PURE
Pesticide Use-and-risk Reduction in European farming systems with Integrated Pest Management

Grant agreement number: FP7-265865

Collaborative Project
SEVENTH FRAMEWORK PROGRAMME

D13.1
Evaluation of the first year of the co-innovation approach in the pilots

Due date of deliverable: M 28
Actual submission date: M31
Start date of the project: March 1st, 2011 Duration: 48 months
Workpackage concerned: WP13
Concerned workpackage leader: Pieter De Wolf
Organisation name of lead contractor: WUR

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<th>Project co-funded by the European Commission within the Seventh Framework Programme (2007 - 2013)</th>
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1. Summary

Workpackage 13 (WP13), ‘Co-innovation of IPM’, develops, implements and evaluates an overarching co-innovation methodology which combines innovation systems analysis and learning to reduce the dependence of European farming systems on pesticides. WP13 facilitates and tests how formal knowledge can be combined with farmer knowledge to arrive at effective new methods of pest management for selected crops on selected farms. WP13 focuses on four pilots in four different countries: Denmark, France, Germany and The Netherlands.

The objective of this deliverable (D13.1) is to evaluate the first year of the co-innovation approach in the pilots. It describes the progress in the four pilots and the WP until approximately June 2013. It therefore provides a snapshot of the evolution of the pilots and the group of researchers-advisors in the WP. The WP13 community consists of 2-3 core members of each pilot, and a 3 person team that oversees and organizes activities at the WP level. The pilots are embedded in an overarching joint learning activity at WP13 level. This revolves around (bi-)annual meetings and bi-annual video conferencing. The meetings serve to exchange concepts and tools, initially in a training format, in which the pilots provide the empirical material. The video-conferences have a strong coaching component and serve to transfer experiences among case studies.

A scientific approach is adopted to monitor and evaluate WP13 activities and outcomes, to increase likelihood of generalization of findings. Both WP13 and each pilot are conceptualized as a Complex Adaptive System and evaluated using a Boundary Work perspective.

From the start, the Danish team made their participating farmers responsible for the innovation process, resulting in farmers taking the initiative in defining the research agenda. The team managed to combine their IPM agenda with the farmers’ agenda and the pilot is engaged in innovative experimentation.

The French team started with a clear agenda, involving the dissemination of a specific IPM concept (‘hardy wheat management’). The team changed its approach in 2012: deployment of a structured farmer-centred participatory approach (co-design), which combines brainstorming with peer review, turned out to be highly successful.

The German team started in 2012 with on-station experimentation and planned the on-farm experimentation for 2013. During the first meeting with cabbage growers, the team organized a workshop on ‘dreams and nightmares’ for future crop protection. Starting from the farmers’ perspective was key for commitment: it created insight in the farmers’ context for research and it established commitment of the farmers.

Finally, the Dutch team started the first stakeholder meeting with the broad scope of ‘how to grow Brussels sprouts in 2020’. Despite animated discussion the step to on-farm experimentation did not meet with enthusiasm among growers. A closer investigation of the reasons for the lack of progress despite thorough preparation of the team is warranted.

All pilot teams translated the co-innovation approach and tools to concrete activities. They all show they work from a co-innovation perspective, some from the start, others switching during the process. The WP13 approaches and tools seem to support the pilot teams in their new role of process facilitators. Widening the perspective from ‘which solution are we going to test on your farm’ to ‘what are the future challenges’ is the most obvious co-innovation feature in all pilots.
2. Objectives and structure

Objectives of WP 13 are to:

1. Develop a generic approach for co-innovation of IPM technology and methods by farmers, advisors, local policy makers and scientists, which includes monitoring capabilities, progress indicators and stakeholder management;
2. Use the approach to guide and evaluate the co-innovation process in 4 pilots in 2 different cropping systems and in 4 countries;
3. Evaluate the approach by comparison across pilots and by demonstrating efficiencies and trade-offs;
4. Demonstrate the applicability of the approach for the development and implementation of IPM methods in PURE farming systems.

This deliverable describes the co-innovation approach in WP13 and its conceptual background, provides an overview of activities within the 4 pilots and gives a reflection on the progress within these pilots from a WP13 perspective. The description of the co-innovation approach in WP13 and its conceptual background, training and coaching (section 3) is written by the WP13 moderator team (DLO and WU). The overview of activities and lessons learned by the pilot teams (section 4) are written by the pilot teams themselves: AU for the Danish pilot, INRA for the French pilot, JKL for the German pilot and DLO for the Dutch pilot. Finally, the reflection on the progress within the pilots (section 5) is again written by the moderator team.
3. The co-innovation approach in WP13

Why co-innovation?

Innovation, in the sense of ‘improved practices’, is often not reached through research programmes, except when research results are evidently beneficial for the user group. This also holds for the IPM innovations that PURE propagates. The incentive for change, coming from the EU’s Sustainable Use Directive policy aimed at implementing IPM in all of Europe, is external to the farmers, the technology requires local adaptations and is not fail-safe, and often markets do not compensate the extra costs involved. Under such conditions ‘rolling out’ the technology is not an option. Technological solutions developed for farmers in research programs need to be re-built on-farm, and relevant actors in the innovation system around farmers need to be involved to create a setting where an external threat is turned into an opportunity.

To develop IPM solutions that are a serious alternative to pesticides, research should try to understand the interests and conditions of the user. This is the starting point of co-innovation: a better (systematic) understanding of the ‘innovation context’ of the farmer. This innovation context differs greatly across the farmer population, depending on crop types, links to markets and production orientation. In low-value crops (e.g. wheat and other bulk crops), farmers will perceive potential yield reduction differently than in high-value crops (like potatoes and vegetables). Customer demands also play a role: leaf damage, caused by diseases or insects, will be a serious quality problem for fresh vegetables (lettuce, cabbage), but will be no problem for the quality of root crops (potatoes, sugar beets). Another difference is related to production orientation and associated regulations: if no pesticides are allowed (organic, some low acreage crops), farmers will be motivated to engage in the development of solutions that can reduce crop damage.

The social context also plays a role, think about the role of advisors and colleague farmers. Especially advisors can be very ‘conservative’ (risk-averse) because if their advice results in quality/yield loss, this may mean loss of confidence or even financial claims by the farmer. For this reason, the role of advisors, suppliers and customers is taken very seriously as a possible barrier for change in e.g. Dutch crop protection projects, but also as a powerful incentive for farmers. This is another key element of co-innovation: involve all relevant stakeholders in the innovation process.

Finally, it would be a mistake to reduce IPM to a set of scientifically validated tools and approaches. IPM is a management approach for a farmer, selecting the right tools and approaches to keep his crop healthy in a cost-effective way, with lowest possible environmental and health risks. The co-innovation approach is very suitable for IPM, because it does not just offer new tools and approaches, but it includes also the management part by involving the farmer from the very beginning of the innovation process. Here, traditional ‘hard’ systems approaches are linked to ‘soft’ systems approaches to better analyse and engage in innovation processes with scientific knowledge. As this document will show, all pilots started with a joint identification of future challenges for the farmer that (s)he is willing to invest time in. This required learning about other actor’s viewpoints and positions, and adjusting the own. Where successful, the result was a joint learning trajectory on tools and approaches to cope with the challenges identified. These considerations lead to a double objective in PURE’s WP13: (1) to apply a co-innovation approach in 4 pilots; and (2) to develop the co-innovation approach by joint learning across the pilots. The first objective is
addressed by local scientist/advisor innovation teams in the pilots in Denmark, France, Germany and The Netherlands. The second objective is addressed by the WP13 moderator team from DLO and WU that facilitates training, coaching and joint learning across the local innovation teams. Monitoring and evaluation is used to provide feedback to the teams and to generalize experiences through scientific analysis.

**Conceptual background to co-innovation**

Co-innovation as developed in WP13 is an approach to managing heterogeneous knowledge (i.e. scientific and informal, abstract and concrete, theoretical and experiential, etc.) in innovation projects. It gleans elements from two project management concepts: Complex Adaptive Systems (Douthwaite and Gummert, 2010) and Boundary Work (Clark et al., 2011). A Complex Adaptive System (CAS) consists of agents, entities which can make things happen, along with the artefacts (e.g., things, technologies, databases, etc.) and strategies (including norms) that agents use in their interactions with other agents and with artefacts. Evaluation of the results of these interactions leads to the selection of strategies or artefacts to copy or recombine, or to the invention of new ones. This evolutionary process introduces novelty. Learning Selection has been proposed as a process by which the generated variation is evaluated and included in practices. The CAS perspective on projects suggests that project design and management should (i) foster variation in agents, artefacts, strategies, (ii) stimulate variation in interaction patterns to provide relevant novelties for Learning Selection, and (iii) support the selection process to assess fitness of novelties, and to better allow survival and spread of the selection result. It has been argued that this requires ‘adaptive innovation management’ (Klerkx et al., 2010), in which there is continuous reflection on intermediate achievements and results in innovation projects, and next steps to take. Science can assist in innovation projects by spanning boundaries between societal communities through generating science-based future options, assisting in selecting options by showing trade-offs between options, and enhancing the legitimacy of innovating actors by verifying their claims. However, for science to become useful, often a boundary between science and the audiences it could serve (policy actors, economic actors) has to be bridged (McNie, 2007). Analysis of the effectiveness of boundary work uses three attributes (Clark et al., 2011): (1) participation: the degree to which different communities along the boundaries have been involved in agenda setting and knowledge generation; (2) legitimacy: the perception that the production of information and technology has been respectful of stakeholders’ divergent values and beliefs; (3) production of boundary objects, described as collaborative concrete or abstract products such as reports, models, maps, or standards that “are both adaptable to different viewpoints and robust enough to maintain identity across them”.

The concepts of CAS and Boundary Work provide the analytical framework as well as guide the work in WP13. Thus, rather than using them only in an **ex-post** fashion, the concepts also help to shape activities and interventions.

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1 Text based on Rossing et al. (in prep). Designing projects for effective use of scientific knowledge in strategic on-farm innovation: evaluation of the co-innovation approach in EULACIAS.


Co-innovation approach

The co-innovation workpackage of PURE provides concepts, tools, training and joint learning opportunities to researchers/advisors who are responsible for an IPM innovation pilot project in their country. Concepts and tools come from previous experiences of the DLO and WU moderator team and constitute and evolve ‘state-of-art’. Co-innovation is seen as a ‘boundary object’ that is under development through the engagement in the PURE project.

During the construction of the PURE project, four teams volunteered to participate in WP13. The teams come from the Wheat workpackage (Denmark and France) and from the Vegetables workpackage (Germany and The Netherlands). The WP moderators asked for teams that would consist of a project leader and a monitor, a person who would be able to monitor and evaluate project events with a certain distance in support of the project leader. In reality the strict distinction in roles was not achieved and the two or three persons per team take different roles at different times. However, project leaders are always represented.

Joint learning is facilitated through project meetings that are physically attended by all teams and by 6-monthly video-conferences between the moderator team and each of the pilot teams individually. During the first 18 months of the project, three project meetings and four sets of video-conferences took place. The first two project meetings had a training emphasis and aimed to transfer knowledge on participatory processes and innovation project management from the moderators to the pilot teams using the individual pilots as input for the exercises. While training was also a component of the third meeting, the venue in one of the pilots (Denmark) and the increasing experience with the use of the concepts and tools by the pilot teams, allowed an increasing input from the teams. The emphasis was then on re-using planning and evaluation tools to map pilot progress and enable peer review.

Materials for the training component of the meetings evolved from ‘off the shelf’ modules that the moderator team considered to be essential to innovation project management, to customized modules in response to demand by the pilot teams, such as meeting preparation and dealing with animosity in meetings. The training topics are described in the next section. Both the project meetings and the video-conferences served to exchange experiences on project evolution. The format of exchanges is also described in the next session.

It is important to emphasize that, in line with the CAS approach, WP13 therefore does not aim for a pre-packaged and generally applicable co-innovation approach. Rather it aims to collate concepts combined with training and coaching to facilitate people to develop a suitable and effective co-innovation approach for their project.

The implications of these concepts for PURE WP13 are multiple: first of all, the position of a scientific research project like PURE becomes more contextualised. It makes clear that research has an important, but also limited role, and reveals the relevance of other stakeholders in this innovation process. Secondly, the co-innovation approach puts researchers and advisors in a different role: they are facilitating the innovation process of a group of farmers and other stakeholders, instead of running a research or demonstration project. This requires new skills and tools to be effective in this new role. WP13 therefore pays attention to skill development and provides exercises and tools for the pilot teams.

Training and coaching

The WP13 training offers participants theory and tools for the pilots. In the training, participants are working on their pilots, e.g. starting a stakeholder analysis and preparing
activities for the period after the training session. These preparations and the activities themselves give participants experience with co-innovation, which is a basic condition for the learning process.

The training is continued during the four years of PURE, with a higher concentration in the first year. This set-up enables WP13 to offer various co-innovation tools and theories to the participants in time and is also accompanying the development of the pilots. It starts with more analytical tools, then moves to helping people with operationalizing the approach in the pilots and finally brings together all results from the monitoring and evaluation that was started early-on. In the figure, the components addressed during the training are presented.

**Figure 1.** Components of the training provided during the project meetings of WP13, their aim and timing. (Note that the number of components decreases through time, as old components are increasingly being used for monitoring and evaluation of pilot development.)

During the meetings, the learning process is visualised through individual learning flipcharts: at start, all participants write their learning questions for the meeting on a flipchart on the wall of the meeting room. The flipcharts are updated a few times by noting lessons learned and emerging new questions. Results also give input for the next meeting.

Since the start in 2011, the instruction element was gradually taken over by a shared learning process: teams started working on their pilots, gained experience and are more able to help each other. To strengthen this ‘peer review’, since 2012 each meeting was combined with a visit to one of the pilots, started in Denmark. For October 2013 a visit to the French pilot is planned. These visits enable understanding of the agronomical, institutional and cultural differences between the pilots.

As mentioned, 6-monthly video-conferences between the moderator team and each of the pilot teams have been organised since the start of WP13, during which activities, results and experiences, and next steps to take are discussed. Joint learning is facilitated by reflection of the moderator team on these activities and results. Reports of the video-conferences are made for documentation and monitoring and evaluation purposes.
4. The pilots

The pilots are the showcases of WP13: the ambition is to develop and demonstrate co-innovation in practice, using the participants as the ambassadors of co-innovation. For each pilot, an overview of activities is provided, followed by the evaluation of the most important activity (highlight). Each pilot consists of a pilot team, consisting of two (or three in the German pilot) advisors and/or researchers. Each pilot cooperates with a number of pilot farmers who participate in the pilot.

**Denmark**

The Danish pilot is carried out by Marianne Haugaard-Christensen and Jens Erik Jensen from VFL, the Danish Agricultural Advisory service. The pilot is related to the IPM Demonstration Farm network, a network of 7 farms over Denmark. Three of these demonstration farmers are also pilot farmers. The pilot concentrates on wheat-based crop rotations, related to PURE WP2 wheat.

**Activities (timeline)**

<table>
<thead>
<tr>
<th>Date</th>
<th>Activity</th>
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<tbody>
<tr>
<td>22 November 2011</td>
<td>First meeting with all seven Danish IPM demonstration farmers. The PURE project in general and the idea of co-innovation in particular were presented to farmers. Farmers were confused about co-innovation but not discouraged and they agreed to participate.</td>
</tr>
<tr>
<td>20 January 2012</td>
<td>Second meeting, with 3 farmers (those having cereal production as their main crop production), their advisors, Marianne and Jens Erik. A better introduction to the PURE project was given by Jens Erik. Aim of this meeting was to develop an idea which the farmers would be comfortable with. Advisors were allowed to feed ideas into the discussion but not to “shoot down” any new ideas presented. Marianne and Jens Erik were worried that farmers would not be able come up with new ideas as there are so many environmental regulations, and because every aspect of crop production is optimized in the light of these regulations. In the beginning of the meeting, ideas were totally open, and the farmers focused much around the Danish nitrogen quota which they find most crippling to their opportunities to generate an income. Consequently, ideas circled around ways of minimized nitrogen emissions in crop production as a prerequisite for possibly lifting nitrogen quotas. At some point, Jens Erik had to intervene and make clear that the aim was to come up with an idea relating to IPM. After another long run of exchanges, the farmers came up with an idea of producing wheat with high protein content for bread or feed by combining the cultivation at wide row distance, and combine this with the use of cultivar mixtures. The idea was to reduce herbicide use in the wheat crop by allowing for mechanical inter-row hoeing, and at the same time obtain a better protein content, essential for producing wheat with baking quality, and preferable for wheat for feed. The idea of variety mixtures is to reduce the need for growth regulators and particularly fungicides.</td>
</tr>
</tbody>
</table>
Another idea was placement of the main fertilizer (pig slurry at two farms, and hen manure at the third farm) in order to improve nitrogen utilization. Jens Erik worried after the meeting about having too many ideas. Farmers want to get into discussion with coops, breeders and millers about their idea for bread making.

<table>
<thead>
<tr>
<th>Date</th>
<th>Event Description</th>
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<tbody>
<tr>
<td>14 March 2012</td>
<td>Third (whole day) meeting, with 3 farmers, 2 advisors and 3 breeders from the Danish breeding company Sejet Plant Breeding. They had a good discussion about IPM, however the original idea was shot down because of quality problems. The breeding experts presented convincing evidence that using variety mixtures is not compatible with the aim of producing wheat with a high falling number, which is preferable when considering baking quality. According to the breeders, a better idea would be to grow varieties separately and mix them only if baking quality criteria were met. Now the farmers felt they had to adopt their idea and suggested to work around producing feed instead of bread. One plant breeder (the host) had prepared a good presentation, and showed the bread making system in different countries. The plant breeder was against the original idea, and said the quality would be insufficient. The farmers did not question the plant breeder; he had knowledge based on research. The meeting was organized by the farmers and hosted by the plant breeding station: Marianne and Jens Erik did not use any methods on stakeholder management.</td>
</tr>
<tr>
<td>14 March 2012</td>
<td>Immediately after the meeting with farmers, advisors and breeders, Marianne and Jens Erik also had a short meeting with only the 3 farmers. Although energy and enthusiasm were low after the first part of the meeting, all 3 farmers (of demonstration farms) agreed to try to sow wheat in rows.</td>
</tr>
<tr>
<td>8 May 2012</td>
<td>Meeting with all seven Danish IPM demonstration farmers including the core group of WP13 on Fyn. Marianne and Jens Erik had discussions with the three pilot farmers during this meeting, focusing primarily on practical and technical aspects of the pilots. New technology on strips for biodiversity was key topic to exchange experiences. Flowering strips do not add productivity but look nice. The meeting contributed to further getting to know each other and provided peer pressure on performance.</td>
</tr>
<tr>
<td>31 May 2012</td>
<td>One of the three pilot farmers had a big demonstration day for farmers in Denmark. Marianne and Jens Erik were also present that day. An organic farmer (neighbor) demonstrated the mechanical weed control in spring barley and spring wheat. Surprisingly, there was a high interest from (conventional) farmers at the field day, as the mechanical hoeing provided very effective weed control (combination of camera-controlled equipment and the skills of the tractor driver).</td>
</tr>
<tr>
<td>Summer 2012</td>
<td>Farmers did not visit each other during the season because they were too busy. The advisor did visit them. Contact with farmers was mainly done by phone.</td>
</tr>
<tr>
<td>Autumn 2013</td>
<td>Two pilot farmers sowed winter wheat and oilseed rape on wide row distance for experiments in 2013. Both farmers have access to suitable equipment. The third pilot farmer has no suitable equipment.</td>
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</table>

14 March 2012 Immediately after the meeting with farmers, advisors and breeders, Marianne and Jens Erik also had a short meeting with only the 3 farmers. Although energy and enthusiasm were low after the first part of the meeting, all 3 farmers (of demonstration farms) agreed to try to sow wheat in rows.
equipment and experiments with variety mixtures.

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<tr>
<td>13 March 2013</td>
<td>Meeting with the 3 pilot farmers (and their co-workers), 2 advisors and 1 farm manager to exchange experiences and to plan the activities for 2013. This time, they decided to bring in an organic farmer, who works part-time as an advisor and grows wheat for bread.</td>
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<tr>
<td>2 April 2013</td>
<td>Together with the pilot farmers Jens Erik and Marianne decided to have phone meetings with them every 2 weeks, to discuss progress, give advice etc.</td>
</tr>
<tr>
<td>24 June 2013</td>
<td>A meeting with stakeholders will be organised, in the field at Jeppe’s (one of the pilot farmers) farm. Stakeholders will be NGO’s, small milling companies.</td>
</tr>
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</table>

**Picture 1. Mechanical hoeing by one of the pilot farmers**

**Learning**

- Lessons learned by Jens Erik after the first two meetings: it is important to let farmers interact, they are eager to come up with ideas. Farmers are naturally thinking in terms of systems, not only on farm, but also about innovation systems.
- Lessons learned by Marianne after the third meeting: it seemed better to have organized this meeting themselves (Jens Erik and Marianne), then the plant breeder would have had a less dominant position. However, Marianne does not think this would have contributed to a different outcome. Other lesson that Marianne learned is that it is important to have regular contact with farmers.
- Lesson learned by Jens Erik after the third meeting: Jens Erik and Marianne could probably do more on stakeholder management: there was no one from the milling industry at the spring meeting. There are a few large millers and several small millers. It is probably wise to get in touch with small millers (however farmers will have to decide).
- General lesson during the first year: Doing co-innovation takes skills, those skills can only to a certain extent be developed by training, most of the skill development is done by practicing the approach in real life situations. The co-innovation part of PURE (WP13) is probably too small for large innovations to happen during the life of PURE, but certainly large enough to demonstrate that the approach is interesting and worth exploring further in future projects.
Evaluation of the most important activity (highlight)
The most important activity in the first year of the pilot was the brainstorm among farmers and advisers. In retrospective, it was important that farmers had the chance to develop their own ideas with support from advisers, even though it took several detours to come up with something related to IPM and crop protection. This has also undoubtedly contributed to the fact that farmers are proceeding with their concept, even though weather conditions in 2012/13 were a big challenge to the system of inter-row hoeing and even though they were challenged by the breeders.

France

The French pilot is located in Burgundy. The pilot team consists of INRA (researcher Raymond Reau) and the Chambre d’Agriculture de Nevers (advisor Michael Geloen), who cooperate with a local network of wheat farmers (CETA). Most farms grow maize in the river valleys and wheat, oilseed rape and sunflowers on the plateau. Some colleagues from INRA and Chambre d’Agriculture are also regularly involved in the pilot (the pilot team and colleagues together are referred to as the ‘French team’). Michael is the direct link to the farmers (being their advisor), Raymond is the link to research (INRA).

Activities (timeline)

<table>
<thead>
<tr>
<th>Autumn 2011</th>
<th>The initial idea of Michael and Raymond for the pilot was to disseminate the “hardy wheat” crop management within the group, as numerous on-farm experiments have shown that it is a robust solution to reduce fungicide and growth regulator use in wheat.</th>
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<tr>
<td>Winter 2011/12</td>
<td>Raymond and Michael organized a meeting with two other colleagues of Burgundy Agricultural Chambers. The meeting was dedicated to organizing a pilot among the “Entre Loire et Allier CETA” farmers group, with as key event a kick-off meeting in January 2012 with farmers. During the meeting Raymond explained what was done (during the WP13 Kick-off meeting) in Lelystad and did the system analysis.</td>
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<tr>
<td>End of February 2012</td>
<td>Second meeting of the French team in Auxerre. They worked with the stakeholder typology following the training in Wageningen.</td>
</tr>
<tr>
<td>End of March 2012</td>
<td>Audio conference of the French team to prepare the first meeting with farmers to be held in mid-April</td>
</tr>
<tr>
<td>Mid April 2012</td>
<td>Meeting with 22 farmers in Nevers, at the headquarters of the Agricultural Chamber. Raymond and Michael explained the PURE project, worked to understand the farmers’ values, their technical motivations and started to design a co-innovation project. They did an exercise on farmers’ values and expected result for a good crop protection. Maximum yield is very important. Interesting to understand this behaviour as this may also affect change in technique. The question also is: are they interested to change their values? Farmers are now expecting a concrete proposal from scientists.</td>
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<tr>
<td>June 2012</td>
<td>First part of the meeting with farmers in June concerned debriefing of the previous meeting. There is a high diversity among farmers, mainly based on the soils they are on; each farm would have</td>
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</table>
specific problems, and specific motivations. Problems of pest management concern more weed management than disease management, not only in wheat but also in oilseed rape and maize. A new meeting is planned on the 25th of September, in order to prepare plans for crop management of maize and OSR/wheat and to do experiments on some of the farms next year. The idea is to ask one or two farmers who have ideas to plan experiments and have a discussion on these ideas with other farmers of the group: to work on co-design of cropping systems management. Next meeting will not be at the head of the Agricultural Chamber in Nevers, but on one of the farms to facilitate expression of farmers in the group. Raymond and Michael changed their strategy: no longer pushing robust wheat systems. Reason for this is that farmers explained that Raymond and Michael were giving solution to problems they were not experiencing.

September 2012 and December 2012
Raymond and Michael organised two ‘co-design’ workshops, starting with the problems of one specific central farmer. At the first workshop 6 other peer farmers were present. The meeting was a success. Another farmer also decided to co-design for his farm. During the workshop, Raymond and Marie-Sophie had the role of expert (helping in the methodology, not being advisors), while Michael and Cedric asked what the problems of the farmer were (as advisors).

October 2012 & Jan. 2013
After both workshops Raymond and Michael met with the research team.

March/april 2013
Third co-design workshop

June 2013
Fourth co-design workshop

April-september 2013
Agronomic master of Maelys BOUTTES in order to describe the cropping systems chosen by the central farmer of each workshop, and to assess their ex ante sustainability performances.

**Picture 2. Co-design workshop**
Learning
Reflection on progress in the pilot is a structural part of the co-innovation training and the coaching moments with the pilot team. A summary from the lessons and reflections by the French pilot team:

- The co-innovation approach helped the team to understand the wider context of the pilot. With help of some co-innovation tools (system analysis), other stakeholders than initially expected appeared to be relevant for success of the pilot. Moreover, cultural aspects and interaction between stakeholders appeared to be important factors for IPM in France, not only knowledge or legislation. The market (high wheat prices) has influence on the farmers’ attitude towards the hardy wheat management system and towards some risk-increasing IPM solutions.
  
- A major event in the timeline was the clear rejection of the farmers to implement the hardy wheat management system, mid 2012. The pilot team had proposed the system from the beginning of the pilot, until this meeting with the farmers. This event was discussed in the video conference with the WP13 moderator team in 2012 and during the training in October 2012. The team expected the end of the pilot, but managed to turn the tables by asking farmers ‘What would you like to do?’ This generated new energy in the group that continued since that time.
  
- The farmers liked the co-design workshops very much. The leader of the group asked the pilot team to repeat such sessions already after the first workshop. For the pilot team, it was the first time to organize design workshops with farmers (normally only researchers and advisors participate). This added some new dynamics to the design process: farmers easily combined the specific situation of the ‘central’ farmer with their personal situation. The pilot team tried to manage this during the workshop and in the preparations for next workshops.
  
- Farmers seem to be interested in techniques more than in cropping systems (which is the approach of the pilot team). Farmers also didn’t propose a common topic to work on, but wanted to work all on something specific for their farm.
  
- The group of farmers wants to build an innovative image towards other farmers in France. Participating in the co-innovation pilot is therefore quite interesting for them.

Evaluation of the most important activity (highlight)
The most important activity of the pilot is the co-design workshop, as the farmers are very fond of it: the chairman now wants to realize one workshop for each member of the group. In June 2013, already 4 workshops have been organized for 4 different farmers. Implementation of the cropping system, chosen by the farmer at the end of the first workshop, is already started at his farm.

Lessons learned for implementing co-design workshops
The personal and collective reflexion of the four animators involved in the co-design workshops gives rise to the following remarks:

- It is important to design new cropping systems for a mid-term (5 or 10 years) without being preoccupied by the current system or by feasibility;
- It is important to describe the combination of chosen techniques for the redesigned cropping system in the workshop output (in contrast with a protocol for an experiment) as the result of the workshop must be understandable for the farmer-peers and for the central farmer.
The last version of the co-design workshop has been translated into a guideline, which will be useful for new co-design workshops of our French pilot, and may be used by other agronomists.

Conclusion
Advisors from Chambre d’Agriculture were used to work with the Stephy guideline: a step by step design approach for improving cropping systems, starting from an initial point and focusing on specific means and changes to meet certain objectives. The approach was used in workshops with farmers. The co-design approach is different: it is a ‘de novo’ design method, used by agronomists (advisors, researchers). In the pilot it has been used for the first time with farmers. Reflections of the pilot team:

- To design cropping systems for mid or long term implementation, the group should not focus on specific solutions for specific problems, but interpret the current problems as (possible) system problems. For instance: the discussion of a specific weed problem led to the question ‘how to deal with weeds on clay soils with short crop sequences?’ By this, the problem becomes more generic and possibly more relevant for other participating farmers as well.
- If new cropping systems are designed, it is helpful to think about mid or long term implementation, for instance to prepare a generational change of the family farm management when a son/daughter is ready to come as a co-farmer or as the main farmer.
- A diverse group of participants (background, knowledge) is important for a good workshop, i.e. understanding the problems, identification of possible and innovative solutions, as is a systems approach.
- Farmers accept a suggestion from peers (colleague farmers) more readily than a suggestion from advisors/researchers, even if it is more or less the same suggestion.
- The main challenge is to make the step from co-design to on-farm implementation: how to ‘break down’ futuristic system designs to feasible procedures and step by step implementation starting from the current farm situation? How to make the cropping systems designs evolve as a systemic unit, rather than end up improving aspects?
- The co-design workshop puts one farm(er) in the center of the discussion, resulting in a design for his farm, or part of his farm. However, the peer farmers were linking the discussion on problems and solutions to their own farm. It is likely that they also go home with ideas for their farm. How to utilize this within the co-innovation pilot?
- For the leaders of the CETA, the co-design workshop changed the way they are managing the field visit with the group. Now the field visit does not only involve solving the actual technical problems observed in the visited field (“hot technical advices”), but also addresses explaining how the strategic project of the farm, designed from ideas coming from the workshop, is progressing and which changes were introduced to enable the transition towards the new cropping systems chosen by the central farmer. “During the CETA field visit the farmers are now much more active than before”.

Germany

The German pilot is linked to Work Package 4 Field Vegetables. The pilot team consists of Martin Hommes, Silke Dachbrodt-Saaydeh and Malaika Herbst, all from Julius Kühn Institute (JKI). The pilot in Germany focuses on cabbage cultivation in Northern Germany.
# Activities (timeline)

<table>
<thead>
<tr>
<th>Date</th>
<th>Event Description</th>
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<tbody>
<tr>
<td>11 January 2012</td>
<td>Silke met with Martin and gave him a summary of the first WP13 co-innovation training. Then they made a plan to schedule the different activities. Now in process of identifying farmers; will be contacted in summer and in January or February a planning meeting will be scheduled. Identification process: farmers and advisors and reps of federal and state advisory services. Maybe pesticide industry and retailers as well since prices are very volatile and this determines strategies very much, as well as consumer protection. Finally someone from grower association who is working on sector specific field guidelines. Purpose of meeting is to show on-station strategies: selective pesticides, non-chemical weeding methods, to try and convince farmers and others to use more of these methods.</td>
</tr>
<tr>
<td>January 2013</td>
<td>Silke, Malaika and Martin met a few days in advance of the first meeting using the dynamic agenda for preparation.</td>
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<tr>
<td>9 January 2013</td>
<td>Board meeting of cabbage growers (‘board’ of cabbage growing association) with about 12 attendants. This group was suggested by the key-contact advisor as it would be an important meeting of opinion leaders. The cabbage growing association consists of advisors and other people representing cabbage growers. Input from the research team was structured as a separate session in a larger meeting with dinner afterward. The group expressed a positive interest in the project aimed at reducing pesticide use and doing on-farm trials.</td>
</tr>
<tr>
<td>16 January 2013</td>
<td>Second meeting. The local advisor organized the meeting: 5 farmers (both conventional and organic) + adviser, Silke, Martin and Malaika were present. Researchers gave presentations about: (1) general info about PURE, (2) legal developments, the role of mandatory IPM and possible withdrawal of pesticides, (3) various experiments on categories of pest and diseases that are planned in PURE. Hereafter, farmers chose the most interesting and relevant subjects for their activities. For example, the organic farmers were interested in testing new species in flower strips. The conventional growers’ interests were closely related to control tactics, which include experiments with the focus on the control of aphids and caterpillars with selective insecticides only when action thresholds are exceeded and the observation and monitoring of cabbage root fly with felt traps. Part of the meeting was a session on dreams and nightmares in IPM: some problems came up and the result was a description of problems the farmers need solutions for. Main problems were the decreasing availability of plant protection products, lack of reliable treatment thresholds and lack of time for monitoring and therefore preventive spraying. Surprising to the researchers, farmers admitted that they lack knowledge on pest identification and to distinguish between pests and beneficials. Wishes included the adaption of action thresholds (especially for organic growers), prognosis and warning systems and long-term coping of problems. During the meeting, Silke used stakeholder management (movers,</td>
</tr>
</tbody>
</table>
floaters, blockers) to identify how the general dynamics in the group were. In the following months contact was maintained via several phone calls. Some problems occurred due to uncertainty about the effect of flower strips. Farmers were afraid that especially *Lobularia maritima* plants could become weeds and create additional long-term problems. In the end the organic farmers chose to plant *Lobularia* while one conventional farmer preferred sowing *phacelia* and buckwheat as flower strips.

<table>
<thead>
<tr>
<th>15 May 2013</th>
<th>Farm visits took place. With each farmer participating in the project, progress and possible difficulties were discussed. Dates for next farm visits were fixed.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer 2013</td>
<td>The pilot will be presented at a large field day on august 28, 2013. During the growing season a field day is scheduled (September 9, 2013) plan of researchers (not yet discussed with farmers, but mentioned to advisor) to have a field day with participating farmers and extra advisors and possibly + food retailers + and environmental organisations. Also interest to link to a bigger exhibition where results are presented.</td>
</tr>
</tbody>
</table>

**Picture 3.** A cabbage field with flower strip (Buckwheat and Phacelia)

**Learning**

- The course materials were very useful for the discussion with the pilot partners (who did not attend the first part of the course) and the detailed planning of the meetings and the co-innovation process with farmers and advisors. By using the intervention logic and the system analysis we clearly identified the crucial issues we would need to address in the stakeholder management process. By discussing the outcomes of our system analysis and the stakeholder map we realized and agreed that it will be more conducive to the process to have the first meetings with growers and advisors, start the experiments and involve other stakeholders such as retailers and ‘environmentalists’ at a later stage (towards the end of first set of field experiments).
- Lessons learned by Malaika: the dreams and nightmares scenario conducted at the meeting with interested farmers helped to start an open discussion and showed the way farmers are thinking (if they are rather blockers, floaters or movers).
Lessons learned by Martin: the different co-innovation tools help to do a better analysis of the aims, methods, possible obstacles etc. These tools give more confidence and improve the pilot as a whole.

**Evaluation of the most important activity (highlight)**
The most important activity of the German pilot was the first meeting of the researchers with the cabbage growers (both conventional and organic). At this first meeting of the group a short introduction of participants was given. Farmers introduced their main crops and researchers gave information about the project and the regulatory IPM framework. The momentum of interest and identification of farmers with the project was maintained by involving them. Each grower was asked to state his dreams (or wishes) and nightmares (or concerns) concerning his production system and the crop protection issues in particular. The short explanation and following discussion created a nice and open atmosphere.

The pilot team used the information to identify the key questions and key concerns of the growers (applying system analysis) and as a starting point to present the planned experimental work to be worked on jointly with the growers. In the meeting each grower agreed to carry out a certain experiment. The choice was solely made by the growers based on their needs and their consideration which tools or measures would be most beneficial to their production systems. For example, other tools such as mechanical weeding supported by sensor controlled robotics were, based on previous experiences, considered inefficient by the growers and after a discussion of pros and cons taken off the list for collaborative experiments. Much of the discussion ran on prejudice concerning new tools. However, consensus was reached to test a number of tools, such as monitoring cabbage root flies with felt traps to better time spraying, combating aphids and caterpillars with selective insecticides only when action thresholds are exceeded and testing the influence of flower strips on pests and beneficial organisms based on the presented experimental results and the agreement of joint (growers and researchers) field visits doing monitoring and assessment.

In terms of the co-innovation process the discussion between growers and researchers helped the pilot team to map the different types of actors (movers, floaters, blockers) within the group. To the surprise of the pilot team, one (organic) advisor mainly acted as a blocker whereas an organic grower was considered a mover and was very open to the proposed new measures (*Lobularia maritima* flower strips). Two other conventional growers (floaters-movers) had a positive attitude toward the proposed new measures but were unsure how this would affect their production system. At the end of the meeting farmers agreed to conduct specific experiments.

A clear intervention by the pilot team was necessary when one of the growers had too many concerns planting *Lobularia maritima* flower strips. There were upcoming concerns of mainly conventional farmers that plants could become weeds and create additional long-term problems. Since *Lobularia* like cabbage belongs to the family *Brassicaceae* the main argument was that the plant could not be controlled chemically. Our own observations from last year’s experiments that it was not possible to sow Lobularia directly into the field and that transplanted plants did not produce germinating seeds during the growing season, could not change the mind of conventional farmers. Finally, both organic farmers agreed in planting *Lobularia* while the conventional grower decided to sow phacelia and buckwheat as a flower strip which can be controlled chemically if necessary. The second conventional grower considered to implement a flower strip next year if experiences of the others are positive.
Netherlands

The Dutch pilot is linked to the on-farm experimentation of WP4 Outdoor Vegetables. The pilot team consists of Marian Vlaswinkel and Hilfred Huiting of DLO - Wageningen UR. DLO only has on-farm experimentation planned for WP4.

Activities (timeline)

<table>
<thead>
<tr>
<th>Date</th>
<th>Activity</th>
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<tbody>
<tr>
<td>November 2011</td>
<td>Directly after the first WP13 training, Hilfred and Marian organised a meeting with the project team (colleagues) to discuss the co-innovation approach for their own pilot. As a reference ‘the sustainable cultivation of Brussels sprouts in 2020’ was used. Idea was to join the Brussels sprouts Boulevard (organised in November 2012). Hilfred and Marian established a list of representatives of trade and industry and two innovative growers, and sent them an invitation for a meeting. Goal was to organise a meeting with this group and to form a coherent network for the entire duration of PURE. Hilfred and Marian carefully prepared this meeting and paid specific attention to the goals they want to accomplish with the meeting. When would they be satisfied?</td>
</tr>
<tr>
<td>February 2012</td>
<td>Meeting with representatives of trade and industry and growers. Prior to the meeting, Hilfred and Marian asked the participants to think about their dreams and nightmares for Brussels sprouts. The most important dream was noted as future perspective and goal. With this perspective, the question was asked: what do the market and cultivation of Brussels Sprouts demand? Followed by the question: what could we do with this? Then the participants unfortunately shut down and no activities or responsibilities were formulated. The common perspective was: in ten years only a few growers will be left. Without energy, the meeting was ended leaving Hilfred and Marian very discouraged and disappointed.</td>
</tr>
<tr>
<td>After the meeting</td>
<td>Hilfred and Marian discussed the use of a different case/project for WP13. However, they decided this would be too easy and went back to their original idea. An alternative (low residue production) with Frugiventa is discussed. Hilfred and Marian decided to work out several ideas.</td>
</tr>
<tr>
<td>December 2012</td>
<td>Contact with advisor and representative of LTO. Focus now is on residue-free products, forming a network with growers. Aim is to have a project by the end of 2013.</td>
</tr>
<tr>
<td>March 2013</td>
<td>Based on the meeting in December and further exploration of possibilities on the idea of residue-free crop cultivation, a meeting was held, with key growers of 5 different vegetables. The atmosphere was rather optimistic but the energy to put together a project in an acceptable time span was not found.</td>
</tr>
<tr>
<td>April 2013</td>
<td>After the meeting in March the idea of residue-free crop cultivation was left. At the same time a group of arable farmers came forward from a network in which Marian participates from the beginning of 2013. This network (called Veldleeuwerik) focusses on increasing sustainability on farms based on each farmer's own ideas and suggestions. Concrete actions and foci are worked out currently.</td>
</tr>
</tbody>
</table>
Picture 4. Meeting with representatives of trade and industry and growers

Learning

- Lesson learned by Hilfred and Marian after the first meeting with the project team: Hilfred and Marian think more carefully about the goal of a meeting and prepare a meeting more carefully as well. One of the tools of the WP13 training (intervention logic) can help them with this.
- Lesson learned by Hilfred after the meeting (Feb ’12) with representatives of trade and industry and growers: Hilfred may have underestimated the importance of dealing with movers, blockers and floaters. Especially prior to a meeting you should know who you invite and if your viewpoint (whether the stakeholder is a mover, blocker or floater) is correct. Besides this, make sure participants stay until the end of the meeting and do not accept colleagues replacing people you invite.
- Lesson learned by the March ’13 meeting: it is difficult to balance between letting the group set the agenda and reaching your own goals. Growers may sometimes not be able to oversee longer term challenges as they are busy with the day-to-day management of their farms.

Evaluation of the most important activity (highlight)
The Dutch pilot team has already worked on IPM and mechanical weed control in Brussels sprouts with a group of farmers. Almost 50% of the Dutch Brussels sprouts growers currently uses mechanical weed control, many of them participated in the Farming with Future project. Knowing this, it was quite a challenge for the pilot team to think about on-farm experimentation on mechanical weed control in Brussels sprouts, as suggested in WP4. During the first co-innovation training, the pilot team defined the question ‘how to get in touch with the other 50% of the growers, who don’t use mechanical weed control?’
Based on the experience of the pilot team, weed control is not the major challenge for growers, so during the WP13 training in February 2012, the pilot team decided to widen the scope to ‘how to grow Brussels sprouts in 2020.’ They prepared a meeting on this question with growers, advisors and suppliers to identify the future challenges as a starting point for on-farm experimentation. During the meeting, the challenges became quite clear: pesticide residues (fungicides and insecticides) are a main concern due to high demands for product
quality (no damage by diseases and pests) and increasingly low residue levels. However, the meeting did not result in on-farm experimentation, because the growers present in the workshop were not willing. The pilot team was very disappointed about this outcome and tried to understand what happened. Their main conclusion was more or less ‘we did the good thing with the wrong people’. A better selection of farmers to invite for the workshop could have helped, to avoid farmers who are thinking about leaving farm business or farmers who are busy with other issues. At the same time, the other stakeholders present did not take the responsibility for the follow-up: they expected the pilot team to think about that. The pilot team reflected on this as well: could we make the stakeholders responsible for the co-innovation process? This has also to do with positioning the role of the pilot team itself (facilitating, not leading).
5. Reflection and dynamic agenda

This report describes the progress in the four pilots and the WP until approximately June 2013. It thus provides a snapshot of the evolution of the pilots and the group of researchers-advisors in the WP. In this final Section we will reflect on this ‘work in progress’ both from an empirical and an analytical perspective, and sketch the topics that we have on our dynamic agenda.

Denmark

From the start the Danish team made the participating farmers responsible for the innovation process. This resulted in farmers taking the initiative in defining the innovation agenda. The WP13 team managed to combine their IPM agenda with the farmers’ agenda on growing wheat with bread-quality. The team attributed this rather easily obtained match between N-management (the farmers research plan) and IPM to a natural systems perspective of the farms. At times the pilot team experienced a feeling of ‘not being in control’ of the process. At the same time, the commitment of the farmers is high and the pilot is engaged in innovative experimentation.

The Danish pilot team works more from the general idea of co-innovation than by explicitly using the various tools. The team is able to translate the general idea into day-to-day actions and reflect on it from the general perspective. This fits quite well to the role and key competences of advisors. The link with research seems however weak: no researchers/scientists are involved in the co-innovation pilot (although the pilot team is well into both Danish and EU IPM research projects). This weak link may constitute a risk for scaling out and making the approach mainstream, both within PURE and within the Danish advisor and (applied) research communities, as they are not involved.

France

The French team started with a clear agenda, involving the dissemination of a specific IPM concept (‘hardy wheat management’). They used the co-innovation tools to design strategies for dissemination by identifying the barriers for adoption by farmers and other stakeholders. When in spring 2012, after two meetings, the farmers still turned out not to be interested, the team changed its approach. Feeling the risk of losing the commitment of the farmers, the team decided to respond to the farmers interests, which were focused on maize rather than wheat. The experiences of the Danish team in leaving the initiative to the farmers and the video-conferencing discussions supported this evolution in strategy: starting from the farmers’ perspective as this is where most energy for change can be found. Deployment of a structured farmer-centred participatory approach (co-design), which combines brainstorming with peer review, turned out to be highly successful. The team works with various other co-innovation tools in the background. In the French team the combination of a researcher and an advisor

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6 The dynamic agenda is a tool that WP13 recommends innovation groups use to list important but not always urgent topics that appear resistant to solution. In each meeting the dynamic agenda is revisited and updated.
results in an approach that offers the perspective of combining scientific and development objectives.

Germany

The German team, which is more strongly linked to their commodity-oriented WP than the two wheat teams, started in 2012 with on-station experimentation and planned the on-farm experimentation for 2013. They prepared the on-farm experimentation with the co-innovation approach and tools, which gave the team a better understanding of the pilot (stakeholders, obstacles). After considerable discussion on the choice of stakeholders to involve, they linked up with a group of conventional and organic cabbage growers and an advisor. In the first meeting with the cabbage farmers and the advisor, the team presented various IPM solutions and asked the farmers to select options for on-farm experimentation. As an initial activity during the meeting, they organised a workshop on ‘dreams and nightmares’ for future crop protection in cabbage. This opened up the discussion with surprising elements for the pilot team in terms of knowledge gaps with the farmers that could be addressed. Thus starting from the farmers’ perspective was key for commitment: it created insight in the farmers’ context for research and it established commitment of the farmers to the innovation process. It seems that researchers were open to the farmers’ stories, regarding the ‘confessions’ the farmers came with (e.g. about not being able to distinguish between pests and beneficials in the field). This shows something about the attitude and setting co-innovation demands.

Netherlands

The Dutch partners in WP4 (open field vegetables) committed themselves to work on mechanical weed control in Brussels sprouts because of their considerable expertise on the topic. This expertise was based on a long history of working in farmer networks. The team, however, considered mechanical weed control not challenging enough to the farmers as a key topic in WP13. Therefore, the team decided to broaden the scope of the first stakeholder meeting to ‘how to grow Brussels sprouts in 2020’. Despite animated discussion the step to on-farm experimentation did not meet with enthusiasm among growers. The pilot team mentioned the lack of stakeholder management to invite the right people for the workshop. Moreover, the growers were just one of the stakeholders in the meeting, not the explicit owners of the innovation process. This set-back had a highly demotivating effect on the pilot team, despite video-conferencing and feedback from other teams. A closer investigation of the reasons for the lack of progress despite thorough preparation of the team is warranted. In addition, methods to plan for and overcome initial deception would need to be developed.

Reflections from the CAS and Boundary Work perspectives

Features of the pilots and the overarching WP13 activities are mapped in terms of CAS and Boundary Work in Table 1. Inputs for the Table were the pilot reports and the exchanges during the WP13 meetings. It is still too early to draw conclusions but there a number of remarks can be made.
Table 1. Analysis of key activities of the WP13 pilot teams from a CAS and Boundary Work perspective.

<table>
<thead>
<tr>
<th>Analytical perspective</th>
<th>Pilot</th>
<th>CAS</th>
<th>Denmark</th>
<th>France</th>
<th>Germany</th>
<th>The Netherlands</th>
<th>WP13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generate variation</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>• Stimulated farmers to come up with innovations in wheat production even if not on IPM</td>
<td>• Stimulated farmers to come up with innovations even if not in wheat production</td>
<td>• Stimulated farmers to come up with innovations even if not on IPM (dreams and nightmares approach)</td>
<td>• Stimulated farmers to come up with innovations even if not on IPM (dreams and nightmares approach)</td>
<td>• 4 pilots</td>
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<tr>
<td>Stimulate unexpected interactions</td>
<td></td>
<td></td>
<td>• Initiated farmer-breeder contact</td>
<td>• Co-design with farmer-to-farmer peer review</td>
<td>• Not evident at the start of the process. Maybe: combination of organic and conventional farmers</td>
<td>• Invitation of broad selection of stakeholders</td>
<td>• Stimulate different approach with stakeholders and between advisors and researchers</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Made contact with small millers</td>
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<tr>
<td>Manage selection of novelty</td>
<td></td>
<td></td>
<td>• Broadened activities to include IPM in addition to N management</td>
<td>• Used peer review and individual decision making to arrive at a farmer-specific research agenda</td>
<td>• Individual experimentation and informal peer review</td>
<td>• -</td>
<td>• Identification and sharing of what worked in the other pilots</td>
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<tr>
<td>Boundary Work</td>
<td></td>
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<tr>
<td>Participation</td>
<td></td>
<td></td>
<td>• Meaningful involvement of farmers in agenda setting from start</td>
<td>• Meaningful involvement of farmers in agenda setting from start, exemplified by a complete change in innovation strategy</td>
<td>• Meaningful involvement of farmers in agenda setting from start</td>
<td>• Involvement of broad stakeholder group, however, without obtaining commitment</td>
<td>• Involvement of participants through their own pilots</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>• Start of widening involvement to next users (millers)</td>
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<tr>
<td>Legitimacy</td>
<td></td>
<td></td>
<td>• Lack of management of expert/breeder input into process</td>
<td>• Explanation of change in traditional definition of research agenda</td>
<td>• Setting allowed farmers to ‘confess’ to knowledge gaps</td>
<td>• Farmers did not offer to move to on-farm experiment-tation; possibly did not feel ownership</td>
<td>• Project meetings and video conferencing</td>
</tr>
<tr>
<td>Boundary Objects</td>
<td></td>
<td></td>
<td>• On-farm experiments</td>
<td>• Co-design sessions</td>
<td>• On-farm experiments</td>
<td>• Insect recognition?</td>
<td>• -</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• On-farm experiments</td>
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<td></td>
<td></td>
<td></td>
<td>• Insect recognition?</td>
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</table>
The ‘generate variation’ guideline inferred from the CAS perspective appeared to work well when the core innovators (i.e. the farmers) were invited and offered a directive role in the process. Generating variation in solutions and stakeholders in itself may also block development, as suggested by the attempts in the Dutch pilot, as too wide a range of problems, solutions and stakeholders may lead to passive behavior. More detailed analysis of the reasons for the failure to get on-farm experimentation going in the Dutch pilot despite two attempts, should reveal whether first innovation meetings should be structured around an ‘inner circle’ of innovators.

Similarly the ‘stimulate unexpected interactions’ guideline inferred from the CAS perspective needs to be managed well to avoid unexpected interactions that prematurely stifle initiatives and drain energy out of the process (cf. Danish case as well as Dutch case). Again, careful selection of who contributes to the primordial idea may be important.

Selection of novelties, the third element of the CAS perspective, was most clear at the level of the WP where a successful approach in the Danish case stimulated adoption by the French case team, and stimulated the other teams. The adoption of the ‘farmers-in-control’ novelty stimulated the French team to develop its own approach. The novelty was thus not adopted ‘as-is’ but, typical of innovations, shaped and reshaped to meet local requirements.

Creating meaningful participation and legitimizing the approach were key elements in the start-up of the innovation process in all cases, as well as in the WP as a whole. Responding to farmer needs was key in the Danish, French and German pilots. At the WP level this was stimulated by two strategic choices: using the meetings to let teams work on their own pilots with relatively novel methods and tools; presenting a scientific basis to co-innovation during the third meeting to create credibility for the approach among the scientifically oriented WP participants. The former strongly enhanced participation in the development of the overarching co-innovation approach; the latter provided the justification that particularly the researchers in the teams felt they needed, to explain and justify their activities among their peers.

The co-innovation approach itself is an important boundary object for the WP participants. It is often emphasized that co-innovation is not a fixed ‘recipe’, but revolves around a number of guidelines that bring the user of knowledge and his/her context closer to the developers/suppliers of formal knowledge. At the level of the cases, the on-farm experiments constitute the most visible boundary objects.

General reflections

Although very differently, all pilot teams translated the co-innovation approach and tools to concrete activities in a pilot. All pilots show that the teams work from a co-innovation perspective, some from the start, others switching during the process. The analytical tools (logical framework, collective systems analysis, stakeholder analysis) are helpful for the pilot teams to understand the context and what is happening in the pilot. The tools therefore seem to support the pilot teams in their new role of process facilitators.

Widening the perspective from ‘which solution are we going to test on your farm’ to ‘what are the future challenges’ is the most obvious co-innovation feature in all pilots. This approach was effective in all pilots: it opened up the discussion, and enabled a shared understanding of the future and the challenges farmers are facing. This was a good starting point for identification of solutions to be experimented. The Danish and French pilot show that joint agenda building contributed to the commitment of the farmers to experimental
changes on their farms. It also enabled the pilot teams to understand and explain the particular value of solutions, related to the future perspective and the farm context.

The self-reflection and learning of the teams is addressed by the moderators of WP13. Most significant elements thus far were the accounts of the pilot teams that the co-innovation approach offered them several ‘surprises’. They did not only do things differently or different things, but outcomes were also different. This is an indication that WP13 has impact on the practice of the pilot teams: the teams don’t just continue ‘business as usual’, they are really experimenting with co-innovation approaches.

The role of researchers and the link to scientific research is one of the major points for reflection. If the lead of the innovation process shifts from research to farmers, what will be the role and value of research in the process? And what is the scientific value of the innovations? Because the co-innovation pilots are facilitated by researchers or advisors with a strong link to IPM research projects, some relation is expected. WP13 also provided the pilot teams with tools to identify relevant stakeholders, to be connected to the pilot, including research. However, WP13 doesn’t want to intervene in this process by adding researchers to the pilots or insisting on experimenting with specific solutions from PURE or other research projects. The four pilots will probably show a variety of linkages with research, that will be evaluated in the final stage of WP13.

**WP13’s dynamic learning agenda**

Each of the 4 pilots has a Dynamic learning agenda consisting of strategic case-study specific topics that need to be resolved to keep the innovation process going. In addition to the 4 pilots, WP13 has its own Dynamic learning agenda. Here, we address the agenda of WP13 as a whole as this has most general value.

1. How can energy be kept high in the innovation network of 4 pilots? Which new elements need to be added, given developments in the pilots?
2. Can the pilot experiences, captured in the current data collection effort be generalized to design of research-for-innovation projects?
   a. Is the analytical framework, which originates from analyses of technology-oriented innovation (CAS and Learning selection; Douthwaite and Gummert, 2010) and from long-term, large-scale involvement of science in societal problems (Boundary Work; Clark et al., 2011), adequate for understanding innovation in a single project that runs over 4 years?
   b. Are the data collected (summaries of coaching sessions, video statements of participants at workpackage meetings, extended sessions per case during pilot visits, interviews with participants) adequate for using the framework?
3. How does the institutional environment of PURE affect development of the Co-innovation approach in WP13?
   a. What is the role of the design cycle in the WPs for the innovation process in WP13?
   b. What is the role of the crop-specific WP for the cases in WP13?
4. How can the Co-innovation approach be scaled out to research-for-innovation projects in agriculture? How cost-effective is the approach in WP13?
Concluding remarks

Although the pilots are still in progress, we can already mention some general lessons about co-innovation and the application of co-innovation in different contexts:

1. Co-innovation in IPM needs to put the farmer in the center of the innovation process, identifying its future challenges and developing solutions that address these challenges within the context of their farm. All teams succeeded to organize a successful futuring workshop with farmers (and stakeholders) and three pilots were able to translate the future challenges to on-farm experimentation. Most important result could be the high commitment of the farmers to the pilot and the on-farm experiments.

2. Co-innovation is not ‘business as usual’ for advisors and researchers. All pilot teams mention surprises, approaches they use for the first time. This requires not only good support but also ‘room for experimentation’ for the pilot team. Within PURE, WP13 can be seen as a playground to experiment with a different approach. Within the pilots, the teams also have room for experimentation within the institutional context of their own organization and projects.

3. As IPM is not just the application of a technology developed in research, co-innovation is also not just the application of a recipe developed in WP13. Co-innovation is about managing an innovation process that is owned by farmers (IPM users). As said in the second lesson, co-innovation is not ‘business as usual’. A training and coaching approach, as used in WP13, seems to be very supportive to advisors and researchers to experiment and learn to work with a different approach for innovation in IPM.
6. Annex I Co-design workshop

A detailed description of a co-design workshop is presented here, with the example of the third co-design workshop realized for farmer BL on 8th of April 2013.

Main characteristic of the ”farmers co-design workshop” :

The workshop is organized into the farm of one farmer (the central farmer) who invites its peers to help him to imagine new issues to solve an important problem (of pest management). It’s a half day indoor meeting, completed in the case of BL by a short field visit.

3 to 5 peer farmers participated to these workshops, animated by the pilot team (Raymond (INRA) and Michael, Cédric and Marie-Sophie (Agricultural Chambers of Burgundy).

Methods

Preparation of the workshop

Michael prepared the workshop with B.L. in order to ask and to help him to prepare the description of its farm, and the description of the problematic cropping system he wants to focus on.

Activity during the workshop

Steps inside the workshop

Step 1: the central farmer describes its farm, its problematic cropping system and its questions for its peers, and then responds to comprehensive questions of the other farmers (half an hour).

Step 2: the peer farmers analyse the problem of the central farmer, through an interactive and comprehensive reformulation of the problem stressed by the central farmer, just before. During this step, the central farmer listen, and is asked to avoid to speak (half an hour).

Step 3: each peer prepare and express its proposal for the central farmer. After a short silent and personal reflexion when each peer organises and writes down on “post-its” its personal proposal, each one expresses towards the central farmers its proposal. In the meantime, an animator of the team collects the post-its in order to stick and organize them on a big sheet (one hour). During this step, the central farmer is always supposed to listen.

Step 4 : after a pause, facilitating its reflective preparation, the central farmer express what are the proposal he wants to remember, and the proposals he wants to include into its cropping systems within 5 or 10 years (half an hour), but not necessarily next year

Step 5 (optional): field visit and feedback on present cropping systems and proposal of change (half an hour).

Roles inside the workshop

Each step is organized by an animator and its assistant. The main animator explains the instructions, and contribute to organize the oral expression of the persons of the workshop.

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7 Only initials of the farmers are mentioned
The assistant animator has a look on the time, and is responsible of the collection and synthesis of information.

During the workshop the organisation was the following:

Central Farmer: BL and his son, as future farmer

Peer farmers: GSD, MD, ED

Step 1: animator Michael, assistant Cedric

Step 2: animator Marie-Sophie, assistant Raymond

Step 3: animator Raymond, assistant Marie-Sophie

Step 4: animator Cédric, assistant Michael

Collected informations

After the agreement of the whole farmers, the meeting is audio-recorded.

Post-its and photos of written sheet are collected during and at the end of the meeting.

Activity after the workshop

Some days after the workshop, Michael and Marie-Sophie visited B.L. in order to realize a detailed description of the new cropping system, he imagine to implement within 5 or 10 years, in order to prepare an ex ante assessment.

Results

Need for change

The first result underlined by the farmers of the group involved in several workshops is a better knowledge of the farms of the other farmers, their specificity, and the problem they deal with in a “changing world” (their need for change). It’s one of the roles of step n°1.

New concepts

During the third step the peers propose different strategies to the central farmer in order to solve his problem, or to reach his new challenge. Each alternative strategy may be describe by a function (for what? in order to…?) and a combination of practical solutions (how?) each one contributing to satisfy the function.

The description of the initial combination of functions of the central farmer, associated with the description of the alternative functions proposed by the peers is useful for capitalizing the different concepts imagined and proposed by the farmers. Even if only a little part is selected by the central farmers, the other concepts could be useful for another farmer of the group, so it is important to record and save in order to come back and may be use it later for another farm.
Rotation diversifiée en parcelles hétérogènes avec sols argileux (60%)

Figure: conceptual framework of the problematic cropping system (red colour) and alternative concepts proposed by the peer farmers (blue colour)

As proposed by Hatchuel et al. (2006), it is important to describe the “partitions”, the change of functions proposed by the peers to help the central farmer.

Project of a cropping system for the central farmer

The description of the new combination of practices chosen by the central farmer is another issue of the workshop to describe the cropping system, in order to assess its expected performances. These descriptions of the cropping system and its assessment are a source for new knowledge, that it is important to share into the group and to record in order to re-use it later.

The translation consist in i) a description of the concepts chosen by the central farmer after the workshop, ii) a description of the expects practices and results which could be obtained after the complete application of the concepts on the farm within some years, and iii) a simple protocol for the first step of the implementation during the next year, considering gradual the transformation of the system.

After the peer review of the workshop, the reflexion goes on with one or two animators, and each central farmer. Michael and Marie-Sophie for farmers JLM and J&MD. Michael and Maelys for farmers BL and AC. The perspective is no to help each central farmer in its reflexion, and then to observe what the farmer implements in his/her farm, what results are obtained, and the cropping system is transform toward IPM.
Next winter, a CETA\textsuperscript{8} meeting will present the results of the 4 workshops, in order to inform the farmers who didn’t participate to any workshop (7 out of 18), and to realize a debriefing with all the others.

\textbf{Needs for knowledge and experiences}

During the exchange between the farmers, questions are formulated, some are rapidly solved by the knowledge of other, but some of them remain without responses:

- What are the best cover crops adapted for our high clay soils?
- How to manage direct drilling on clay soils for spring crop?
- How to be successful with spring crops implantation avoiding problems of lumps

Such questions have been recorded in order to ask from scientists to respond to it, or to organize visits and exchange with farmers or advisors of other region dealing with similar questions.

\textsuperscript{8}Centre d'Etude des Techniques Agricoles