optimal picking time will be decided. At the optimal picking date quality measurements will be performed on 10 fruits per treatment and 3 replication.

To be updated on current research activities on organic fruit production, Hanne Lindhard Pedersen will visit relevant institutions through Europe during summer 2003. Focus will be on fruit quality and methods used to determine organic quality.

## E. Project publications and other products

1. Articles in international, scientific journals with review procedures

B.F. Kühn, T. Toldam Andersen & H. Lindhard Pedersen. 2003. Evaluation of 14 old unsprayed apple varieties. *Biological Agriculture & Horticulture* Volume 20(4), accepted August 2002 and should appear around April/May 2003.

2. Papers presented at congresses, symposiums, etc.

Hanne Lindhard, Maren Korsgaard and Holger Daugaard, October 2000. Organic fruit production in Denmark. Growers Experiences in Denmark. Organic Fruit Opportunities and Challenges. 16-17 October 2000. \*\*

Ole Callesen, Hanne Lindhard and Holger Daugaard, October 2000. Research and development needs for organic fruit production. Organic Fruit Opportunities and Challenges. 16-17 October 2000. \*\*

Lindhard Pedersen H. and Bertelsen M. 2002. Alleyway groundcover management and scab resistant apple varieties. ECO-FRU-VIT. 10<sup>th</sup> International Conference on Cultivation technique and Phytopathological problems in Organic Fruit-Growing and Viticulture. P. 16-21.

### 3. Reports, articles in agricultural journals, etc.

Lindhard Pedersen, H. 2000. Æbler uden kemi, Bidrag til årsberetningen. 2000. DJF, afd. For vegetabiliske fødevarer, forskergruppe for frugt og bær.

Lindhard, H. 2000. Dækkulturer og skurvresistente æblesorter, Forskningsnytt i Norden, august s. 13-16.

Lindhard, H. 2000. Økologisk frugt og bær: Et langt, sejt træk. Leder i Forskningsnytt i Norden. August s.1-2.

Lindhard H. og Marianne Bengtsson. 2000. Genvejen bruges i kampen mod æbleskurv. Frugt og Bær 11/2000, s. 274-275. \*

Kühn, B.F. & Thybo, A., 2000. Sådan smager de skurvresistente æblesorter. Frugt & Bær 29, 242-243. \*\*

*Daugaard, H., K. Thorup-Kristensen, L. Petersen, B. Leonhard, H. Lindhard, M. Korsgaard, B. Rasmussen, J. Solvang, O. B. Hansen og J. Jensen 2001. Vurdering af økologisk produktion i gartneri og frugtavl. Rapport til Kirsten Jensen Udvalget. 103 pp.\**

Kühn, B.F., 2001. Perspektiver for skurvresistente æblesorter. Gartner Tidende 117(31), 12-13.\*

Jørgensen Gitte Hallengreen, Lindhard Pedersen H. og Philipsen H. 2001. Vælg den rigtige type feromonfælde til viklere. Frugt og Bær. 4/2001, s. 88-90. \*

Lindhard H. et. Callesen O. 2001. La production fruitiere biologique en Europe. Le Fruit Belge, s.111-114.\*\*

Lindhard H. 2001. Plant et Frugttræ. Grøn Viden, Havebrug. September 2001. . \*

Lindhard H. 2001. Vurdering af mulighederne for forebyggelse og alternativ bekæmpelse i frugt og bær. Rapport til Kirsten Jensen udvalget.\*

Lindhard H. 2002. Nye æbler på vej. Økologisk Jordbrug.nr. 270. S 6.

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

Cover crops for scab resistant apple varieties. Nordic scientist meeting 28-29 September 2000. The Agricultural university of Norway.

Evaluation of Swedish fruit and berry project for a Swedish organic scientific research programme. October 2000. Skogs- och Jordbrukets Forskningsråd (SJFR). \*

Exhibition of scabresistant apple varieties at the organic congress at Bræstrup. November 2000.

Collaboration meeting among organic scientists in Europe. 29-30. November 2000. Switzerland. Frigg. FIBL. HLP.

Invited speaker to Sweden. Resistant varieties at distrikt Vests årsmøde, 15. January 2001 Helsingborg Sweden.

Control and prevention of apple scab. Talk at organic meeting at Flakkebjerg. Marts 2001.

Education of organic apple growers. Koldkærgaard. 14. marts 2001

Field day for organic growers. 9. August 2001

Field day, for organic and traditional growers. 6. August 2001

Field day for traditional apple growers. 4. September 2001\*

Education of organic apple growers. Lolland June 2002.

Field day for organic and traditional growers may 2002.

40 Visitors from Czech republic especially interested in organic apple production. May 2002 \*

Field day for organic growers, August 2002.\*

EU journalist visiting interested in organic apple production. Sep. 2002.

#### **F. Scientific education**

None

#### **G. National and international cooperation**

##### **National**

**Kirsten Brandt**, Organic food and health – a multigeneration animal experiment. Darcof project no. III.4.

**John Hockenull and Marianne Bengtsson**. Royal Veterinary and Agricultural Uni-

versity, Department of Plant Biology, Frederiksberg C, Denmark). Control of scab in organic apple growing (Stop Scab) Darcof project no. VII.5

**Maren Korsgaard.** Demonstration project for organic fruit and berry production, Industrivej 31 C, 4230 Skælskør, Denmark

### **International co-operation**

**Yves Lesspinasse**, INRA, France. Breeder of apple scab resistant varieties.

**Marc Trapman**, Private, Dutch organic consultant, specialised in development of an advanced apple scab warning system.

## **H. Critical reflection on the project**

### **WP 1**

**Early testing of new resistant selections.**

#### **D1.M1.**

##### **Conclusion:**

Because of delay in the collaboration agreement with INRA and France nursery growers about the rights for selection in the breeding programme, ***this work package is cancelled.***

### **WP 2.**

**Reducing apple scab infection risk using cultural methods.**

This WP is running according to plan. There has been a big outcome and big interest for the trials. The only thing that makes a little trouble is the 6-month delay of a scientific publication. Basic data came out as an article at an international organic conference in February 2002.

The data is so interesting that I will go for an article in Nature.

We tried to get a supporting budget through EU last January but it failed (Crea). We now work on a new application for EU.

The next two years some of the trial will be used in project. Darcof VII. 5: 'Control of scab in organic apple growing (Stop Scab)'.

## 8. Budget

**A. Account for any change in budgets**

**Only budget for WP2 is shown. The new total budget for WP2 is highlighted.**

**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 2002	Expected consumption 2002	2003	2004	2005	Total
Man-months	9	6	8	5½	0	28.5
Scientific personnel	3	2	3	2	0	10
Technical personnel	6	4	5	3½	0	18.5

Year:	Consumption before 2002	Expected consumption 2002	2003	2004	2005	Total
Salaries	262.5	175	245.5	162.5	0	845.5
Scientific personnel	112.5	75	117.5	75	0	380
Technical personnel	150	100	128	87.5	0	465.5
Other operational costs	0	0	40	0	0	40
Equipment	100.8	5	5	5	0	115.8
Others Soil and leaf analyses:	15	20	20	20	0	75
Fruit analyses.	0	0	25	24	0	49
Direct costs	378.3	200	335.5	211.5	0	1.125.3
Indirect costs (20% of direct costs)	75.7	40	67.1	42.3	0	225.1
Total	454	240	402.6	253.8	0	1.350.4

*9. Signatures and stamps*

Name	Institute	Date	Signature
Head of project <b>Seniorscientist, Hanne Lindhard Peder- sen</b>			

