# Annual report

**for the CORE Organic II funded project**

**“Improve-P”**

**Period covered: 1 January 2015 – 31 December 2015**

| | | | | |
|---|---|---|---|---|
| **Project acronym:** | IMPROVE-P | | | |
| **Title:** | IMproved Phosphorus Resource efficiency in Organic agriculture Via recycling and Enhanced biological mobilization | | | |
| **Coordinator information:** | | | | |
| **Institution:** | Universität Hohenheim | | **Acronym** UHOH | |
| **Faculty/ Department/ Section/Unit** | Faculty of Agricultural Sciences<br>Institute of Crop Science<br>Department Fertilization and Soil Matter Dynamics | | | |
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| Start of Project: | June 01, 2013 | End of project: | May 31, 2016 | |

**Project partners and contact persons:**

| Partner no. | Country | Organisation name: | Functions*): | Involved in WP's: | Contact person with e-mail address: |
|---|---|---|---|---|---|
| **1** | G | Universität Hohenheim | PC | WP 0-4 | kurt.moeller@uni-hohenheim.de |
| **2** | UK | Newcastle University | WPM | WP 0,1,2,4 | julia.cooper@ncl.ac.uk |
| **3** | CH | ETH Zürich | WPCM | WP 0-4 | astrid.oberson@usys.ethz.ch |
| **4** | CH | FiBL Switzerland | WPM | WP 0-4 | paul.maeder@fibl.org |
| **5** | DK | University of Copenhagen | P | WP0,1,2,4 | jma@life.ku.dk |
| **6** | N | Bioforsk, from 1.7.2015 NIBIO, Norwegian Institute of Bioeconomy Research | WPM | 0,1,2,4 | anne-kristin.loes@norsok.no |
| **7** | A | FiBL Austria | WPCM | 0,(1),2,4 | stefan.hoertenhuber@fibl.org |
| | A | University of Natural Resources and Life Sciences Vienna | WPCM | 1,2,3, | juergen.friedel@boku.ac.at |

***)** PC: Project coordinator, WPM: Work package manager, WPCM: Work package co-manager, P: Participant

**Projects website:**
https://improve-p.uni-hohenheim.de/

## Index

Project summaries, pre- and post/mid-project



**Annual project summary**

(max. 1 page. - Arial, size 11) (Please sum-up the activities in the project in 2015 without results and conclusions)

The main activities of the coordinator in 2015 are focused in checking and moderating the progress to achieve the promised deliverables and to ensure data exchange between partners to perform risk analyses and life cycle assessments. Further activities include the motivation of partners to prepare scientific publications and the preparation of factsheets as a dissemination instrument for more advanced readers in the farmers' advisory systems and policy makers. Two factsheets has been published, and two are in a very advanced status shortly before publication.

In WP1, the activities were focused on compiling the newest literature and exchange of unpublished data on the P status in European organic farming, in order to be able to compile the data in the last months of the project. The final aim is to prepare an overview providing an advanced analysis of the current P status in organic farming including input-output balances and soil P status.

In WP2, the field and pot experiments were performed as expected in all participating countries, and most of them were finished in 2015. Currently some laboratory data are still missing for a final evaluation of the obtained results. It is expected that we will get the data within the next few weeks, with the aim to finish all evaluations until spring 2016. Part of the tasks in WP2 are the evaluation of the risks related to the use of alternative P fertilizers (risk assessment) as well as the expected environmental performance (by life cycle assessment). These tasks are on very advanced status.

In WP3 all expected experiments were carried out as expected. Currently we miss, similarly as in WP2, some laboratory data for a final evaluation of the results.
In WP4, several stakeholder meetings were carried out in different countries (Switzerland, Germany, and Denmark), the last two stakeholder meetings were carried out in January 2016 (in Germany and in Austria). The stakeholder meetings include the use of a questionnaire to assess the stakeholder perception on alternative P fertilizer. Evaluation of the questionnaire responses will be carried out within the next few weeks.

Within the frame of WP4, six stakeholder meetings were carried out in the participating countries, including three in Germany, one in Switzerland, and one in Norway and the last one in Denmark. The last two stakeholder meetings were carried out end of January 2016 in Austria and Germany. The obtained questionnaires are now evaluated, we expect to be able to finish the evaluation timely before the final project meeting.

## 1. Fulfilment of objectives

To what extend did the project achieve its objectives?
*Note: this should explain if the project achieved its objectives and if not, what was not performed, why, what happened, etc.* (max 1/2 page – Arial size 11)

In the project proposal we stated that "The overall aim of this project is to develop and evaluate sustainable strategies for increased recycling of P and other nutrients from APF, combined with the development of measures to enhance plant P availability due to agronomic innovations (cover cropping, band application of APF, P efficient cultivars). Moreover, the challenge of soil P mobilization will be addressed by application of PGPRs applied in combination with APF to legume and non-legume crops. Using various field, pot and growth chamber experiments in combination with isotope markers, we propose a functional biology approach, focusing on understanding the roles and interactions among the numerous soil processes contributing to soil nutrient cycling, soil fertility, crop health, and productivity. Furthermore, environmental burdens related to APF production and appropriate management of the risk of soil and plant pollution is a major challenge when introducing APF in OF systems, and the development of appropriate assessment tools to define high quality APF will therefore be a major target."

We expected to achieve all the objectives as promised, or even a little bit more.

## 2. Milestones and deliverables status

### Milestones:

| No[1] | Milestone name | Planned delivery month[2] | Actual delivery month[2] | Means of verification |
|---|---|---|---|---|
| M0.1 | Organization of kick-off meeting (in month 3) | 2 | 0 | minutes |
| M0.2 | Draft list and protocol of methods | 3 | 1 | document based on Biofector-project |
| M0.3 | Organization of kick off meeting (in month 3) | 3 | 1 | minutes |
| M0.4 | Organization of interim meeting (in month 16) | 13 | - | minutes |
| M0.5 | Organization of final project meeting (in month 34) | 33 | - | minutes |
| M1.1 | Data collected from peer-reviewed literature, "grey literature" and other | 12 | | Data compiled in UNEW data base |
| M2.1 | Identification of the mineral and alternative P fertilizer for assessment of P bioavailability in pot experiments | 3 | 3-4 | minutes |
| M2.2 | Methods to determine P availability and P forms defined | 3 | 8 | minutes |
| M2.3 | Chemical properties of P sources determined | 12 | 24 | data sheets |
| M2.4 | P use efficiency in pot studies assessed across a range of soils | 18 | 24 | report |
| M2.5 | P use efficiency in field experiments assessed across a range of pedo-climatic conditions | 33 | | report |

[1] Please use the numbering convention <WP number>.<number of milestone/deliverable within that WP>. For example, deliverable 4.2 would be the second deliverable from work package 4.
[2] Measured in months from the project start date (month 1).

| | | | | |
|---|---|---|---|---|
| M3.1 | Determination of PGPRs for use in field and pot experiments | 4 | 4 | minutes |
| M3.2 | Identification of P-use efficient varieties of potatoes for use in Danish and UK field trials | 6 | 6 | minutes |
| M3.3 | Identification of spring wheat cultivars with efficient root systems for use in Danish and UK field trials | 6 | 19 | minutes |
| M3.4 | Identification of cover crops and APF for use in green manuring field experiment | 16 | Finished | Minutes based on literature review and experiments |
| M3.5 | Effect of PGPRs on P use efficiency determined | 30 | Advan-ced | Data sheets |
| M3.6 | P use efficiency by different crops determined | 30 | Advan-ced | Data sheets |
| M4.1 | Preparation of workshop power-point presentations completed | 14 | Through-out the project | Completed |
| M4.2 | All national stakeholder workshops completed | 28 | 32 | Workshops nearl completed in all countries |

**Deliverables:**

| No[1] | Deliverable name and language | Nature[3] | Dissemination level[4] and link to the document | Planned delivery month[2] | Actual delivery month[2] |
|---|---|---|---|---|---|
| D0.1 | Draft for a consortium agreement | Contract | INT | 1 | 2 |
| D0.2 | Report on project implementation | Report | INT | 6 | 8 |
| D0.3 | Interim report | Report | INT | 12 | 8 |
| D0.4 | Interim report | Report | INT | 24 | - |
| D0.5 | Final report | Report | PU | 36 | - |
| D0.6 | Public project Webpage established | Report | PU | 3 | 3 |
| D0.7 | List and detailed protocols of methods copiled out of WP2 and WP3 | Protocol | INT | 5 | Biofector protocols used as template |
| D0.8 | Project brochure | Booklet | PU | 6 | 5 |
| D0.9 | 3 articles targeted to consumers/ far-mers/end users in national languages | Articles | PU | 18,35 | 35 |
| D0.10 | Technical guides on use of alternative P sources (translation and adaptation to national needs by partners) | Booklet | PU | 36 | 18, 28, 32, 33, 36 |
| D1.1 | Excel template for compilation of grey literature from partner countries & instructions for use | Excel file/pro-tocol | INT | 2 | 7 |
| D1.2 | Internal report on improving P supply in OF through: recycling, APF, PGPRs & improved cultivars | Report | INT | 12,33 | 14 |
| D1.3 | Interim report | Report | INT | 11 | 8 |
| D1.4 | Updated Internal report on improving P supply in OF through: recycling, APF, PGPRs & improved cultivars | Report | INT | 33 | |
| D1.5 | Final report | Report | PU | 34 | |

[3] Please indicate the nature of the deliverable. For example Report, Paper, Book, Protocol, Prototype, Website, Database, Demonstrator, Meeting, Workshop…

[4] Please indicate the dissemination level using one of the following codes: PU = Public; INT= Internal (Restricted to other project participants); RE = Restricted to a group specified by the consortium; CO = Confidential, only for members of the consortium.

| | | | | | |
|---|---|---|---|---|---|
| D1.6 | At least one manuscript for a peer-reviewed journal | Manuscript | PU (after acceptance) | 33-36 | |
| D2.1 | List and detailed protocols of methods for analyzing P bioavailability of APF | Report | INT | 3 | 2 |
| D2.2 | Report on project implementation | Report | INT | 5 | |
| D2.3 | Interim report | Report | INT | 11,23 | 8 |
| D2.4 | Preliminary results of Task 2.3 and 2.4 for WP4 | Report | INT | 12 | 14 |
| D2.5 | Final report | Report | PU | 34 | |
| D2.6 | At least one manuscript for a peer-reviewed journal | Manuscript | PU (after acceptance) | 36 | |
| D3.1 | List and detailed protocols of methods for testing effects of PGPR and agronomical measures | Report | INT | 3 | 3 |
| D3.2 | Report on project implementation | Report | INT | 5 | 5 |
| D3.3 | Interim report | Report | INT | 11, 23 | 8, 20 |
| D.3.4 | Final report | Report | PU | 34 | |
| D3.5 | At least one manuscript for a peer-reviewed journal | Manuscript | PU (after acceptance) | 36 | ongoing |
| D4.2 | Based on D1.2, preparation of PP presentations in national languages to discuss relevant APF for use in OF | Power point files | INT | 12 | 15 |
| D4.3 | Interim report | Report | INT | 12 | 8 |
| D4.4 | Report to summarize the output of the discussions with concluding statements about relevant P sources | Report | PU | 34 | |
| D4.5 | Final report | Report | PU | 34 | |

**Additional comments (in case of major changes or deviation from the original list)**
There have been only very minor deviations from the original plan (factsheets), as stated in the last year report.

## 3. Work package activities, changes and deviations:

| **WP 0** | **" Coordination and Dissemination "** |
|---|---|
| **Responsible partner: Partner no 1, UHOH, Kurt Möller** | |
| **Report on activities, changes to the original plan/WP aims and comments on deviations:**<br>(max 1 page, Arial, size 11)<br>The main activities of the coordinator in 2015 are focused in checking and moderating the progress to achieve the promised deliverables and to ensure data exchange between partners to perform risk analyses and life cycle assessments. Further activities include the motivation of partners to prepare scientific publications and the preparation of factsheets as a dissemination instrument for more advanced readers in the farmers' advisory systems and policy makers. Two factsheets has been published, and two are in a very advanced status shortly before publication. | |

| **WP 1** | **Compilation of existing knowledge and synthesis** |
|---|---|
| **Responsible partner: partner no 2, UNEW, Julia Cooper** | |
| **Report on activities, changes to the original plan/WP aims and comments on deviations:** | |

**A – results obtained:**
Partners within WP1 have continued to provide editorial and technical input into the factsheets being prepared in Task 0.2. Data on the P status of organic farms in Europe continues to be collected. The focus of this work is on studies surveying real farms reporting measures of soil P availability (e.g. Olsen's, Double lactate, Bray's extractants). Data is being accessed from both published sources and "grey" literature that includes MSc theses. A spreadsheet for data extraction has been prepared and is being populated with figures from the published and unpublished literature. The data extraction step should be complete by the end of M33. Analysis of data and preparation of a draft manuscript will take place in M34-35. Nutrient Cycling in Agroecosystems has been identified as the target journal.
**B – Comments on deviations from the original plan:**
There have been some delays in the completion of the study on P status of organic farms; but this is now on track for completion by the end of the project. A final article for the popular farming press in the UK magazine Organic Farming is also planned to summarize the findings of the IMPROVE-P project on strategies to improve P efficiency in organic systems.

| **WP 2** | **Evaluation of efficacy and potential environmental impacts of alternative P fertilizers** |
|---|---|

**Responsible partner: partner no 1, UHOH, Kurt Möller**

**Report on activities, changes to the original plan/WP aims and comments on deviations:**
(max 1 page, Arial, size 11)

**A- results obtained:**
The pot and field experiments projected for UHOH, ETHZ, FiBL and BOKU have been carried out as planned for 2015. Experiments were finished, we still need some data for the final evaluation.

During 2015, Bioforsk (Dr. Bente Føreid) has completed a pot experiment comparing different P fertilisers with barley as a test crop. 7 organic residues were compared with triple super phosphate (TSP) and rock phosphate (RP). Barley was grown with optimal fertilization of all nutrients except P in a sand/peat mixture, at pH (H2O) 5.3 and 6.8. P availability was assessed by diffusive gradient in thin films (DGT) and plant uptake. Anaerobically digested liquid manure gave similar plant growth as TSP. Wood ash, fish sludge, composted solid manure and composted food waste produced 65-79% of plant material compared with TSP. Meat and bone meal (MBM), the commercially available product "Ladybug" (containing mainly MBM) and RP produced 30-35% of plant material compared with TSP, which was similar to no P (32% of plant material with TSP). Soil pH did not affect P availability. DGT predicted P availability moderately well. Most treatments had little residual available P assessed by DGT, but wood ash was an exception. The results indicate that that some organic residues can supply the crop with sufficient P without leading to P accumulation. The commercially available P source performed poorly.

In Task 2.3 and 2.4, the calculations regarding the LCA evaluation and the risk assessment for the different APF´s were carried out, the work is nearly finished. The preparation of final reports/publications is in a very advanced status (see attached documents).

**B- comments on deviations from the original plan:**
No new deviations from the original plan.

| **WP 3** | **Improved P mobilization by adapted agronomic strategies and addition of P mobilizing Plant Growth Promoting Rhizobacteria** |
|---|---|

**Responsible partner: partner no 4, FiBL CH, Paul Mäder**

**Report on activities, changes to the original plan/WP aims and comments on deviations:**

**Task 3-1: Experiments with spring wheat cultivars with contrasting root traits, and potato cultivars with contrasting efficiency traits (UCPH, UNEW)**
UCPH has finalized measurements of nutrient content in plant materials harvested in 2014, and analysed the data. A manuscript[a] describing the field trials with spring wheat cultivars in 2013 and 2014 has been prepared, and is currently circulated between authors for finishing

touches. Data on the potato field trial has been sent to UNEW, and will be part of a publication in ICROFS electronic news, made ready for publication early next year, with UNEW being lead authors.
[a]Wang Y, Magid J, Thorup-Kristensen K and Jensen LS Genotypic differences in growth, yield and nutrient accumulation of spring wheat varieties in response to varied soil fertility regimes, (to be submitted in February 2016)

**Task 3-2: Cover-crops for P mobilization (BOKU, ETHZ)**
At BOKU the second pot experiment is ongoing. In July 2015 the first main crop of this pot trial, winter wheat, was harvested. Plant parameter like biomass, plant number, infertile shoots, ears, infertile and fertile spiklets, grain number and weight per pot and the P-content in straw and grain were analysed. Soil samples from the beginning of the winter wheat growing season were analysed on Pcal-content. Cover crops (buckwheat, phacelia, red clover) have been sown into the pots end of July. They were grown outside in a wire shelter until their harvest end of September. Biomass parameter and P-content were analysed. Soil samples were taken after harvest. The pots were moved to the greenhouse and corn was planted at the beginning of November. It will be grown until end of March and subsequently analysed. The remaining analysis (C/N ratio, soil samples) will be continued in January.
Also P-content measurements of maize from the first pot experiment were finalized in 2015.

ETHZ will conduct a pot experiment with buckwheat (Fagopyrum esculentum) and lucerne (Medicago sativa) in early 2016 in order to test P use efficiency of APF in calcareous soil, e.g., thermos-chemical treated sewage sludge ash (MgSSA) and digestate.

**Task 3-3: Influence of Plant Growth Promoting Rhizobacteria on plant P availability in pot/greenhouse experiments using radioisotope labelling (ETHZ, FiBL-CH, UHOH)**
ETHZ has completed a plant growth and an incubation experiment in 2015 in which the effect of a plant growth promoting bacteria (PGPR) on gross phosphorus (P) fluxes in a microbial active calcareous soil by $^{33}P$ isotopic dilution was studied.
It was hypothesized that the inoculant dilutes the specific activity (SA, $^{33}P/^{31}P$) in the plant shoots or in the soil solution because of P solubilization beyond the P mobilization by the inherent microbial population. To this end, a plant growth experiment with *Lolium multiflorum* under controlled conditions and an incubation experiment were conducted. In the two experiments soil was amended with or without a calcium P rich sewage sludge ash (SSA) and with or without a PGPR strain. In the plant growth study P taken up and $^{33}P$ recovered in shoots of *Lolium multiflorum* at three harvests and root colonization by the PGPR after the last harvest was measured. In the incubation experiment the involvement of sequentially extracted soil P pools in P dynamics was as well studied.. Survival rate of the PGPR in soil was measured after 40 days and at the end of the incubation period, i.e., after 70 days. In addition, soil respiration rates and P solubilizing potential of the PGPR in liquid P solubilisation assays were assessed.

At UHOH no work was conducted with radioisotope labelling. Also no further PGPRs were tested in pot experiments in 2015. Evaluation of previous pot experiments had been finalized. The field experiment was repeated in 2015. Pseudomonas (Proradix) was applied twice in some treatments after germination of maize. Maize was harvested in August 2015 and soil samples were taken. Evaluations will be done beginning of 2016.

**Task 3-4: Plant Growth Promoting Rhizobacteria tested in combination with alternative P fertilizers in field experiments (FiBL-CH, ETHZ, UHOH)**
FiBL/ETHZ: All analysis of red clover and maize field trials conducted in 2014 were finalized beginning 2015. Due to a lack of differences in the red clover trial, it was decided not to repeat the field trial in 2015. Instead, two trials with maize were conducted: (i) a repetition of the 2014 trial with the same experimental design: 2 fertilizer treatments (No phosphorus, compost) x 3 BE (Bioeffectors) treatments (no BE, Proradix (Pseudomonas sp.), Rhizo Vital (Bacillus

amyloliquefaciens)) with four replications; and (ii) a newly designed trial with the following design: 2 fertilizer treatments (No phosphorus, composted chicken manure pellets=pellets) x 3 BE treatments (no BE, Proradix and Nematec (extract of Laminaria species)) with four replications. The experimental design of the second field trial was based on results of a previously conducted pot experiment were a set of alternative organic fertilizers in combination with BEs in two soils with contrasting pH (neutral, alkaline) were tested: 6 fertilizer treatments (No Phosphorus, Rock phosphate, digestate, compost, farmyard manure, pellets) x 3 BE treatments (no BE, Proradix and Combifect (Bacillus licheniformis, B. megaterium, B. pumilis, B. subtilis, Paenibacillus polymyxa, Trichoderma harzianum) x 2 soil-specific additive treatments (no additive, Nematec (neutral soil) or humic acids (from composted artichokes, alkaline soil) with four replications. Additionally, a treatment with Triplesuperphosphate x BE0 was introduced to check the potential of maize growth in the respective soils. The experiment was conducted in 1 L pots and grown for 4 weeks in the climate chamber. Especially the treatment with Proradix and Nematec in combination with pellets resulted in improved growth of maize plants compared to the non-inoculated and TSP control leading to the choice of treatments for the second field trial. In the frame of a MSc thesis, the same set up was tested in a pot experiment using 3 L pots and a growth period of 8 weeks. Furthermore, a BSc student has assessed the impact of BEs on cold stress tolerance of maize in a set of climate chamber experiments. A manuscript on maize pot experiments with compost, digestates and RP and different BEs is in progress.

At UHOH, the PGPR Pseudomonas was tested in combination with 4 APF treatments: sewage sludge ash, compost, rock phosphate and unfertilized. Plant samples of the first year were evaluated for P-uptake. Plant and soil samples of the second year are ongoing.

UCPH will soon submit a manuscript to Chemical and Biological Technologies in Agriculture before the end of December 2015: Sánchez-Esteva S, Gómez-Muñoz B, Jensen LS, de Neergaard A and Magid J*. Penicillium bilaii* effects on wheat growth and phosphorus uptake from acidic and calcareous soil amended with sewage sludge.

| **WP 4** | **Discussions with stakeholder about APF applicability, mainly by workshops in each of the participating countries** |
|---|---|
| **Responsible partner: partner no 6, Bioforsk, Anne-Kristin Løes** | |
| **Report on activities, changes to the original plan/WP aims and comments on deviations:**<br>**A- results obtained:**<br>Workshops in Germany, Switzerland, Denmark and Norway were conducted during 2015, with 20-30 respondents filling in the Improve –P questionnaire. In January 2016, a workshop will be conducted in Austria, and questionnaires will be brought to one more national event in Germany to attract the interest of some more German stakeholders to fill in the questionnaire (q). Results from the qs were compiled in an Excel sheet for further analyses, and will be compiled into a report plus papers in relevant national magazines during the spring of 2016.<br><br>**B- comments on deviations from the original plan:**<br>The program for each national workshop had to be adapted to the frame conditions in each case. E.g., the time frame for the workshops ranged from 60 minutes (Biofach Germany) to one whole day seminar (Switzerland). In all workshops, Anne-Kristin Løes and/or Kurt Möller participated, plus at least one WP leader or other project colleague. After presentation of project results, participants were involved in discussions before filling in the same questionnaire in each country (translated to the national language; in Switzerland German). | |

## 4. Publications and dissemination activities

### 4.1 List extracted from Organic Eprints

(Publications affiliated to European Union > CORE Organic II > “project acronym”, grouped by EPrint type, with date of extraction)

*The list can have these headers:*

***http://orgprints.org/view/type/***

*publications that are not allowed as open access should be deposited as “Visible to: Depositor and staff only.”. The funding bodies and project evaluators will be granted access to these during the evaluation. Guidance on the use of Organic Eprints can be found here: http://orgprints.org/help/ .*

Alföldi, T. (2014): YouTube Video: Improve-P: Re-Use the phosphorus! - Workshop in Istanbul (Oct 2014). Research Institute of Organic Agriculture (FiBL), Frick.

Cooper, J. (2014): The need to recycle societal P in organic farming systems.

Friedel, J.K., M. Kasper, H. Schmid, K.J. Hülsbergen, B. Freyer (2014): Need for phosphorus input in Austrian organic farming? [Ist eine Phosphorzufuhr auf ökologisch wirtschaftenden österreichischen Betrieben erforderlich?] In: Rahmann, G. und Aksoy, U. (Hrsg.) Building Organic Bridges, Johann Heinrich von Thünen-Institut, Braunschweig, Germany, 1, Thuenen Report, Nr. 20, 37-40.

Løes, A.-K., J. Cooper, K. Gascoyne (2015): Facing up to the Phosphorus Challenge. Organic Farming magazine of Soil Association, UK, September 2015, 36-37.

Magid, J. (2013) A note on sewage sludge - risk assessments and fertilization value. IMPROVE-P working paper, Nr. 1, Plant and Environmental Sciences, Copenhagen University.

Möller, K. (2013) Improving the phosphorus efficiency of organic farming systems. CORE Organic newsletter, October 2013, pp. 2-3.

Möller, K. (2015) Assessment of Alternative Phosphorus Fertilizers for Organic Farming: Meat and Bone Meal. Fact Sheet. Universität Hohenheim, ETH Zürich, FiBL, Bioforsk, Universität für Bodenkultur Wien, Newcastle University, University of Copenhagen.

Wollmann, I., K. Möller (2015) Assessment of Alternative Phosphorus Fertilizers for Organic Farming: Sewage Precipitation Products. Dossier/Fact sheet, Nr. First edition. Universität Hohenheim, ETH Zürich, Research Institute of Organic Agriculture (FiBL), Bioforsk, BOKU, Newcastle University, University of Copenhagen.

Wollmann, I., K. Möller, (2015) Recycling Phosphor Düngemittel für den Ökologischen Landbau. Vortrag at: 13. Wissenschaftstagung Ökologischer Landbau, Hochschule für nachhaltige Entwicklung Eberswalde, 17. - 20. March 2015.

### 4.2 Additional dissemination activities in 2015

(List dissemination activities that are not uploaded to Organic Eprints)

We carried out six stakeholder meetings in 2015 providing the participants with a lot of information’s and provisional outcomes of the project.