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Project Title: Sustainable low-input cereal production: required varietal characteristics and crop diversity

Short Title: SUSVAR

Project Code: COST860

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Project Partners:

SAATZUCHT DONAU AGES, Institute for Plant Varieties Agricultural Research Center Agricultural Research Institute Kromeriz Agricultural Research Institute, Martonvásár Agricultural University of Norway Agrounija - Skopje **ARDI-Agricultural Research Development Institute** ARVALIS-Institut du Végétal **BBA**, Braunschweig **BBA**, Kleinmachnow Bundesortenamt, Hannover Centre for Genetic Resources, the Netherlands (CGN), Wageningen University Cereal Breeding, Agroscope Cereal Reseach Non-Profit Company **COBORU** Slupia Wielka Danish Institute of Agricultural Sciences Department of Crop Husbandry & Ecophysiology Department of Crop Production, Viterbo DIAS, Flakkebjerg DIAS, Foulum DIAS, Tystofte Elm Farm Research Centre Experimental Institute for Cereal Research, Foggia Faculty of Agricultural Sciences and Food, Skopje Faculty of Agriculture, Skopje, FIBL CH



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End Date:

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Key Words: crop, cereal, diversity, varieties, populations, breeding, testing, genetics, molecular markers, European, low input, varietal characteristics, mixtures, populations, certification, COST action.

EFRC Programme: cereals

Project Aim: To ensure stable and acceptable yields of good-quality crops for low-input, especially organic, cereal production in Europe by:

- developing ways to increase and make use of crop diversity
- establishing methods for selecting varieties, lines and populations to fulfil these requirements
- establishing methods for appropriate variety testing

Abstract of Research: The main aims of the network are to ensure stable and acceptable yields of good quality for low-input, especially organic, cereal production in Europe. This will be achieved by developing ways to increase and make use of crop diversity (e.g. variety mixtures, crop populations or intercropping) and by establishing methods for selecting varieties, lines and populations with special emphasis on the influence of genotype-environment interactions. Finally, the network will also establish common appropriate methodology for variety testing.

Cereals are an important contribution to food production and the economy in Europe. Reduced inputs of pesticides and chemical fertilisers are universally of great interest, and increasing the area grown under organic conditions receives much public support. For the last 50 years, cereals have been specifically developed to produce high yields under potentially unlimited use of pesticides and synthetic fertilisers. These inputs are therefore necessary to achieve optimal yields independent of the actual conditions in the farmer's field. As a result, the presently available crops and varieties may not be the best to ensure stable and acceptable yields under low-input conditions.

In many countries, national projects are in progress to investigate the sustainable lowinput approach. In the present COST network, these projects are coordinated by means of exchange of materials, establishing common methods for assessment and statistical analyses and by combining national experimental results. The common framework is cereal production in low-input sustainable systems with emphasis on crop diversity. The network is organised into six Working Groups, five focusing on specific research areas and one focusing on the practical application of the research results for variety testing: 1) plant genetics and plant breeding, 2) biostatistics, 3) plant nutrition and soil microbiology, 4) weed biology and plant competition, 5) plant pathology and plant disease resistance biology and 6) variety testing and certification. It is essential that scientists from many disciplines work together to investigate the complex interactions between the crop and its environment, in order to be able to exploit the natural regulatory mechanisms of different agricultural systems for stabilising and increasing yield and quality. The results of this cooperation will contribute to commercial plant breeding as well as official variety testing, when participants from these areas disperse the knowledge achieved through the EU COST Action.

Objectives:

- To establish methods for selecting varieties, lines and populations, an to develop ways to increase and make use of crop diversity and genotype-environment interactions to ensure stable and acceptable yields of good-quality crops for low-input, especially organic cereal production in Europe.
- To develop hypotheses based on exchange of results from national research and development
- To coordinate running national trials
- To disseminate results within the following areas:
 - 1. Maintenance and enhancement of agro-biodiversity by use of genetic diversity
 - 2. Understanding the complex biological systems under low-input, especially organic farming conditions by collating new knowledge on plant complementarity, on epidemiology of disease complexes and on nutrient acquisition
 - 3. Genetic resources for traits of importance under low-input, especially organic farming conditions
 - 4. Potential of genetically diverse cropping systems for reducing diseases and weeds and increasing nutrient uptake efficiency

- 5. Markers for traits relevant for low-input condition and variety mixture efficiency
- 6. Beneficial interactions of the resident soil microflora with cereal varieties under low input conditions
- To develop common acceptance for combinations of variety characteristic required for cereal crops to be successful in low-input, especially organic growing systems, and methodologies measuring these characteristics
- To implements strategic use of appropriate varieties, variety and species mixtures and populations to improve yield and yield stability in the different countries
- To evaluate the need for specific variety trials for organic farming on a European scale, and if necessary implement such trials by influencing policy making on regulation of organic variety testing and certification of population crops
- To evaluate farmer's practice and breeders methods and thereby establish and approach to breeding for crop material adapted to low input/organic systems

Expected Benefits: The Action will provide a forum for exchange of knowledge and expertise between conventional production and the organic view of low input production. In addition to the general benefits of establishing a network among breeders, farmers, extension services and researchers all considering cereal production and products in low-input and particularly organic farming systems, specific benefits for end users are:

Breeders

- Definition of combinations of traits for low input/organic farming
- Definition of breeding methods (including the use of molecular markers) for obtaining these traits in varieties and in populations

VCU-testing authorities

- Recommendations for new testing an dlisting procedures for organic/low input variety testing and for populayion crops
- Procedures for combining information from national organic variety testing

Farmers and extension services

- New stable, higher yielding crops
- Increased agro-biodiversity stabilizing the system as a whole
- New strategies for exploitation of genetic diversity

Researchers

• A European network supporting researcher mobility to ensure interaction on planning of trials and on analyses of results as well as publication of common papers

• A European Network within which applications for European funding can be generated

Output:

- Wolfe, M. S., S. Phillips, J. Snape and L. Fish, 2004, AR0914 Generating and evaluating a novel genetic resource in wheat in diverse environments. Presentation for COST 860 2004.
- Phillips, S. and M. S. Wolfe, 2004, WG5 Plant-disease complex interactions: An interpretation of the word complex in low-input systems. A presentation for COST 860.
- Phillips, S. L and Wolfe, M. S. (2005) Centenary review: Evolutionary Plant Breeding For Low Input Systems. Journal of Agricultural Science **140**, 1-10.
- Jones, H., Hinchsliffe, K., Pepler, S. and Wolfe, M. (2005) Evolutionary Breeding of Wheat for Low Input Systems poster COST 860 Driebergen 17-19 January 2005