# Organic Knowledge Network Arable

# OK-Net Arable

# Collection of end-user material

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## Executive summary

The main aim of OK-net Arable project is to make available tools that facilitate exchange of knowledge and promote co-production of knowledge relevant for farmers to help them improve organic arable cropping.

This report is the main outcome of task 3.3 of the project. The goal of this task was to identify criteria for relevant end-user and education material, select the best materials among those already available and develop new material, based on state-of-the-art research results and best practices (deliverable D3.1) and the recommended methods and tools for knowledge exchange (deliverable D3.2) in each of the thematic areas important for organic arable farmers (soil quality & fertility, nutrient management, weed control, pest & disease control as well as cropping systems and crop specific tools).

The selection of materials and tools took place in three steps:

1. Out of a pool of more than 150 materials, 30 tools were selected for the first offer of end-user material using a set of seven selection criteria decided by the Steering Committee. The offer was presented and discussed with all project partners at the project meeting on 18-19/04/2016 in Newbury (UK).
2. Based on the feedback from the farmer innovation groups in Newbury, the selection criteria were simplified. The new selection criteria were used to re-evaluate the tools from the first pool that did not make it into the offer. In addition, a number of new tools were selected. This is the second offer of tools.
3. The third offer of tools consists of the tools generated by OK-Net Arable. These are existing materials that were adapted and translated into other languages, as well as newly created tools (videos and practice abstracts). In addition, farmer innovation groups and Steering Committee members identified several other existing tools worthwhile to include in the offer.

At the end of the process, 139 tools were collected or made. They include 26 videos, 37 leaflets/guidelines, 9 calculation tools, 19 web-based tools, 1 power-point presentation, 4 books/reports and 43 practice abstracts. Concerning themes: 45 tools deal with soil quality and fertility, 27 with nutrient management, 24 with pest and disease control, 42 with weed management, 34 with issues related to cropping systems or specific crops. Several tools deal with more than one theme. Looking at languages, English and German are the main languages, but also French, Italian, Dutch, Danish, Bulgarian, Hungarian, Spanish, Polish, Greek and Swedish are represented. Several tools are in more than one language.

All themes covered by the project are considered relevant by practitioners, with a slightly lower urgency on pest and disease management, while weed management and soil fertility receive the main interest in all groups. Considering the increasing use of smartphones, the limited time professionals can dedicate for gathering information, difficulties to exchange information in foreign languages and the preference for peer-to-peer learning, videos have higher chances to generate impact than books or other long texts. Calculation tools and web-based tools have been developed in the last decade and still face difficulties in being accepted and become integrated in daily work routine.

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# 1. Introduction

Agricultural research is challenged by the rate of its take-up in real farming practice. Often, brilliant scientific outcomes do not see any implementation for many years or they struggle to become mainstream. Some agricultural practices that are already used by organic farmers in one area often are not commonly practiced or even known in other areas. Time plays also an important role as several farming practices demonstrate their impact only after many years (i.e. crop rotation, ecological infrastructure etc.), so it may take several years from the first scientific discovery, over experimental tests until wide adoption. This process will fail if not enough long-term engagement is maintained from both scientists' and practitioners' side to implement new knowledge. Using a participatory approach can shorten the time needed to reach on-farm implementation and ensure commitment from the farmers. Another key aspect are the methods and the tools used to communicate among the actors concerned.

The OK-Net Arable project aimed to facilitate the use and further elaboration of available knowledge (practical and scientific) on the specific topic of organic arable cropping systems. The task is to gather, select, adapt such knowledge and to foster the use of tools able to efficiently circulate the knowledge among practitioners with different experiences, background and language skills. The ultimate aim is to facilitate the implementation of the available knowledge on a broad geographic scale, in order to improve organic arable systems all over Europe.

The scope of this report is on the one hand to describe the process the consortium undertook to identify the available materials that are likely to best fulfil farmers' and advisers' needs and expectations and, on the other hand, to provide an overview of the tools that were eventually selected and uploaded on the OK-Net knowledge platform (http://farmknowledge.org). As such, the report responds to the recommendations of the EIP-AGRI Focus Group on Organic Farming (EIP-AGRI, 2013) that highlight the need to "develop new tools for knowledge sharing based on information and communication technology, and social media or other online tools".

# 2. Selecting the OK-Net Arable tools

OK-Net Arable endeavoured to make available a large number of tools to organic arable farmers that are based on sound scientific knowledge and that are user-friendly, meaning that the knowledge is clearly communicated in a format suitable for end-users.

Within the OK-Net Arable project 3 types of tools were collected and made available on the knowledge platform:

1. Existing tools, previously produced by project partners or other organisations, in the EU or other parts of the world, and selected by partners because they fit the needs of European organic arable farmers.
2. Adapted tools: these are existing tools translated to other languages by the project partners and adapted to the specific growing conditions in the respective country or region.
3. New tools produced by project partners, in particular practice abstracts (PAs) and videos, often complementing each other.

Since the start of the project, all partners have been looking for existing tools that could potentially be included in the OK-Net Arable knowledge platform. This screening was done for all languages and for all themes and the gathered material was collected in a big table. The actual selection of tools took place in three steps, following on the one hand the information about practitioners' needs and preferences and, on the other hand, the scientific and tacit knowledge progressively gathered.

1. Out of the more than 150 materials that were collected by March 2016, 30 tools were selected for the first offer of end-user material using a set of seven selection criteria decided by the Steering

Committee. The offer was presented and discussed with all project partners at the project meeting on 18-19/04/2016 in Newbury (UK).

2. Based on the feedback from the farmer innovation groups in Newbury, the selection criteria were simplified. The new selection criteria were used to re-evaluate the tools from the first pool that did not make it into the offer. In addition, a number of new tools were selected. This is the second offer of tools.
3. The third offer of tools consists of the tools generated by OK-Net Arable. These are existing materials that were adapted and translated into other languages, as well as newly created tools (practice abstracts and videos). During this process, farmer innovation groups and Steering Committee members identified several other existing tools worthwhile to include in the offer. For reporting puposes, they are included in the second offer.

# 3. Sources of information

The first part of the project resulted in:

1. An overview of the farmer innovation groups participating in the project and the challenges they face (Cullen et al., 2016; D2.1 - Descriptions of the farmer innovation groups, agronomic and social context, challenges faced and approaches to solutions)
2. An overview on scientific knowledge available on the topics of soil quality & fertility, and control of weeds, pests and diseases (Niggli et al., 2016; D3.1- Report on state-of-the-art research results and best practices)
3. Results of a survey with farmers and advisers concerning their use of information sources and preferred types or formats of digital and other communication tools (Ortolani & Micheloni, 2016; D3.2 Report on best methodology for learning and knowledge exchange)

This section describes the main conclusions of the three deliverables and how they were used to select the tools in the project.

## 3.1 Topics and outcomes from research and best practice

Deliverable D3.1 (Niggli et al., 2016) identified a number of topics related to bottlenecks in organic arable farming, where more scientific knowledge has become available which is only partially exploited in practice. Linking available knowledge and the needs expressed in the EIP-AGRI focus group on organic arable farming (EIP-AGRI, 2013) with challenges and solutions identified by the farmer innovation groups (Cullen et al., 2016; D.2.1), allowed to identify topics on which tools should be proposed to the farmers. A summary of the key topics identified is presented below.

### 3.1.1 Soil quality and fertility

Sustainable crop production depends on maintaining and improving soil quality and fertility, where soil organic matter is a key issue. Following topics are a priority:

- (visual) assessment of soil quality and fertility
- crop choice, green manure, use of catch crops and rotation. Decision support systems for the design of crop rotation for maximum soil fertility
- reduced tillage to improve soil quality, and effect on soil micro-organisms and earthworms
- intercropping and its potential to extract macro- and micro nutrients from soil
- regional co-operations between livestock producers, mixed farms and stockless farmers to optimise crop rotations and use of manure
- improved use and management of fertility building leys

### 3.1.2 Nutrient management

Insufficient nitrogen supply is acknowledged as the key factor causing a lower yield in organic arable systems. Growing leguminous crops, incorporating crop residues and manure, using organic fertilisers in the most efficient way are important solutions, but also the timing and method of several operations should be adjusted. Deficiencies in potassium, phosphorus and sulphur may also limit yields and need to be considered within the fertilisation strategy. Following topics are a priority:

- nitrogen sourcing from legumes (grain and forage), and agronomic management of legumes
- pre-crop effects on yield and N-supply to following crops
- strategies to overcome nutrient deficiencies, including use of compost (from farms, food processing and households), regionally available manures, digestates and commercial fertilisers
- soil inoculation with suitable micro-organisms (arbuscular mycorrhizal fungi and plant growth promoting rhizobacteria), use of bio-effectors (fungi strains, mycorrhiza and humic acids) in organic fertilisers
- Decisions Support Systems for P and N fertilization
- plant tissue analysis to assess nutrient status

### 3.1.3 Weed management

Weeds need to be controlled to ensure good crop yields. The amount and diversity of weeds depends on crop rotation, nitrogen supply, soil type, soil structure and climate. In general, crop rotation and soil management are fundamental in the weed management strategy. Following topics are a priority:

- design of weed suppressing crop rotations, both in livestock-based arable systems and in stockless systems. This includes use of cover crops, green manures and intercropping.
- identification of weeds, and information about their biology and life cycle
- control of annual weeds in stockless arable systems through preventive methods (e.g. false seedbed technique)
- mechanical/physical weed control and weeding machinery (including precision farming and use of weeding robots)
- improved methods for control of perennial weeds (e.g. dock control)
- implementation of reduced tillage under organic conditions

### 3.1.4 Pest and Disease control

Prevention is the main tool in organic arable systems to control pests and diseases. Prevention can be done through the right design of crop rotation and the use of resistant varieties, mixtures of varieties or species and use of healthy seed. Following topics are a priority:

- choice of less susceptible, more tolerant or even resistant crop varieties
- crop rotation design
- identification of pests and diseases, and information about their biology and life cycle
- Decision Support Systems, and forecasting tools to predict pest/disease outbreaks and guide control strategies
- physical control methods
- biological pest control, use of functional biodiversity, use of biocontrol organisms
- use of plant support products, botanicals, bio-fungicides and bio-insecticides

### 3.1.5 Cropping systems and crop specific challenges

The yield gap that usually exists between organic and conventional farming is caused by different crop-specific factors. The main yield-limiting factor in cereals and tubers is nutrient availability, especially nitrogen deficiency. Weeds and diseases can cause major yield losses in legumes, while attacks of insect pests on oil crops may limit yields significantly. Each crop group shows variations in susceptibility to the

different yield-limiting factors. Choice of crop variety and crop species, mixing varieties or species, and the design of crop rotation will all have a major impact on crop yield and quality. In this respect, farmers have highlighted the need for tools that help them to manage conflicting goals within the farming system (e.g. weed control versus soil fertility).

### 3.2 Tools for knowledge exchange

In terms of selecting the appropriate format or type of tool, the definition of a tool as outlined in Deliverable D3.2 (Ortolani & Micheloni, 2016) was used:

A “tool” is "formatted information that is used as a means for the circulation of knowledge (on organic arable crops topics in the specific project case) among farmers and advisers, potentially also involving researchers (as source of information or as reference, but not as the primary target audience)”.

The knowledge exchange tools made available on the OK-Net knowledge platform supply technical/scientific information that can be used directly by farmers/advisers and can be shared on an internet-based platform. Besides technical information, such tools may also present links to other tools or refer to other material for specific issues or for more detailed information. Examples of knowledge exchange tools are: technical leaflets, videos, pod-casts, web-platforms with info sheets, calculation tools and decision support systems. A field day, a seminar or a field experiment are knowledge exchange tools too, but for the specific purpose of the project we did not consider tools that are not recorded or otherwise transformed in a tool that can be shared via the on-line knowledge platform. Dissemination tools (social media posts, newsletters etc.) were not taken into account either. They are considered to complement knowledge exchange tools because they can raise awareness about the tools on the knowledge platform.

The features that tools should have in order to be successful were investigated in Task 3.2 through two internet-based surveys, one addressing farmers and one addressing advisers. The full outcome is reported in Deliverable D3.2 (Ortolani & Micheloni, 2016). The conclusions from the survey are the following:

- a well-planned mix of tools has the best impact on different target groups
- internet is largely used by farmers and advisers of any age, farm size and education
- use of digital communication devices such as smartphones is increasing, but tablets are not commonly used. This requires that tools should be usable in different formats
- use of social media is growing and will have wider use in the near future. Facebook is by large the most used social medium. However, social media are not well suited to directly give technical information to farmers. Rather, they can be used to inform farmers about the availability of specific new technical information
- Most used tools are printed publications, newsletters and social media, less relevant are blogs, internet fora and podcasts
- Online videos are mostly used by younger farmers
- Videos can reduce the language barrier with the help of images and are a more direct way of communication, which is appreciated by farmers. This is confirmed by the outcome of the Farmer Innovation Group workshops (Bliss et al., 2017; D2.2). Visual social media (e.g. Instagram and Pinterest) have similar potential
- Apps are not frequently used, nor downloaded. Their effectiveness is questionable
- Podcasts and agricultural radio programmes are not widely available or used at present, but may have high potential
- Language remains a barrier to knowledge exchange among farmers and advisers in Europe.

### 3.3 Farmer Innovation Group workshops

Between June and October 2015, the 14 Farmer Innovation Groups held workshops to identify the specific needs of farmers and advisers in terms of topics and preferences for tool type (see Cullen et al., 2016;

D2.1). The overall outcome from the workshops is that needs are varied and depending on local context. Yet, three topics were ranked as highly relevant by all the groups: 1) weeds management; 2) soil fertility and 3) pest and diseases.

Concerning the preferences in terms of format and type of tools, the groups identified as important factors for effective information sharing:

- **Pratical information**: all groups expressed the need for practical information and highlighted the fact that research outputs often fail to meet these needs and conflicting research results can lead to confusion.
- **Time**: Farmers clearly expressed the need for information that can be consumed quickly and easily. More than one group mentioned "information overload" being a problem and asked for material that is trustworthy, practically oriented and presented in an accessible format.
- **Context specific information**: the capacity of a knowledge platform to offer answers to site- and system-specific needs (e.g. variations of farm size, variations in crop production and management practices etc.) was identified as crucial. Because of this request, farmer innovation groups were offered the possibility to adaptat (and translate) existing tools and test a number of tools in practice (i.e. in their own conditions)
- **Trust**: it is worth considering how online methods can demonstrate the reliability and authenticity of information as trust is an important factor in terms of uptake and adoption of new methods, practices and approaches.

# 4. Tool selection process

### 4.1. First offer of tools

The first offer of 30 tools (see Annex 1) was selected from a pool of 165 tools based on a set of criteria identified by the Steering Committee (meeting of 3 March 2016). First, it was checked for each tool if it addressed topics raised by deliverables D2.1 (Cullen et al., 2016) and D3.1 (Niggli et al., 2016). Tools that didn't address topics raised in both deliverables were excluded. Secondly, the remaining tools were rated for 7 criteria, from 1 to 4 (see Table 1). The tools with the highest scores were included in the offer.

**Table 2:** seven criteria for tool selection resulting in first offer (scored on a scale of 1 (=poor) to 4 (=good))

| Criterion | Evaluation scores |
|---|---|
| **Type of tool** | 4 =practical format, type of tool preferred by farmers; 1 = format not preferred by farmers, not practical, time-consuming |
| **Provision of practical information** | 4 =for good amount of practical information; 1= limited practical information |
| **Language (English)** | 4 = if available in English, 2 = if not; |
| **Availability in multiple languages** | 4 = at least available in 2 languages; 0 =available in 1 language only; |
| **Suitability for manual translation** | 4 = very easy, for example in the case of large use of tables and figures; 1 not easy at all, for example in case of long text and specific terminology; |
| **Suitability for automatic translation** | 4 =very easy, e.g. plain language and English original which can easily be inputted in translation engine; 1 =not easy, e.g. original text in minor language or language not much used by web translators; not easy to input text in translator engine |
| **Geographical coverage** | 4 =information valid all over Europe; 1 =information related to very specific locations. |

The selected tools were offered for assessment by the farmer innovation groups at the project meeting in Newbury (UK) on 18-19 April 2016. The outcome of the evaluation clearly demonstrated that the criteria were too complex and not leading to a selection of tools preferred by practitioners. For example, the groups expected more videos, Decision Support Systems, apps and interactive tools. Also, they said a lot of the tools in the offer was good for beginning farmers and use in agricultural schools, but not for experienced organic farmers. Finally, they stressed again that language is a serious barrier. Tools in English are not sufficient. Translation into native language is needed.

### 4.2 Second offer of tools

Based on the feedback from the Newbury meeting, the Steering Committee simplified the selection criteria. The new selection criteria mainly consider whether a tool contributes to one (or more) of the five OK-Net Arable themes. This is the only automatic exclusion mechanism. If the tool is considered relevant to one or more of the themes, the other criteria only help to assess the tool but do not per se lead to an exclusion from the offer. Fig. 2 gives a scheme of the new set of criteria.

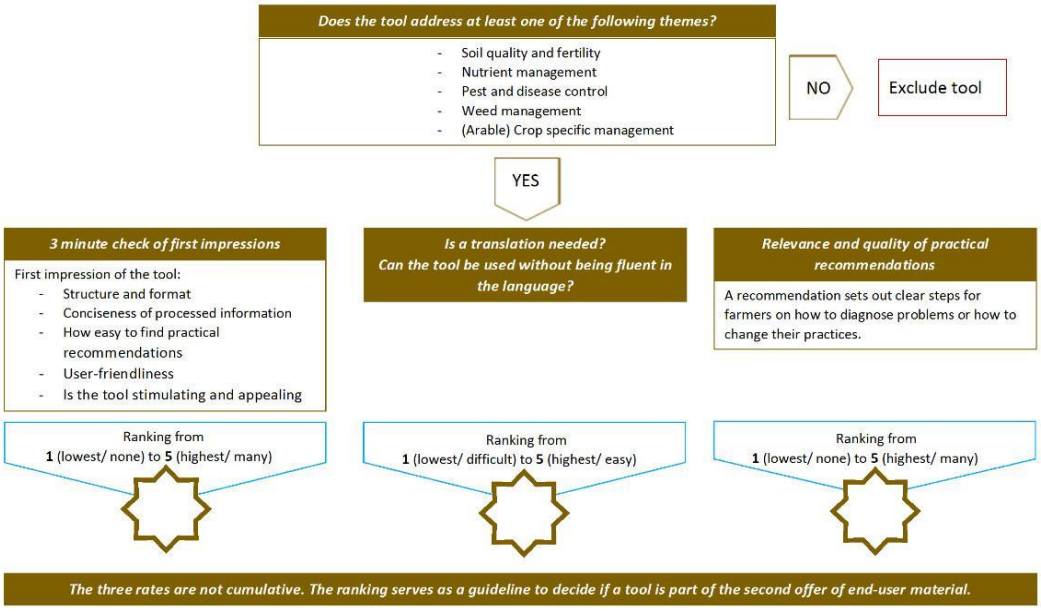


**Fig. 1:** simplified selection criteria

The new selection criteria were used to re-evaluate the tools from the first pool that did not make it into the offer. In addition, a number of new tools were selected. In April 2018, 94 tools were selected, described and made available on the knowledge platform. Table 2 classifies the tools according to theme and type. The second offer has a good balance between the 5 themes, although tools covering the theme “soil quality and fertility” have a bigger share than tools in the other themes. There is a reasonable distribution between tool type. The greatest share of tools are leaflets and guidelines which reflects the fact that most of the tools available are of this type. A special effort was made to collect videos, which makes this type of tool is also well represented. Table 3 gives an overview of the tools according to language. English is the most represented language, followed by German and French. Other languages available on the platform are: Bulgarian, Danish, Greek, Spanish, Hungarian, Italian, Dutch, Polish and Swedish. 39% of the tools are available in more than one language.

**Table 2:** number of existing tools made available on the knowledge platform per theme and tool type (April 2018)

| | Soil quality and fertility | Nutrients | Pests and diseases | Weeds | Cropping systems and crop specific | Multiple themes | **Total** |
|---|---|---|---|---|---|---|---|
| Calculation tools | 2 | 4 | 2 | - | - | 1 | **9** |
| Leaflets/guidelines | 11 | 5 | 2 | 8 | 8 | 3 | **37** |
| Books/reports | 1 | - | 1 | - | 2 | - | **4** |
| Video | 6 | - | 1 | 4 | 8 | 5 | **24** |
| Web-based/platforms | 5 | 2 | 3 | 2 | 2 | 5 | **19** |
| Other type of tool | - | - | 1 | - | - | - | **1** |
| **Total** | **25** | **11** | **10** | **14** | **20** | **14** | **94** |

**Table 3:** number of existing tools in most represented languages and number of tools in more than one language (April 2018)

| **Language** | **Number** |
|---|---|
| English | 48 |
| German | 43 |
| French | 24 |
| Tools in multiple languages | 37 |

### 4.3 Third offer of tools

The third offer of tools consists of the tools produced by the project partners as part of the project activities. This includes translations/adaptations of previously existing tools, as well practice abstracts, and videos that were made to report on the practical testing activities.

#### 4.3.1 Translation of tools

Table 4 gives an overview of the tools that were translated by the project partners. In some cases, the tool was also adapted to local growing conditions. In total 28 tools were translated, of which 16 videos, 11 leaflets and 1 calculator tool. The most popular video was Direct Sowing of Maize which is spoken in Swiss German. Subtitles were made in German, French, English, Bulgarian, Hungarian and Italian. The most popular leaflet was "Earthworms - architects of fertile soils" which was translated into 4 languages. FiBL had already made this successful leaflet in 3 languages (German, French, English) which means it is now available in 7 languages. A description of the video and the leaflet is provided in section 5. In terms of themes, tools related to soil quality and fertility (9 tools), weed management (7 tools) and cropping systems/crop-specific issues (9 tools) were most popular. Only 2 tools related to nutrient management were chosen (Cover crop and living mulch toolbox; The spade test), and 1 tool about pest and disease control (Control of wireworms).

**Table 4:** overview of tool translations

| **Title** | **Original language** | **Translated into** | **Project partner** | **Tool type** |
|---|---|---|---|---|
| Control of wireworms in organic potato cultivation | Swiss German | German, English, Hungarian | FiBL, ÖMKI | videos |
| Cover Crop (Rye) and No-Till System in Wisconsin | English | Bulgarian, Hungarian, Italian | Bioselena, ÖMKI, AIAB | videos |
| Cover crop and living mulch toolbox | English | Danish, Estonian, French | SEGES, Estonian Foundation Organic Farming, ITAB | Calculator |
| Creeping thistle | German | English, Estonian, Hungarian | ORC, Estonian Foundation Organic Farming, ÖMKI | Leaflets/guidelines |

| | | | | |
|---|---|---|---|---|
| Crop Management of Rapeseed and Pollen Beetle Control | German | Hungarian | ÖMKI | videos |
| Direct Sowing of Maize | Swiss German | German, French, English, Bulgarian, Hungarian, Italian | FiBL, Bioselena, ÖMKI, AIAB | videos |
| Dock control | German | English | ORC | Leaflets/guidelines |
| Earthworms - architects of fertile soils | German | Bulgarian, Danish, Dutch, Estonian | Bioselena, SEGES, BioForum VL, Estonian Foundation Organic Farming | Leaflets/guidelines |
| Green manure and cover crops in organic agriculture: general introduction | French | English, Dutch | ITAB, BioForum Vlaanderen/INAGRO | Leaflets/guidelines |
| Green manure and cover crops in organic agriculture: guide to the choice of the species | French | English, Italian | ITAB, AIAB | Leaflets/guidelines |
| Hairy Vetch – an Excellent Green Manure for Dry Conditions | English | Hungarian | ÖMKI | videos |
| Incorporating Green Manures | French | English, German, Hungarian | FiBL, ÖMKI | videos |
| Intercropping grain peas with barley | Swiss German | German, French, Hungarian | FiBL, ÖMKI | videos |
| Ley Destruction with Shallow Ploughing or Cultivators | Swiss German | German, English | FiBL | videos |
| Mechanical Weed Control in Maize | French | English, Hungarian | FiBL, ÖMKI | videos |
| Mechanical weeding in arable crops | French | English | ITAB | Leaflets/guidelines |
| New ways of stubble cultivation | Swiss German | German, Hungarian | FiBL, ÖMKI | videos |
| Organic cereals | German | Hungarian | ÖMKI | Leaflets/guidelines |
| Organic potato production | German | English | ORC | Leaflets/guidelines |
| Perennial weed control in organic agriculture | Swiss German | German, English, French, Hungarian, Italian | FiBL, ÖMKI, AIAB | videos |
| Processing Quality of Organic Wheat | Swiss German | German, French | FiBL | videos |
| Reduced Tillage Stubble Incorporation - Comparison of Different Machine Types | Swiss German | German, English, Hungarian | FiBL, ÖMKI | videos |
| Reduced Tillage Systems - Practical Recommendations | English | Hungarian | ÖMKI | videos |

| | | | | |
|---|---|---|---|---|
| Satellite based and camera-controlled steering systems | Swiss German | German, English | FiBL | videos |
| Successful cultivation of grain legumes mixed with cereals | German | Bulgarian | Bioselena | Leaflets/guidelines |
| The basics of soil fertility | German | English, Italian | ORC, AIAB | Leaflets/guidelines |
| The Spade test - Visual soil assessment in the field | Swiss German | German, English, French, Hungarian, Italian | FiBL, ÖMKI, AIAB | videos |
| Weed control in organic farming through mechanical solutions | German | Estonian | Estonian Foundation Organic Farming | Leaflets/guidelines |

### 4.3.2 Practice abstracts

The practice abstract (PA) is a new tool developed within the project, based on the common template provided by EIP-AGRI. However, project partners felt that the actual template of EIP-AGRI (in excel) is too limited. The possibilities for structuring the text are limited, and it is not possible to include pictures or graphical elements. Therefore, OK-Net Arable developed a 2-page template. The main elements of the common template have been maintained (problem, solution, outcome and practical recommendations). But an "applicability box" with guidance on the conditions in which to apply the practice, as well as instructions for testing and sharing the practice have been added. See here for an example of a practice abstract on the comb harrow, which is available in English and Bulgarian.

In response to the request for site/system specific information brought forward by the farmer innovation groups (see above) several PAs have been compiled on the same topic by different groups, considering different conditions and systems. For example, the technique of direct sowing of summer crops (maize, soybean or sunflower) into green manure with a roller crimper has been presented in three different practice abstracts.

The practice partners also carried out some practical testing of specific approaches or equipment of their choice, not necessarily based on tools included in the first or second offer. Each group was free to choose what they wanted to test as part of their project activities. Each group shared their experience, including any data gathered in the field, through one or more practice abstracts, and sometimes also video. In April 2018, 43 practice abstracts had been produced, of which 11 as a result of the practical testing activities by the farmer innovation groups. These 11 practice abstracts are included in the database, but are also available on the "Farm knowledge sharings" page of the knowledge platform that has been created to report about the results of the practical testing activities. In line with the needs of the farmer innovation groups as reported in D2.1 (Cullen et al., 2016), the biggest share of practice abstracts addressed topics related to weed management (see Table 5). All practice abstracts are at least available in English and usually also in one (or more) other languages (see Table 6).

**Table 5:** overview of practice abstracts

| **Theme** | **Number** |
|---|---|
| Soil quality and fertility | 3 |
| Nutrient management | 5 |
| Pest and disease control | 5 |
| Weed management | 13 |
| Cropping systems and crop specific | 7 |
| Multiple themes | 10 |
| **Total** | **43** |

**Table 6:** overview of languages of practice abstracts

| Theme | Language (number) |
|---|---|
| Soil quality and fertility | English (12), German (2), Italian (4), Dutch (1), Bulgarian (1) |
| Nutrient management | English (10), German (2), Danish (1), Dutch (1) |
| Pest and disease control | English (7), German (5) |
| Weed management | English (20), German (6), Italian (5), Dutch (3), Bulgarian (1) |
| Cropping systems and crop-specific | English (8), German (5), Italian (2) |

### 4.3.3 Videos

As a result of the practical testing activities, 7 videos were produced by the practice partners. Some videos describe the whole experiment that was carried out and its results, other videos are limited to the main outcomes and take-away messages for farmers. All videos are available on the Farm knowledge sharings" page. FiBL Austria did not carry out practical testing, but did produce a video explaining the most important things to know for successful organic soybean production. The video is in English and the title is "Organic Soybeans – Made Easy!". That video as well as the video produced by ORC on the NDICEA tool (see Table 7) have been added to the database of the knowledge platform.

**Table 7:** overview of videos made by project partners as a result of practical testing

| Title | Theme | Language | Made by partner |
|---|---|---|---|
| Direct seeding mulch-based cropping systems | Soil quality and fertility, Weed management | English, Italian | AIAB |
| Comb harrow for weed control in organic agriculture | Weed management | English, Bulgarian | Bioselena |
| SEMINBIO®: Innovative seeder for weed control in cereals | Weed management | English, Italian | ConMarcheBio |
| New harrow machinery in organic cereals | Weed management | English, Dutch | Bioforum Vlaanderen and Inagro |
| Multispectral remote sensing for organic wheat variety trials | Soil quality and fertility, Nutrient management, Weed management | English, Hungarian | ÖMKI |
| The WUZI dock-cutter- a potential strategy for managing docks in pastures | Weed management | English | SEGES |
| NDICEA- A digital tool to model nutrient balances across a crop rotation | Nutrient management | English | ORC |

## 5. Preferred tools

Some tools were liked by several farmer innovation groups and were frequently viewed on the knowledge platform. Their popularity was also evidenced by the fact that they were translated and adapted by several farmers groups. In this chapter, five examples are described in order to understand the reasons for their success, and how they respond to the needs of the farmer innovation groups.

1. **Organic Cereals** (available here)

**Original language**: German

**Translation by OK-Net Arable**: Hungarian

The leaflet gives detailed and to-the-point instructions for successful cereal production, both for food and feed. Farmers can learn how to improve quality, relying on the provided criteria for variety choice. Techniques and practical recommendations for crop rotation, nutrient supply, manure amendments, sowing, undersowing, pest and disease control, weed management, harvest, and storage are given. The leaflet also provides additional information and contacts for variety testing, seedbanks and breeding in the Swiss context.

Key features of success:

- short texts, well structured
- based on scientific information but rich in practical hints
- even if very much linked to Swiss conditions, it tackles issues that are relevant wherever cereals are grown

2. **Green manure and cover crops in organic agriculture: guide to the choice of the species** (available here)

**Original language**: French

**Translations by OK-Net Arable**: English, Italian

It is one of two dossiers produced by ITAB about green manures and cover crops. This one helps farmers choosing the right species. It provides detailed and practical descriptions of 42 cover crop/green manure species, with assessment of all aspects (including economics), requirements and outputs of the crop. The dossier is well illustrated and the synthesis is very clear.

Key features of success:

- short texts, well edited
- easy to use also for persons not fluent in French
- the topic is of high interest and there is big need for this kind of information.

3. **Cover crop and living mulch toolbox** (available here)

**Original language**: English

**Translations by OK-Net Arable**: French, Danish, Estonian

This toolbox was produced in the framework of the FP7 "OSCAR" project by the Technische Universität München (TUM) in collaboration with other project partners, including ORC. The toolbox aims at making scientific literature and technical information on cover crops and living mulches widely available. It fits to skilled farmers as well as newcomers. It is structured in a series of questions that help selecting the right cover crop/mulch species in relation to geographical region, soil, and crop characteristics and use. The toolbox also provides information about appropriate species mixtures, appropriate machinery and management, and includes economic considerations.

Key features of success:

- cover crops and their role in crop rotations is an important issue in all parts of Europe
- the structure, based on specific practical questions and answers, facilitates the use as the reader can skip the parts s/he is not interested in and focus only the questions that are relevant
- limited language barrier thanks to short texts and use of images

4. **Earthworm: architects of a fertile soils** (available here)

**Original languages**: German

**Translations by OK-Net Arable**: Dutch, Danish, Bulgarian, Estonian

This is a technical guide that shows the impact of earthworms on soil quality, their interactions with other soil organisms and the influence of farming practices on their population. It provides an overview of the biology, ecology and multiple services of earthworms. Agricultural practices are recommended to enhance earthworm populations, e.g. alternatives to intensive soil tillage and the use of ploughs, minimising ground pressure and soil compaction. Finally, a method for estimating the earthworm population in the soil is explained which offers a proxy for the state of soil quality.

Key features of success:

- very practical and easy to use
- good images

**5. Direct Sowing of Maize** (available here)

**Original languages**: Swiss German

**Translations by OK-Net Arable**: German, English, French, Italian, Bulgarian, Hungarian

In organic farming, the plough is generally used in maize cultivation because it provides a simple way to control weed. Unfortunately, regarding soil erosion, compaction and runoff, ploughing is especially harmful in maize cultivation. Direct sowing of maize could largely solve these problems. This video presents the technique of direct sowing of maize. Based on tests by FiBL, the video shows that under optimal conditions, the direct sowing of maize in organic farming is possible without significant yield losses.

Key features of success:

- Important topic: how to combine minimum tillage and direct sowing with organic management
- reduced language barrier because spoken word is supported by images
- short enough to be seen on smartphone and in a break

## 6. Conclusions

The exercise of collecting tools from different sources showed the large amount of available knowledge and experiences and the large potential to improve its dissemination, use and further elaboration. What also became clear is the difference in quality of tools, both in terms of content (reliability, scientific soundness, implementation potential…) and in terms of user-friendliness. This makes it essential to use a set of selection criteria able to identify what users need, so avoiding "information overload". In this regard, the selection process made clear that a too complex set of selection criteria, based on a rigid scientific methodology risks to be misleading. The simple set of selection criteria, on the other hand, allowed to identify tools with high potential to be used and shared by practitioners. This is proven by the interest of the farmer innovation groups in translating and testing several of the tools so identified.

At the time this report was finalised, 139 tools were selected or produced by the project of which 133 tools had already been added to the knowledge platform. They include 26 videos, 37 leaflets/guidelines, 9 calculation tools, 19 web-based tools, 1 power-point presentation, 4 books/reports and 43 practice abstracts. Concerning themes: 45 tools deal with soil quality and fertility, 27 with nutrient management, 24 with pest and disease control, 42 with weed management, 34 with issues related to cropping systems or specific crops Several tools deal with more than one theme. Looking at languages, English and German are the main languages, but also French, Italian, Dutch, Danish, Bulgarian, Hungarian, Spanish, Polish, Greek and Swedish are represented. Several tools are in two or more languages.

Some topics are widely covered by research and a large body of practical experience exists (e.g. soil assessment, preventive measures for weed management). Other topics are relatively new, only implemented to little extent or very site-specific so there is still room for more tools to facilitate their implementation. These are intercropping, new machines for soil management and weed management, and

combination of conservation tillage with organic farming. Other topics still need more research before tools or end-user material can be produced (e.g. techniques for improving P availability).

Concerning the type of tool, audio tools (e.g. pod-casts) are totally missing on the knowledge platform. There are only few specialized audio tools for agriculture (organic and conventional) but considering the use mode -while working on the tractor, in the breaks, via smartphone- they have a clear potential for sharing farmer experiences and disseminating good practices. It is possible that a specialized set of pod-casts or even a radio channel for organic farmers could achieve good outreach, as experience from Italy indicates, but language will be a strong barrier for cross national use.

In order to allow farmers and other professionals to fully exploit the knowledge base, a combination of tools works the best. Such a combination of tools allows for a stepwise increase of knowledge, adapted to the respective needs of farmers and end-users and their available time.

Language remains a barrier for the exchange among practitioners. This needs to be considered in the design/format of the tools and also in the structure and facilities of the knowledge platform. This implies, on one side prioritising tools that can be used also by people not fluent in the original language and, on the other hand, considering the possibilities for tool translation. In this context, videos and concise guidelines (leaflets, brochures) with pictures and graphic schemes are most suitable.

## 7. References

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# Annex 1 – First offer of 30 tools presented at the project meeting in Newbury on 18-19 April 2016

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|---|---|
| | **Pest and disease control** |
| 1 | ECOPHYTOPIC – The portal for integrated crop protection of arable crops |
| 2 | Atlas of agricultural entomology -a knowledge base of pest insects |
| 3 | FusaProg: risk assessment of fusarium and mycotoxin infestation for wheat production |
| 4 | Agrometeo: webapp for pest prognosis and risk assessment |
| 5 | Database for ecological pest management |
| 6 | Description of biological control agents and agroenvironmental measures for plant protection |
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| | **Soil quality and fertility** |
| 7 | Earthworms: architects of fertile soils |
| 8 | Soil quality test kit: visual assessment of soil quality and soil properties |
| 9 | Visual soil assessment: field guide |
| 10 | Green manure and cover crops in organic agriculture |
| 11 | Sort Out Your Soil: A practical guide to green manures |
| 12 | Muencheberg soil quality rating: visual method for assessment of soil properties |
| | |
| | **Nutrient management** |
| 13 | Knowledge exchange platform for agroecology |
| 14 | ROTOR: organic crop rotation planner |
| 15 | Cover crop and living mulch tool box |
| 16 | Nutrient management in farms in conversion to organic |
| 17 | Bioaktuell: web platform for nutrient management |
| 18 | Humus balance in organic farming |
| | |
| | **Weed management** |
| 19 | Mechanical weeding in arable crops |
| 20 | Weed management on organic farms |
| 21 | Bringing the dirt to your doorstep: organic no-till weed management |
| 22 | Tilman-org: videos on reduced tillage in organic farming |
| 23 | Bioaktuell: web platform for reduced tillage |
| 24 | Agricultural machinery as solution against weeds in organic agriculture |
| | |
| | **Crop-specific tools /miscellaneous** |
| 25 | Risk management for small grains |
| 26 | Guidelines for pest and disease control and weed management in organic farming and crop-specific production recommendations |
| 27 | A farmer's guide to organic fruit and vegetable production |
| 28 | Practical advice for organic production of lupines |
| 29 | Criteria and management recommendations for organic cereal production |
| 30 | Oekolandbau.de: portal for organic plant production |