# Plant genetic resources for food and agriculture: roles and research priorities in the European Union

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Agriculture in Europe faces some major challenges, associated with the need to deliver food security worldwide at a time of increasing pressures from population growth, climate change and economic instability and the continuing imperative to avoid further losses in biodiversity. Making better use of plant genetic resources is a very important part of the necessary response to the challenges for agriculture.

Plant genetic resources for food and agriculture (PGRFA) include the traditional crop varieties and their wild relatives, modern cultivars, breeding lines and genetic stocks which provide food, feed for domestic animals, fibre, clothing, shelter, medicine and energy. They are part of the world's biological diversity and come under the provisions of the global Convention on Biological Diversity (CBD), but they have additional properties which require special recognition within the framework of the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGFRA).

*Why are they important now for the EU?* Europe is considered relatively species-poor compared with other parts of the world, but its biodiversity has undergone complex interactions with human populations whose activity transformed the continent into a centre of diversity for cereals, legumes, fruits, vegetables, industrial crops, oil crops, forages, medicinal and aromatic plants. Although deriving from other parts of the world, these crops developed distinct properties through the selection skills of farmers and breeders. Agricultural developments over the past 60 years, increasingly within a common EU policy framework, have helped to ensure food security and safety for a growing population, a reasonable standard of living for farmers, and the modernisation and development of the agricultural industry. However, these achievements incurred costs that are unsustainable: for example, considerable areas of permanent grassland and orchards were transferred to crop production, leading to augmented release of nutrients from the soil; rapid increases in the area of some crops such as maize and wheat occurred at the expense of other traditionally important crops; and a near doubling of the irrigated land area has been associated with an increase in agricultural inputs. These developments have been associated with, or directly led to, a loss of plant genetic resources and diversity in European production systems. The Common Agricultural Policy (CAP) reform introduced environmental measures, such as large schemes of set-aside land, reintroduction of fallows and encouragement of extensive agriculture. However, that was not without negative consequences: neglected or abandoned land lost environmental value, being often occupied by invasive species or subject to soil erosion or other degradation.

The loss of plant genetic resources has serious consequences for food security. Underpinning the agricultural advances of the past 60 years has been the development of increasingly productive and better adapted crop cultivars. These have depended on the continuing availability and use of a wide diversity of plant genetic resources. Factors such as climate change, the need for more sustainable production systems, the emergence of new pests and diseases and the importance of improving food quality, are expected to require an increased input of a wider range of plant genetic resources than before. The maintenance and use of plant genetic resources will therefore be increasingly central to our continuing ability to create a sustainable and competitive European agriculture and to feeding the world.

EASAC advises that the conservation and use of plant genetic diversity should be an important concern in Europe. The European Commission and national governments have made significant efforts to tackle the challenges by establishing programmes of conservation, characterisation and documentation. Nonetheless, inadequacies in conservation efforts remain and further action is urgently needed, particularly with respect to neglected and underused crops and crop wild relatives. The development of more effective use strategies is equally important.

*What should be the new vision?* In the view of EASAC, there is great potential to capitalise on advances in the biosciences, including the use of molecular breeding, to develop agricultural systems based on sustainable intensification principles, offering safe, high-quality products, while protecting the environment, supplying diversified public goods, promoting growth and creation of jobs in rural areas and reinforcing the competitive ability of the EU agricultural sector. The EU has a legacy of excellence in plant sciences. There is a critical need to strengthen our understanding of biodiversity and ecosystem services while also doing much more to identify and use plant genetic resources for agriculture.

The EASAC report on PGRFA identifies research priorities including the needs to:

- clarify fundamental aspects of plant biology – using diversity to understand genome organisation, gene function and plant evolution;
- improve conservation science – for example, using molecular methods to modernise conservation practice, such as reducing the number of duplicated samples, and developing indicators of diversity;
- mobilise diversity to enhance sustainable productivity increases – focusing on useful traits and interpreting phenotypic characteristics;
- deploy diversity in production systems – including the study of plant–micro-organism co-evolution, improving adapatability and resilience, increasing production, tolerance/resistance to stress, and nutritional value.

*What are the implications for policy-makers?* Success in tackling these research areas requires increased policy commitment to co-ordinated and sustained EU-wide programmes and improved collaboration between the relevant scientific disciplines (including genetics and genomics, plant sciences, ecology, social sciences). In addition there must be improved linkage between all the activities inherent in plant conservation, research and breeding and improved use of the scientific evidence to inform strategic development for agriculture and land use.

New global challenges are emerging and the EU is not immune. Climate change is expected to have a considerable impact on agriculture and food availability, with significant losses and gains that will vary for different crops and for different geographical regions. New crops and new cultivars have to be developed throughout Europe adapted to new environments and to particular abiotic or biotic stresses or new combinations of these. Adaptation to, and mitigation of, climate change will require a different kind of agriculture which combines higher levels of resilience with changed production practices, such as the cultivation of low methane-producing animal feedstock.

Maximising crop production has not been perceived in recent years by policy-makers as a priority for the EU. However, the EU is a net importer of food/feed and has an overdependence on a few crops. Pursuing the scientific priorities for plant genetic resources can help to address the issues for EU food security, sustainability, crop diversification and nutritional value, and offers opportunities for restoration of neglected and underused land and for the development of new crops or new crop uses, such as biofuels, biomaterials and chemical feedstocks.

EASAC concludes by emphasising that it is vital for policy-makers in the EU and at the Member State level to recognise the crucial contribution that plant genetic resources can make to tackling the EU societal challenges across a broad front and ensuring policies are in place to support their enhanced conservation and use. It is essential to align the policy tools available in CAP reform with the imperative for increased innovation in agriculture; to appreciate the enhanced significance of the biosciences-based agriculture sector in contributing to adaptation to climate change and to managing and promoting biodiversity; and to give greater prominence in the current process of setting EU research priorities for the period up to 2020 to the new scientific opportunities now coming within range. Capitalising on plant genetic resources and the advances in molecular breeding can make a substantial contribution to quality and competitiveness of EU agriculture.

**The full report is available at www.easac.eu.**

## About EASAC

EASAC – the European Academies Science Advisory Council – is formed by the national science academies of the EU Member States to enable them to collaborate with each other in providing advice to European policy-makers. It thus provides a means for the collective voice of European science to be heard.

Its mission reflects the view of academies that science is central to many aspects of modern life and that an appreciation of the scientific dimension is a pre-requisite to wise policy-making. This view already underpins the work of many academies at national level. With the growing importance of the European Union as an arena for policy, academies recognise that the scope of their advisory functions needs to extend beyond the national to cover also the European level. Here it is often the case that a trans-European grouping can be more effective than a body from a single country. The academies of Europe have therefore formed EASAC so that they can speak with a common voice with the goal of building science into policy at EU level.

Through EASAC, the academies work together to provide independent, expert, evidence-based advice about the scientific aspects of public policy to those who make or influence policy within the European institutions. Drawing on the memberships and networks of the academies, EASAC accesses the best of European science in carrying out its work. Its views are vigorously independent of commercial or political bias, and it is open and transparent in its processes. EASAC aims to deliver advice that is comprehensible, relevant and timely.

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EASAC Secretariat
Deutsche Akademie der Naturforscher Leopoldina
German National Academy of Sciences
Jägerberg 1, D-06108 Halle (Saale), Germany
Tel: +49 (0)345 4723 9833 fax: +49 (0)345 4723 9839
email: secretariat@easac.eu

EASAC Brussels Office
Royal Academies for Science and the Arts of Belgium (RASAB)
Hertogsstraat 1 Rue Ducale, B 1000 - Brussels, Belgium
Tel: +32 (2) 550 23 32; fax: +32 (2) 550 22 05
email: brusselsoffice@easac.eu
web: www.easac.eu