European Network for the durable exploitation of crop protection strategies

IA3 Activity: *Human resource exchange*

ENDURE - Internal Mobility

Final activity report

Topic of the visit
"Resource efficiency in different farming systems as related to different intensity of fertilizer application and pesticide use"

1. Information about researcher and sending partner

Name and surname: Stephan Deike

Professional status: PhD student

Sending partner: Federal Biological Research Centre for Agriculture and Forestry (BBA)

Institute/Department/Research Unit: Institute for Integrated Plant Protection

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2. Information about hosting partners

2.1 Hosting partner: University of Aarhus (AU), Faculty of Agricultural Sciences

Institute/Department/Research Unit: Department of Integrated Pest Management

Address: Forsøgvej 1, DK-4200 Slagelse, Denmark

Supervisor name: Dr. Per Kudsk

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2.2 Hosting partner: Rothamsted Research (RRes)

Institute/Department/Research Unit: Department of Soil Science (SCC)

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3. Information about the visit

3.1 AU, Denmark

Duration: 5 weeks

Start date: 27/08/2007

End date: 28/09/2007

3.2 RRes, UK

Duration: 5 weeks

Start date: 30/10/2007

End date: 30/11/2007

4. Description of the activities and outcomes

Background and context: Nitrogen surplus, efficiency of fossil energy use, and humus replacement are important indicators for the assessment of different farming systems with regard to their sustainability. Information on the long-term effect of pest management strategies on yield, nitrogen balances, and energy use efficiency are scarce, though various husbandry measurements will often cause changes in the population dynamic of weeds and other soil-borne pests not until several years.
Moreover, changes in the soil organic matter content and different steady-state-situations, with consequences for the nitrogen turnover, will take a number of years to develop. So, long-term effects of different management practices on the indicators mentioned have to be taken into account when assessing different strategies of pesticide use.

Objective: The main objectives of both visits were to investigate the impact of different pest management strategies on different indicators of resource efficiency, namely nitrogen balance, energy use efficiency and humus replacement by considering interactions with other management practices, such as crop grown, crop rotation, tillage intensity, or fertilizer application. Furthermore, other important agronomical and phytopathological aspects like yields and pest infestation level should have been taken into account.

Activities carried out:

AU, Denmark:

- Investigation of several one-year field trails with different pesticide use intensity conducted on different experimental sites in Denmark, e.g. different application rates and dressings of fungicides in winter wheat, in regard to nitrogen surpluses by using the balance model REPRO (co-operation with Lise Nistrup-Jørgensen, Head of sub-activity "Case-study Wheat" in RA 1).
- Detailed investigation of the CENTS-Experiment (**C**rop Management and **E**conomics of **N**on-Inversion **T**illage **S**ystems) conducted at the experimental Flakkebjerg for the period from 2003 to 2006. By using the balance model REPRO, yields, nitrogen efficiency, humus replacement, and energy efficiency as related to different intensity of tillage, pesticide use and crop rotation have been investigated (co-operation with Bo Melander, Head of sub-activity "Case-study Integrated Weed Management" in RA 1). It is aimed to assess the potential risk of environmental endangerments caused by the different pesticide treatment applied to the CENTS-Experiment by using the model SYNOPS (co-operation with Jörn Strassemeyer, BBA; also involved in Research Activity RA3).

RRes, UK

- Investigation of the Broadbalk-Experiment with respect to yields, nitrogen efficiency, humus replacement, and energy efficiency as related to fertilizer application, crop rotation, and pesticide use by using the model REPRO for the period from 1997 to 2006. Specific emphasis on interactions between fertilizer and pesticide application, long-term effects of different husbandry and changes of soil humus content caused by different management practices.

5. Links between visit activity and ENDURE

The investigations carried out within both visits can be assigned to the Endure Research Activity RA3: "Multi-sector evaluation of crop protection methods and farming systems". There is a specific link to the sub-activity RA 3.4 "Life Cycle Assessment". Existing methods to assess pesticide risk and environmental impact cannot be readily applied to a Life Cycle Assessment (LCA) approach. So, it has to be investigated if certain indicators used within LCA, such as nitrogen efficiency, energy use, and humus replacement, can be applied for the assessment of different strategies of pesticide use.

6. Impact

Added value for the researcher: The investigation of different long-term experiments with different husbandry conducted on different sites with respect to resource efficiency enables us to arrive at more general conclusions regarding the impact of different strategies of pesticide use as well as their long-term effects.

The results of comparing the different field trials in Denmark and in the UK with other long-term field trials conducted at the experimental site Dahnsdorf, Germany are aimed to be enclosed in the PhD thesis of Stephan Deike.

Added value for sending partner and hosting partner: The investigations of all research institutes are either focussed on phytopathological aspects (AU, BBA) or agronomical and phytopathological aspects (RRes). The investigation of their field experiments in existence with regard to resource efficiency is a fairly new and different way of assessing the different management practices tested. Since environmental effects of agriculture (e.g. nitrate leaching, fossil energy use, and carbon dioxide emissions) are of growing concern, the indicators used for investigating the field experiments (e.g. nitrogen surplus, energy efficiency, and humus replacement) have to be taken into account for an overall assessment of farming systems or different husbandry practices. This is especially true for different strategies of pesticide use.

Date of submission
05/12/2007

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Approved