

# Strategies for Organic and Low-input Integrated Breeding and Management



October 2011

## Newsletter 1

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Collaborative Project  
(large-scale integrating project)

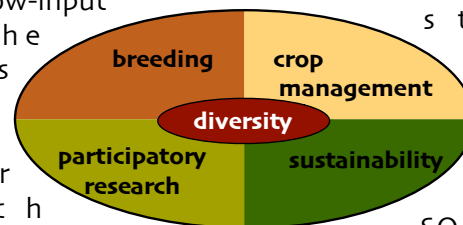


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## The rationale of SOLIBAM

Veronique Chable (INRA - Project co-ordinator)

This is the first in a series of newsletters, which aim to outline the activities of the SOLIBAM consortium. The overall objective of SOLIBAM is to develop specific and novel breeding approaches integrated with management practices to improve the performance, quality, sustainability and stability of crops adapted to organic and low-input systems. The project is founded on the concept of diversity. Our research hypothesis is that



developing diversity at all levels is the best strategy for improving the capacity for crops to adapt to fluctuating environmental conditions and for increasing yields and yield stability in organic and low-input systems. Diversity is also a characteristic of the consortium members, who bring a wide range of competencies and scientific approaches, farming systems experience, climatic conditions and cultural backgrounds. The partners come from 12 countries, representing many different regions from the North of Europe to Africa and our consortium represents most of

the disciplines needed to explore and sustain diversity in the field.

During this first stage of the project, we have succeeded in building a cohesive team approach. The diversity of members has led to the development of what we may call: "the SOLIBAM strategy". From the first annual meeting,

the definition of our strategy incorporated both scientific and organisational viewpoints: In SOLIBAM we are combining many disciplines and values with the aim of increasing system diversity and participatory methods. In addition to developing techniques and assessing quantitative and qualitative data, transdisciplinary thinking is central to the success of SOLIBAM.

In this first newsletter, we offer an overview of all the disciplines involved in the development of an innovative sustainable strategy for producing quality crops and appropriate processes for the food supply system based on PPBM (Participatory Plant Breeding and Management) and diversity at all levels.

# Identify traits for organic/low-input systems

Workpackage 1

Frederic Rey (ITAB)

## Diversity of contexts is fundamental in Solibam: a national chapter for each country involved

Describing the range of geographical and cultural backgrounds to organic and low input crop production is one goal of the Solibam project, as this kind of data has not been collected yet, neither in Europe or in other Solibam member countries. The national chapters provide a first step to defining the various situations in terms of agro-ecological conditions, seed regulation and the organic seed sector. All partners have contributed to this activity by completing a "common questionnaire" in 2010. The compilation of this data is in process and is being carried out by ITAB, the lead organisation for this task (T1.1).

## A survey of stakeholder's expectation

There is a lack of varieties adapted to organic systems in the agricultural sector. Within the framework of Solibam (T1.1), a survey was undertaken to determine the important traits specific to organic and low input farming for cereals including wheat, and for horticultural crops including tomatoes. The survey also aims to describe organic stakeholders' expectations in plant breeding over a wide range of different agro-climatic conditions in Europe and Africa. The result of this study will be to provide data where existing published information is scarce, for example: identification of the varieties currently grown by the organic/LI producers; reasons for their variety choice; producers' expectations for organic varieties. Most of the published papers dealing with organic plant breeding programs concern cereal crops (Lammerts

et al. 2008, Goldringer et al. 2010). Papers on horticultural crops are limited and those on organic stakeholders expectations are even fewer. The recent State of Organic Seed report (USA) is an exception which can nevertheless be highlighted; based on stakeholder surveys it analyses the challenges and opportunities in building the organic seed sector (Dillon & Hubbard 2011).

In our study, as a first step, a qualitative survey (with open questions) was implemented in six different countries: Ethiopia, France, Germany, Italy, Mali and Portugal. This work aimed to identify the key research questions/hypotheses within both a European and African perspective as useful plant traits for organic/LI agriculture may differ considerably from one country to another depending on the agro-ecological conditions and on the market. As an example, two main market categories have been clearly identified from the French stakeholders' answers. These categories and results fit with the hypothesis that the market is a significant factor influencing the choice of seeds and varieties. Expectations and practices of producers selling on a local market (i.e. direct sale) differ radically

from those of producers selling to large retailers. For vegetables, the impact of nurseries is considered as a major factor, and this issue needs more investigations. The final analysis of this work is expected in late 2012.



Tomato seedlings tested in Italy in WP3

**Acknowledgments:** The following persons are involved in this WP1 (T1.1) work; they have contributed to the methodology and have implemented this survey in their own countries: Riccardo Bocci (Italy, Associazione Italiana per l'Agricoltura Biologica), Hans-Jürgen Reents (Germany, Technical University of Munich), Isabel Dinis, Daniela Santos and Pedro Mendes Moreira (Portugal, Escola Superior Agraria de Coimbra), Salif Foulani Sissoko (Mali, Coordination Nationale des Organisations Paysannes du Mali), Fetien Abay and Abdelkadir Kedir (Ethiopia, Mekele University).

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Broccoli varieties tested in France and Italy in WP3 and participatory quality assessment in France



## Identify and monitor genetic diversity

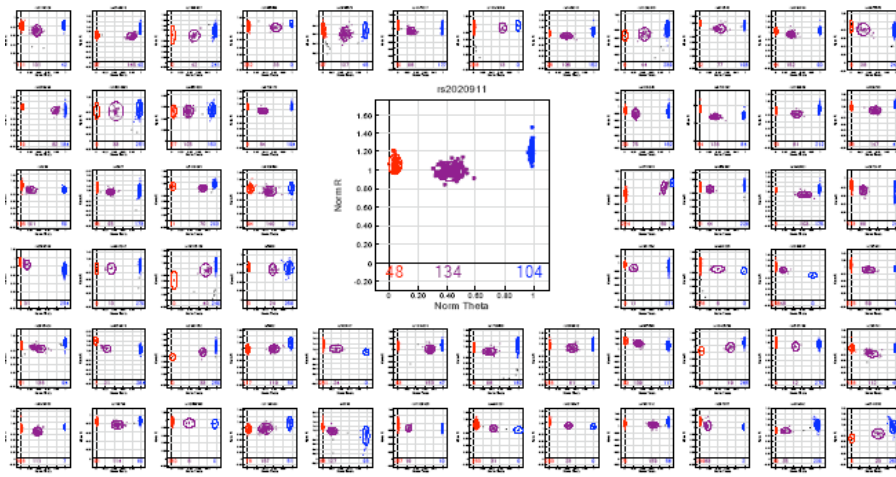
Workpackage 2

Isabelle Goldringer (INRA)

Because breeding for organic or low-input (LI) farming implies working with complex traits controlled by many genes interacting with each other and with complex and variable environments, new approaches are needed to appropriately integrate the most recent biotechnology tools into specific breeding for organic and LI conditions. WP2 objective is to renew the genetic concepts of plant breeding for organic and LI agriculture, by associating knowledge from genomics, quantitative genetics, population genetics and epigenetic approaches to phenotyping under different organic and low-input crop management systems. In contrast to the usual approaches where associations between molecular markers and phenotypes are studied in

a specific design optimized for their detection (QTL mapping), WP2 focuses on populations and plants developed for organic or LI systems under specific systems (i.e. plant breeding scheme x crop management) in WP3, 5 & 6.

In Task 2.1, WP2 is identifying and checking for polymorphisms in breeding populations developed in WP3, WP5 & WP6 using three relevant types of molecular markers already available: (i) neutral or background DNA markers, (ii) markers related to epigenetic states and, (iii) markers in candidate genes. Different species important in the SOLIBAM project are being studied: wheat (winter and durum wheat), barley, maize, bean, broccoli and, tomato. Individuals from maize, bean, barley, wheat and broccoli populations have been



Illumina GoldenGate Output: Multiple SNPs at Once (G. Pea, SSSUP)

sampled and DNA extraction is completed or in progress. Depending on the species, microsatellite or SNP will be used as background neutral markers. Illumina Golden Gate assay has been tested by SSSUP partner on the parents of a CCP populations (WP3) and it gave a satisfactory rate of polymorphism. The list of key candidate genes for the different species is under development based on the literature. Markers of the epigenetic state (methylation) are under development in broccoli (UNIPG) and in wheat for a specific vernalization gene (INRA).

In Task 2.2, the resulting polymorphic markers will be used to assess the evolution of genetic diversity under different

crop management systems x agro-climatic conditions to better understand the responses of different kind of populations (e.g. composite cross populations vs mixtures) to different selection practices, and to develop strategies for maintaining appropriate levels of diversity within the populations/ varieties. Their efficiency in monitoring the evolution of diversity under selection will be evaluated and compared. Original association methods will be developed to apply within and between the breeding populations in order to identify genetic and epigenetic markers associated with phenotypic responses to selection pressures (agro-climatic conditions, crop management systems, selection practices).

Phenotypic responses will be assessed considering both specific adaptive traits (such as drought resistance) and more general adaptation features. The potential role of a few selected candidate genes will be further analysed through transcriptional characterisation of the genes in contrasting genotypes. The levels and

variability of outcrossing in populations will be assessed in relation to the different agroecological conditions in order to develop strategies to increase and maintain heterozygosity and heterogeneity, and thus the buffering capacity, within the populations, increasing the potential for movement of plants between agroecological zones in response to climate change.

In Task 2.3, multivariate approaches to selection responses and methods for association studies in breeding populations will be developed. Based on the insights obtained on the genetic and epigenetic mechanisms involved in adaptation to organic and LI farming, appropriate strategies incorporating marker assisted selection (MAS) at different levels will be proposed. Multivariate approaches will be used to assess the selection strength of various traits under different conditions and to predict selection responses. The results obtained on the molecular diversity of all populations will be discussed during a common meeting at month M40 with all the partners that have been involved in the development of the populations in other WPs (e.g. WP3 and WP5) and also including the partners who are not directly involved in WP2.



Wheat seedlings - INRA Le Moulon (France)

## Exploitation of diversity in breeding

### Workpackage 3

Sally Howlett (ORC)

The focus of Solibam WP3 is the 'Exploitation of Diversity in Breeding'. This work package incorporates trials of a number of vegetable and arable crops in a wide range of countries. The objective is to increase and utilise diversity in crops in both organic and low-input systems in order to improve their yield and quality at the same time as dealing with increasing environmental variability. Diversity encompasses both novel sources, such as synthetically created lines with new genomic structures, and existing sources, such as landraces, variety mixtures and populations; all are included in the Solibam approach. The relative strengths and weaknesses in performance of crops containing differing levels of diversity are being compared in the WP3 trials. The findings will also feed into other workpackages, including those centred on elucidating the underlying genetics of adaptation (WP2), the role of management in utilising diversity (WP4) and evaluating the organoleptic characteristics of the crops produced (WP7).

A key driver for WP3 is the need for crops bred specifically for organic and low-input systems. Currently, commercially available varieties have largely been developed for performance under high-input conditions and they often fail to achieve acceptable and reliable yields in more heterogeneous organic and low-input environments. Furthermore, increasingly unstable weather patterns put more demands on crops, which require a greater capacity for adaptability if they are to be resilient to and perform reliably under such conditions.

The crops involved are broccoli, common bean, cabbage, tomatoes, maize and cereals (winter wheat, durum wheat, einkorn, emmer and barley). The trials include a large number of Solibam partners in three subtasks:

#### A) Population development

Novel populations are being developed in broccoli (calabrese type), durum, einkorn, emmer and bread wheat using different techniques to intercross a wide range of genetic resources. The populations will be trialled against modern lines; this part of the WP is led by Véronique Chable (INRA) and Geza Kovacs (HAS). Broccoli trials are already underway at three French sites and the novel cereal populations are currently being bred and multiplied for inclusion in project years 2-4 (2011-12).

#### B) Comparison of breeding strategies

A larger number of crops are included in comparisons of breeding strategies in winter wheat, barley, common bean, sprouting broccoli, cabbage, maize and tomato. Led by ORC, the trials compare genotypes representing different breeding strategies (populations, mixtures, landraces and pedigree lines) in varied geographical locations in Europe and sub-Saharan Africa. A major assumption to be tested is that reliability will be correlated with increased within-crop diversity. Trials started in 2010 and will continue through to project year 4.



Wheat - evolutionary population (Italy)

#### C) Integrating the new and existing approaches

The idea here is to integrate the best populations with the best in pedigree line breeding. The trials focus on winter wheat and are being carried out in Hungary (HAS), Austria (DONAU) and the UK (ORC) in all project years. The hope is that mixing pure line varieties with populations will simultaneously combine the benefits of high performance and diversity in a flexible way, which could also extend the useful life of a variety

## Exploiting diversity in crop management

### Workpackage 4

Paolo Bàrberi (SSSUP)

Our goal is to design, develop and test innovative arable and vegetable cropping systems based on a high level of agrobiodiversity. This means diversification within and between crop species, management and habitat, coupled with use and development of genetically diverse germplasm. Our activities are deployed across a range of different pedo-climatic conditions in Europe and Sub-Saharan Africa. The degree of diversification and typology of interventions differ from place to place depending on the prioritisation of crop features as well as on local opportunities and constraints, but common treatments across sites are being used wherever possible.

WP4 is structured into four tasks. The first aims to design novel organic and low-input cropping systems based on optimum use of agrobiodiversity by simultaneously taking into account the genotype, environment and management components altogether. The hypothesis is that cropping systems based on higher genotype, species and/or management diversity would increase crop yield, yield stability, produce quality, soil fertility and weed suppression. Experiments will make use of genetically diverse germplasm (wheat, maize and tomato) developed by SOLIBAM partners. When



SSSUP wheat trials - Pisa (Italy)

highly diverse germplasm is not available, increased agrobiodiversity at the species and/or variety level (e.g. crop rotation, cover crops, intercropping, variety mixtures) and at the management/habitat level (e.g. tillage, sowing method, weed management, non cropped areas) will compensate for this. These experiments will highlight the feasibility of using cropping system diversification as an effective strategy to improve crop performance, quality traits, and the overall

sustainability of the systems. A common set of parameters will be measured across all experiments to ensure homogeneous evaluation of cropping system effects on key traits. Data and samples collected in WP4 experiments will feed the global performance analysis of highly diverse germplasm (WP1), the analysis of produce quality (WP7) and the sustainability analysis (WP8).



SSSUP wheat trials - Pisa (Italy)

The second task aims to improve performance of diversified cropping systems through (co)breeding. Plant breeding has always considered selection under monoculture conditions, thus little is known about populations grown in competition. We expect that there will be a strong selection pressure towards better adaptation to these conditions. The objective of this task is to identify genotypes adapted to diversified systems and to assess changes in morphophysiological and genetic characteristics of populations. We are identifying traits that contribute to higher competitive ability, which are necessary to obtain higher yield under living mulch systems, and we will select the best performing genotypes in cereal-legume systems. Work is being carried out on wheat, maize and common bean.

The third task is checking the effects of breeding and management diversity on arbuscular-mycorrhizal fungi (AMF). The research hypothesis is that cropping systems with higher breeding and/or management diversity are more prone to develop effective AMF symbiosis, thereby contributing to soil fertility enhancement in organic and low-input agriculture. We will identify how certain cultivars of model species of cereals and grain legumes have a better ability to associate



SSSUP wheat trials- Pisa (Italy)  
 On the left: Hungarian composite population  
 Bottom: Differences in earliness between a modern cv. (Bolero, front) and a conventional and organic composite population (back)



with AMF and form effective symbiosis, and how plant breeding methodologies may take this trait into account. Also, we are testing if diversified cropping systems including legumes as cover crops or intercrops increase AMF root colonisation of host crops and associated agroecosystem services, and whether AMF inoculation can be used as a management strategy to enhance crop productivity.

The final task is testing the effect of conservation and/or (re)introduction, and of appropriate management of linear and non linear semi-natural elements (e.g. hedgerows, field margins, small woodland patches) on production-related agroecosystem services (biological control of pests and prevention of weed invasion). The research hypothesis is that the maintenance of well structured non cultivated areas (i.e. functional biodiversity at the habitat level) promote production-related agroecosystem services and that this effect is greater in more diversified cropped fields. It is expected that the

results will also provide hints on which types of structure and management of non cropped areas (e.g. flora composition, habitat complexity, mowing and/or cultivation of field margins) are more likely to enhance these agroecosystem services.



Old wheat varieties trials - France

## Comparison of conventional/organic breeding

Workpackage 5

Geza Kovács (HAS)

The focus of Solibam WP5 is to compare the methods and the efficiency of organic breeding approaches with conventional breeding methods to be able to improve the competitiveness of organic varieties in the most appropriate way. The work package involves characterisation of the most important genetic resources of a number of autogamous and allogamous species for their possible use in organic breeding, followed by studies of the effectiveness of early stage selection under different management systems. The data obtained will support WP1 activities and selected materials will be incorporated to the different experiments and trials within WP3 and WP4. During the study of the effectiveness of early stage selection several new crosses have been developed in a large number of species, and the selection work was

initiated under different environments and management conditions in order to study their effects and interactions. The performance and yield stability of the existing varieties of bread wheat and durum wheat grown under organic and conventional systems was studied using ring tests in three different countries, and detailed studies on the resistance against common bunt were carried out. According to the time schedule the majority of the experiments are at the initial phase of development, but the first selection steps have been successfully completed. Based on the results from these existing varieties, the development of organic maintenance breeding methods has been initiated, and tests of the effect of post harvest methods for organic seed production were carried out to examine the whole process of organic variety production.



Farm days in Italy in June 2001. In the left Castellaneta (Puglia), in the right Isernia (Molise).





## Participatory plant breeding and management

Workpackage 6

Salvatore Ceccarelli and Adnan Al Yassin (ICARDA)

The objective of WP6 is to develop participatory plant breeding and management strategies to address the specific demands from marginal areas or small scale agriculture in developing countries, Europe and Africa. The difference between participatory research applied to plant breeding and management (PPBM), and conventional research is that in PPBM scientists offer farmers, end-users and consumers a number of choices (varieties, populations, management options, combinations of management options and varieties) so that farmers can select, after an adequate period of testing under their own conditions, the most appropriate option. Therefore, PPBM takes into account the diversified management practices, needs, expectations and traditions of farmers' preferences and is particularly suitable for the development of new varieties and management practices adapted to low input and organic farming. One innovative aspect that WP6 has introduced is evolutionary participatory plant breeding which is based on populations with large genetic variability, including mixtures of landraces, which can be handled directly by farmers in a multitude of environments while they slowly evolve and adapt. It is like making available, in the hands of farmers, an evolving gene bank of a given crop. One major advantage of evolutionary breeding is its simplicity and its

enormous potential to adapt crops – any crop – to climatic changes as well as other agronomic changes which might occur in the future (Ceccarelli et al., 2010). The expected outputs of WP6 are improved germplasm, populations and/or varieties, specifically adapted to these conditions that will be more easily adopted by farmers.

WP6 is organised into three components:

In Task 6.1 we analysed important experiences in participatory research. This component has assembled an inventory of 22 PPBM cases covering Wheat (5), Legumes (3), Cauliflower, Barley (6), Maize (3), Tomato, Faba bean (2), Sweet Potato, Cassava, Sorghum (3), Rice (1) Millet (1), Fonio (1) and Potato from the UK, France (2), Ethiopia, Portugal, Spain (2), Uganda, Ghana, Burkina Faso, Mali, Algeria, Iran, Eritrea, Nepal (2), Yemen, Netherlands, Nicaragua and China. The inventory has been assembled mostly through informal contacts and is currently going through a critical analysis by the partners. The results of this analysis will be useful to implement activities in other work packages.

In Task 6.2 we develop methodologies for participatory research: one of the activities has been the preparation of a Manual on PPB which will help to disseminate the methodologies for this approach. Training courses based on the manual have been conducted in a number of

Farm days in Italy in June 2001. On the left Caltagirone (Sicilia), On the right Peccioli (Toscana).





On the left: Farmers discussing barley attributes during field selection day

Bottom: The participants to the training in data analysis: from left to right Mr. Mulken Bantayehu, Mr. Dejene Kassahun, Mr. G/ Egzihabher Miruts, Mr. Molla Fentie, Mr. Afework Kebede, Dr. Ceccarelli, Dr. Berhane Lakew, Mr. Yosef Gebrehawariyat. Sitting Mr. Tamene Mideksa and Mr. Kefyalew Taye.



countries, including Ethiopia, with the participation of University of Mekelle. The manual covers a summary of the main breeding methodologies of self-, cross-, and vegetatively-propagated crops. It describes both participatory plant breeding and participatory variety selection, and discusses the detailed description of possible experimental designs and statistical analysis. The final section of the manual presents examples of multi-environment data analysis, genotype x environment interactions, variety release and seed production and examples of PPB impacts. These methodologies have been implemented in trials planted in 16 locations in Ethiopia in 2010/2011. The trials were designed at ICARDA and three types of germplasm were planted across 12 farmers' fields, of which 5 were conducted in women's farms due to their direct involvement in the decision making process of the varietal selection, and 6 Farmers Training centres. Three evolutionary populations, one on barley (based on about 1600 F<sub>2</sub>), one on durum wheat (based on

about 700 F<sub>2</sub>) and one on bread wheat (based on more than 2000 segregating populations) have been planted in many locations in Italy (Toscana, Molise, Puglia and Sicilia). Sufficient amounts of seed were harvested to distribute the populations to other farmers practising different management systems.

The objectives of Task 6.3 are (i) to identify the effects of farmer mass selection in several species and in different conditions and (ii) to measure the evolution and the adaptation of the populations in terms of genetic and phenotypic diversity. During the first period, field experiments have been set up for most species (wheat, barley, maize, bean and broccoli) in France, Italy, Portugal, Ethiopia and Mali. Germplasm has been distributed to farmers, measures have been recorded and trials have been harvested. An experiment to assess farmers' mass selection response has been carried out in France on bread wheat and the first results indicate that farmers' mass selection within populations has a significant positive impact on traits of interest. This will be assessed for more populations, other species and countries. The impact of the participatory breeding programme implementation was assessed as very positive in Ethiopia.



Participatory quality testing of tomato varieties in Italy. The test was organised in the farm involved in WP3 on tomato (Vetralla) with the participation of ARCOIRIS, AIAB, ITAB and Gautier Semences



## Breeding/management effects on crop quality

Workpackage 7

Marianna Rakszegi (HAS)

Organoleptic, nutritional and end-use properties of the breeding lines and populations developed under WP3-6 will be studied in the framework of WP7 taking into consideration the global and local needs and expectations of the consumers. Properties of plants growing at different agro-climatic conditions will be studied using different breeding techniques and crop management systems. Hedonic tests with a large panel of consumers as well as sensory analysis with trained juries will be carried out in order to select the organic cereal, legume and vegetable genotypes preferred by consumers. Nutritional properties, such as antioxidant levels, protein, starch and amylose content will also be measured to evaluate the health related effects of the organically bred lines. At the same time the impact of crop management and breeding approach (crop rotation, mulching, irrigation etc.) on the end-use quality will be studied (e.g. bread-making, pasta making), particularly taking into consideration the requirements for the production of special local products. Results will ultimately support the breeders, the agronomists, the processing industry and last, but not least, the consumers.

In the first period of the project, a methodology was developed to integrate organoleptic quality criteria in breeding programs of tomatoes, broccoli and bread. This resulted in a tasting guide which recommends four different tests and explains how to prepare samples and analyse the results. This guide gives a common starting point for all those partners who are planning to study organoleptic quality of vegetables or bread.

Adaptation and optimisation of extraction and analytical methods have also been started. Aroma and flavor compounds will be measured by SPME-GC-MS, while carotenoids, tocopherols and phenolic compounds will be analysed by HPLC.

Barley genotypes were selected for kolo production in Ethiopia and their nutritional quality ( $\beta$ -glucan, Fe, Zn) was studied. One genotype with outstanding iron (Fe) content was identified. Laboratories are awaiting the arrival of seeds expected from the harvest of 2011

## Sustainability assessment of innovations

### Workpackage 8

Michal Kulak (FDEA-ART), Mads Ville Markussen and Hanne Østergård (Risø-DTU), Laurence Smith (ORC) and Thomas Nemecek (FDEA-ART)

In work package 8 we are assessing the sustainability of a range of farm management strategies using 8 case study farms. In order to do this, we are evaluating current practices, and the resultant environmental and socio-economic impacts from the implementation of SOLIBAM strategies. We also want to know what farmers views are of the SOLIBAM strategies in addition to the food supply and legislation-related issues that can influence their adoption. The methods that are being used include Life Cycle Assessment, Energy and eMerger analysis and Cost Benefit Analysis.

The assessments are based on a number of farm and food supply case studies located in Europe, selected according to pre-defined criteria. The samples represent various European climatic conditions, different production systems and marketing schemes. What is common to all cases is a willingness to reduce farm external inputs as much as possible and to produce food in a sustainable manner.

With help from local partners, the team established contact with the case-study farms. During the visits, data on external inputs, production, financial data and distribution channels have been recorded. So far we have been to France to look at grain and bread production and in UK to investigate vegetable production and distribution.

The first French case is a small 5 ha farm that was established only 10 years ago. The main product for the farm is bread, produced



On the left: Michal Kulak, Laurence Smith and Mads Ville Markussen during the field trip in England.  
Bottom: French visit to the case studies analysed in WP8



using grain that is grown and milled on the farm.

The other farm is a well established farm of more than 70 ha that, in addition to its cereals and flour production, also produces milk and a variety of cheeses. Both farms are selling directly to end consumers and both are involved in the participatory breeding of cereals.

In the UK we have visited two stockless vegetable producers; a large farm that supplies most of its products to pack houses that distribute the vegetables to supermarkets and a small market garden with more than 70 different (!) vegetables on its 7 hectares.

With the first datasets gathered, the next step will be to feed the data into our different models while the data collection continues on more case study farms throughout Europe.

One of the biggest challenges is to adapt existing models for sustainability assessment to these highly diverse farms. As for other work packages within SOLIBAM it is a challenge to conduct research that is both relevant to the project and society in general, and is multi-disciplinary in its approach.

## Dissemination, training and technology transfer

### Workpackage 9

#### Riccardo Bocci (AIAB)

SOLIBAM dissemination activities in the first year have been focused primarily on setting up the [website](#), designing and publishing the brochure in 6 languages and organising the first round of Farm days. Partners have also participated in many international and national meetings in order to present the project and its objectives.

Farm days (see table 1 for 2010 activities) are designed to be our main dissemination tool among farmer's communities in each country. They will be held each year, to enable breeders, farmers, extension services and researchers involved in WPs to share their skills, information, and knowledge with participating and non-participating farmers. In addition, Farm days act as a forum for the discussion of project results and related topics with farmers. ITAB is in charge of the overall co-ordination of Farm days.



On the left: Farm day in Italy in June 2010.  
Bottom: Farm day in France in September 2010.



Table 1 - 2010 Farm days in the different countries

Country	Date 2010	Visit	Species	People involved
France	September 9	Research Regional platform on farmers' varieties (Association AgroBio Périgord)	Maize	Farmers, association's animators, researchers, local politicians
	October 8, 9 and 10th	Salon Ile et Bio ( by the association Culture Bio and the Triptolème)	Wheat	Farmers, association's animators and volunteers, researchers, local politicians
	September 10th	Fête de la vache nantaise (involvement of the association Triptolème and INRA in the fair)	Wheat	Farmers, researchers, association animators and volunteers
Austria	June 30th	Visit to the farm of Gerhard Hof	Winter wheat	Saatbau Linz ( <a href="http://www.saatbaulinz.at">www.saatbaulinz.at</a> ), seed producing farmers for Saatbau Linz, and Saatzucht Donau
Portugal	June 4th	APCC association	Maize	Some farmers involved in the trials, the farmer (Mr. Francisco Meireles who still run the PPB programme since 1984) and the Breeder Dr. Silas Pego who started the VASO PPB programme in 1984
UK	June 15th	Wakelyns Agroforestry Open Day	Beans	Local farmers and growers, ORC staff.
Italy	June 1st	Visit to the farm of Rosario Floriddia (collection of wheat landraces).	Wheat, barley	Farmers, Public institutions, researchers
	June 2nd	Meeting at the farm of Oriana Porfiri (collection of wheat, barley and emmer landraces).	Wheat, barley and emmer	Farmers, Public institutions, researchers
	June 4th	Visit to the farm of Andrea Pitton	Radicchio (red-leafed chicory, barley, wheat	Farmers, Public institutions, researchers

SOLIBAM has also started activities regarding training and dissemination in Africa. ICARDA and the University of Mekelle conducted a training course on participatory plant breeding in Ethiopia (April 2010). Twelve scientists from Universities and National and Regional Agricultural Centres attended the training course.

## List of deliverables published

We provide a complete list of the deliverables released until now by the SOLIBAM consortium. The ones marked with PU are public and freely downloadable from our website [www.solibam.eu](http://www.solibam.eu).



[Download the brochure](#)

- D1.1 - Methodologies to assess farmer-perceived needs and practices (PU)
- D1.5 - Determination of traits most relevant for model species (PU)
- D9.1 - Public WebSite (PU)
- D9.2 - Project brochure (PU)
- D9.4 - Printing of the Tasting Guide booklet (PU)
- D9.7 - Report on the outcomes of the farm days in 2010 (PU)
- D10.1 - KOM minutes
- D10.2 - collaborative workspace
- D10.3 - 3rd Executive Committee Meeting minutes
- D10.3 - 2nd Executive Committee Meeting minutes
- D10.4 - 1st Annual meeting minutes

**11 TECHNICAL BOOKLETS**

Recommended tests

How to prepare the samples

How to analyze the results

**TASTING GUIDE :**  
Tools to integrate organoleptic quality criteria in breeding programs

**Authors :** Camille VINDRAS, Nicolas SINOIR  
**Reviewers :** Aude COULOMBEL, Sally HOWLETT, Frédéric REY, Bruno TAUPIER-LÉTAGE

**ITAB Solibam**  
Institut Technique de l'Agriculture Biologique

**Breeding innovation**

As worldwide food demand increases, concern over how to meet it grows. **Dr Riccardo Bocci** tells us about a research programme investigating strategies for organic and low-input breeding and management aimed at enhancing sustainability and crop performance in Europe and Africa

Firstly, could you provide an overview of the context from which the project was developed?

Low input and organic farming systems require crop varieties that are specifically adapted to these environments. The particular conditions of these systems should therefore be considered during breeding activities, not only from an agronomic and biological point of view, but also a social and economic perspective. For example, organic farmers in most cases have developed different sowing methods from those of conventional producers, relying more on local or direct sales. This means they have the responsibility to sell quality produce, usually having to diversify to include a number of crops and varieties in order to meet consumer needs.

All these requirements should be considered in crop breeding programmes, not only to increase production but also to address the breeding per management interaction, as is the case with the SOLIBAM project aimed at enhancing sustainability and crop performance.

Climate change is also an emerging issue that agricultural systems are battling and which will become a weighty burden in the future. Increasing the diversity of agroecosystems will produce more resilient agriculture, better adapted to climate change. Breeding programmes should take into account this issue, working more on population than on homogeneous varieties. Low input and organic systems constitute the perfect environment for diverse varieties or population crops to grow.

However, these changes all need a new model of breeding and SOLIBAM will support this shift. This will be seen from market-driven agricultural research - increasingly in the hands of private companies - to decentralized and participatory research where public institutions can again find their place and play a pivotal role. In this way, technical innovations and knowledge of organic farmers will be shared and enriched through breeding methods.

The general aim of SOLIBAM is to pursue diversity, trying to answer the following questions: How can we increase the diversity of our farming systems and how is this diversity related to cultural practices? What is the relation between cultural practices and varieties, and how can cultural practices (eg green manure, intercropping, weed management) impact the adaptability of all genotypes to different environments? Moreover, how could diversity be included in our seed laws that at the moment only protect, promote and allow the commercialisation of uniform varieties? And finally how is diversity related to environmental, social and economic sustainability of farming systems?

Can you outline some of the research activities that are carried out in order to achieve the aims of the project?

SOLIBAM will conduct field trials on the following species: wheat, maize, barley, tomato, cabbage, broccoli, faba beans, common beans and some African species. These trials will be conducted using organic conditions and farmer fields, other than solely in a research laboratory or station. In fact, our aim is to develop a breeding method for organic agriculture and low input agriculture that includes farmers in its process and explores genotype-environment interactions. The population of these crops will therefore be analysed in different agroecosystems using diverse technical practices such as the use of field trials and participatory breeding methods in organic and low input conditions. To this end, innovative tools such as molecular markers will be added to assess and monitor the diversity in varieties and population. The SOLIBAM farms will also be evaluated to gauge their socio-economic and environmental impacts.

Specific attention will be paid to dissemination and training activities, which will be targeted to different audiences: farmers, scientists, extension services, policy makers and consumers.

Could you explain the use of 'farm days' within your dissemination strategy? How are these events conducted and how do they help in the project to fulfil its objectives?

Farm days will act as the main tool for the dissemination of project outcomes among farmer communities. They will be held separately in each country twice per year to enable breeders, farmers, extension services and researchers involved in the work packages to share the skills, information, and knowledge generated with neighbouring, non-participating farmers. These days will also be used to distribute project booklets and other material from the stakeholder congresses and as a space for discussion of both the project results as well as other related topics with farmers.

[Download the English version of the Tasting guide](#)

[Download the article](#)

## Next meetings and events

- 15 -16 September - Pisa (IT) - SOLIBAM WP4 Workshop
- 26-27 September - Seoul (South Korea) - IFOAM Organic seed pre-conference
- 28 September - 1 October - Seoul (South Korea) - IFOAM Organic World Congress
- 18-19 October - Wakelyns (UK) - SOLIBAM Executive committee
- 3-4 November - Frankfurt (DE) - European Consortium for Organic Plant Breeding 10 year's Anniversary Conference. Organic Plant Breeding: What makes the difference?
- 20-22 November - Rennes (FR) - SOLIBAM WP8 Workshop



Veronique Chable  
Project Coordinator  
(INRA)



Italy - wheat and tomato fields trials 2011



SOLIBAM  
Snapshots



# The 23 SOLIBAM Partners

Institut National de la Recherche Agronomique (France)

Associazione Italiana per l'Agricoltura Biologica (Italy)

The Organic Research Centre, Elm Farm (UK)

RISØ National Laboratory for Sustainable Energy (Denmark)

Institut Technique de l'Agriculture Biologique (France)

Technical University of Munich (Germany)

Instituto de Tecnologia Quimica e Biologica (Portugal)

Agencia Estatal Consejo Superior de Investigaciones Cientificas/Instituto de Agricultura Sostenible (Spain)

Escola Superior Agraria de Coimbra (Portugal)

Agricultural Research Institute of the Hungarian Academy of Sciences (Hungary)

Scuola Superiore Sant'Anna, Pisa (Italy)

University of Perugia (Italy)

Agroscope Reckenholz-Taenikon Research Station ART (Switzerland)

Institute of Food and Resource Economics (Denmark)

INRA Transfert (France)

University of Pisa (Italy)



## Crop breeding companies

Saatzucht Donau - cereal breeding (Austria)

Gautier Semence - vegetable breeding (France)

Agrovegetal - legume breeding (Spain)

Arcoiris - vegetable breeding (Italy)



## Institutions from African countries and international organisation

International Center for Agricultural Research in the Dry Areas (International)

Coordination Nationale des Organisations Paysannes du Mali (Mali)

Mekelle University (Ethiopia)



<http://www.solibam.eu>

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