

Euroseeds contribution to the biodiversity strategy

Brussels, 13th May 2020

EXECUTIVE SUMMARY

Euroseeds welcomes the European Biodiversity Strategy for 2030. The plant breeding industry is committed to the United Nations' "Convention on Biological Diversity (CBD)" and to the FAO's International Treaty on Plant Genetic Resources for Food and Agriculture and its objectives. Moreover, we believe that the biodiversity strategy can only be successful if social, environmental and economic considerations are taken into account in the decision making. This will allow minimising trade-offs and make best use of synergies when it comes to the sustainable use and conservation of biodiversity. An integrative assessment including the United Nations Sustainable Development goals (SDGs) is also necessary to achieve the biodiversity goals.

Genetic resources in agriculture

Euroseeds believes that the most efficient way to preserve genetic resources is by making sustainable use of all available genetic diversity. Plant breeding therefore must be acknowledged and supported as sustainable use of plant genetic resources.

In order to fulfil the many social, environmental and economic needs of society, plant breeders need continuous and efficient access to the broadest genetic pool possible to be able to continue developing the varieties that are required. The current framework for access and benefit sharing under of the Convention on Biological Diversity and its Nagoya Protocol does not fit but contradict this purpose.

Euroseeds is of the opinion that open access to digital sequence information must be safeguarded and the benefits such open access generates should be more seriously considered in the relevant international discussions. Forcing burdensome obligations and non-enforceable rules on users of digital sequence information may put the important societal benefits of open access at risk, without generating the money that is necessary for genetic resource conservation.

Plant breeders have always been actively engaged in genetic resources conservation through various types of activities and projects. Genetic resource conservation is of key importance and needs proper funding, it should not be linked to and made dependent on money coming from benefit-sharing regimes.

Land use and agroecosystems

Euroseeds believes that plant breeding can help alleviate the pressure on biodiversity in agriculture. Improved plant varieties can increase productivity on existing land reducing the need to convert natural areas into agriculture and diversifying crop rotation alternatives. Plant breeding

can also increase resource efficiency in farming. Resistance breeding and breeding for nutrient efficiency can for instance decrease the use of external inputs reducing the chance of pollution.

The decline of agricultural land area in Europe, if not followed by an increased productivity in the remaining land, implies that both production and production-related effects are “externalised”, i.e. transferred to other places around the globe. As a consequence, more land is used in those third countries to produce food, often at the expenses of high value ecosystems like rainforest. This loss of biodiversity affects climate change worldwide, including Europe. The negative consequences to food security and availability of much less productive land and land abandonment can only be solved by increased yields thanks to innovative technologies. In this respect, plant breeding innovations must play a key role in increasing sustainability and preserving biodiversity while maintaining output and profitability.

Euroseeds believes that integrating biodiversity in agroecosystems is important for farm resilience and the conservation of biodiversity in farming. Biodiversity is an important tool for farmers and can in combination with seeds and other tools in the toolbox of the farmer be used to build resilient integrated cropping systems that can fulfil the social, environmental and economic needs of society. Integrating biodiversity in farming systems is however not a goal in itself. It should be implemented to support farm functioning in order to fulfil sustainability needs.

CAP measures can strongly contribute to enhance EU biodiversity, mainly through agri-environment-climate measures included in Rural Development Programmes. These measures include, for instance, support for conservation and sustainable use of genetic resources in agriculture. However, proper funding and promotion of these tools needs to be ensured in order to make them more attractive.

Euroseeds believes the focus in the biodiversity strategy should not be on specific farming systems but on the sustainability performance of farmers in general. All farming systems can use biodiversity sustainably and contribute to its conservation if provided with the right incentives. The biodiversity strategy should therefore not focus on organic farming, agro-ecology and agro-forestry to ensure conservation of biodiversity and its sustainable use.

Euroseeds is of the opinion that organic farming, agroecology or agroforestry have a role to play in meeting the demands of European consumers. We however believe that facilitation of consumer demand can be left to the market and therefore we do not support the European Commission’s aim to increase the shares of these farm systems for the purpose of biodiversity conservation. The current policy proposals of the Commission discriminate between different types of farmers. There is no reason to believe that the one type of farming performs better than the other if both are given the right incentives to increase biodiversity of their farming system.

Research

Euroseeds believes that research and innovations in plant breeding provide many benefits in relation to sustainability by improving crop genetic diversity, responding quicker to climate change effects, creating new varieties more resistant and tolerant to pests and diseases and resource efficiency. Research and innovation outcomes, promoted by the EU, should be properly backed up by other relevant EU policies. This would allow farmers to implement innovation at farm level, which is the real indicator for successful innovation in agriculture. This process has to be accompanied by a consistent regulatory framework that allows such innovations to reach the farmer field and the market by promoting and effectively implementing the innovation principle.

Biodiversity – the need for urgent action

- Euroseeds welcomes the European Biodiversity Strategy for 2030 and our industry is committed to the United Nations' "Convention on Biological Diversity (CBD)" and its objectives, including the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of benefits arising from the utilization of genetic resources and traditional knowledge.
- Euroseeds recognizes that agriculture, through land use change and pollution, is an important contributor to biodiversity loss. We believe that plant breeding can help alleviate the pressure on biodiversity of agriculture. Improved plant varieties can increase productivity on existing land reducing the need to convert natural areas into agriculture and diversifying crop rotation alternatives. Plant breeding can also increase resource efficiency in farming. Resistance breeding and breeding for nutrient efficiency can for instance decrease the use of external inputs reducing the chance of pollution.

Seed more than ever is the key input for farmers in Europe and worldwide. It is estimated that more than 50% of all productivity gains are due to improved varieties resulting from sophisticated plant breeding¹; it is also estimated that this figure will rise to up to 80% in the coming years, not least due to the necessity for innovation in the face of growing restrictions on the use of crop protection products, fertilizers and other inputs.

Next to assuring the much-needed productivity gains that support farmers' income, rural economies and the entire agri-food chain, there are many further challenges affecting European agriculture. Some of them are very well known, such as ensuring food security and healthy diets for a growing global population, reducing food losses and waste, adaptation to and mitigation of climate change, etc. Others are less known but still highly relevant: emerging pests and diseases and increased pressure on a declining area of agricultural land.

The decline in agricultural land area in Europe, if not followed by an increased productivity in the remaining land, forces reliance on production in other places around the globe. As a consequence, more land is used in those third countries to produce food, often at the expense of high value ecosystems. This loss of biodiversity affects climate change worldwide, including Europe.

Without the genetic crop improvements contributed by plant breeding in the EU in the last 15 years, the global biodiversity equivalent to 6.6 million ha of Brazilian rainforest or 9.4 million ha of Indonesian rainforest would have been lost². This becomes especially relevant after the Amazon wildfire crisis and the resolution from the European Parliament on climate and environmental emergency³.

The IPCC has alerted that for agricultural ecosystems, there is evidence that some crop species and varieties currently grown in a particular area may not be able to adapt quickly enough to climatic changes. Because different species will react differently, the complex interactions among species will be disrupted, potentially affecting ecosystem services such as pollination and the control of crop pests by natural predators⁴.

¹ http://www.plantetp.org/system/files/publications/files/hffa_research_paper_03_16_final_unprotected.pdf

² http://www.plantetp.org/system/files/publications/files/hffa_research_paper_03_16_final_unprotected.pdf

³ https://www.europarl.europa.eu/doceo/document/TA-9-2019-0078_EN.pdf

⁴ <http://www.fao.org/3/a-i6583e.pdf>



It is a well-documented fact that the amount of land used for agricultural purposes in the EU is shrinking as a result of increasing urbanisation in Europe. In this situation, plant breeding plays a crucial role in helping to increase yields, thereby reducing the need to dedicate more non-farmland (forests etc.) to agricultural production in the EU and/or in third countries and in turn, preserving habitats and biodiversity. Innovation in plant breeding also helps reducing the time to develop more adapted varieties to respond quicker to climate change.

- Euroseeds believes that the biodiversity strategy can only be successful if other social, environmental and economic considerations are taken into account in the decision making. There are trade-offs and synergies when it comes to the sustainable use and conservation of biodiversity. An integrative assessment including the United Nations Sustainable Development goals (SDGs) is necessary to achieve the biodiversity goals.

Europe's seed sector is committed to delivering on the United Nations Sustainable Development Goals (SDGs) by⁵:

- Improving the sustainability of food production, including contributing to the new EU Farm to Fork strategy;
- Maintaining and promoting Europe's high food quality and standards;
- Ensuring that the European agri-food sector can remain fair and competitive;
- Contributing to Europe's climate, environmental and biodiversity goals.

⁵ <https://www.euroseeds.eu/app/uploads/2020/01/20.0007-Euroseeds-seed-sector-brochure.pdf>

Plant breeding in the EU not only brings about economic and social benefits but it also generates substantial environmental benefits. Biodiversity is the variety and variability of life on Earth. Biodiversity is typically a measure of variation at genetic, species, and ecosystem levels. In this context agro-ecosystems and their biodiversity play an important role. Agro-biodiversity typically consists of the species living in agricultural habitats. One important aspect in agro-biodiversity is the diversity of crop species as well as the genetic diversity within crop species. Both are positively influenced by plant breeding activities.

In addition, there is an interaction between agro-biodiversity and biodiversity in other surrounding ecosystems, including natural habitats. Also here plant breeding can have a positive effect by saving scarce land resources around the globe by generating higher yields per unit of area. This improves the EU agricultural trade balance.

Thus, plant breeding minimises the net virtual land imports of the EU, which currently amount to more than 17 million ha⁶. In the absence of plant breeding for major arable crops in the EU in the last 15 years, the global agricultural acreage would have had to be expanded by more than 19 million ha. Moreover, plant breeding also contributes to reduce greenhouse gas emissions (a total of about 3,4 billion tons of direct CO₂ emissions have been avoided by genetic improvements in major arable crops in the EU in the last 15 years)⁷.



⁶ https://www.agrar.hu-berlin.de/de/institut/departments/daoef/ihe/Veroeff/opera-final_report_100505.pdf
⁷ http://www.plantetp.org/system/files/publications/files/hffa_research_paper_03_16_final_unprotected.pdf

Genetic resources in agriculture

- Euroseeds believes that the most efficient way to preserve genetic resources is by making sustainable use of all available genetic diversity. Plant breeding therefore must be acknowledged and supported as sustainable use of plant genetic resources for food and agriculture. In order to fulfil the many social, environmental and economic needs of society plant breeders should have access to the broadest genetic pool to develop the varieties that are required.

The genetic diversity of crop plants is an essential basis for seed innovation; it is the foundation for the sustainable development of new varieties for present and future challenges. Plant breeders have been relying on genetic diversity for centuries to develop new varieties better adapted to agricultural practices, environmental stress conditions and new consumer requirements. By the development of new varieties, plant breeders have also contributed to further enhance the genetic diversity available. In this respect, more than 42,000 different varieties are available to European farmers today, and more than 3,500 new varieties are registered in the catalogue every year⁸.

To be able to carry out their work, plant breeders need access to genetic resources for the purpose of breeding new varieties of plants. In this respect, several international agreements exist which regulate the access to genetic resources and benefit-sharing from their utilization such as the Convention on Biological Diversity (CBD) and its Nagoya Protocol and the FAO International Treaty on Plant Genetic Resources for Food and Agriculture. However, more practical approaches and further alignment is required among those treaties in order to allow breeders to access a broader genetic pool and to develop the varieties that are required.

Access to genetic resources and the fair and equitable sharing of benefits arising from their utilization should be settled in such a way that the new global conservation strategy is not being affected by those arrangements. Access should be stimulated and facilitated rather than obstructed as with the current implementation of the Nagoya Protocol and benefit-sharing conditions should not be eternal as those have a negative impact on the conservation of biodiversity.

- Euroseeds is of the opinion that open access to digital sequence information must be safeguarded and the benefits such open access generates should be more seriously considered in the relevant international discussions. Forcing burdensome obligations and non-enforceable rules on users of digital sequence information may put the important societal benefits of open access at risk, without generating the money that is necessary for genetic resource conservation.
- Plant breeders have always been actively engaged in genetic resources conservation through various types of activities and projects. Genetic resource conservation is of key importance and needs proper funding, it should not be linked to and made dependent on money coming from benefit-sharing regimes.

Recently, a discussion arose on the possible application of the access and benefit-sharing regime of the CBD and its Nagoya Protocol to so-called digital sequence information. In the ongoing international discussions DSI is used a place-holder and its meaning is still being discussed. Euroseeds understands DSI as referring to genetic resource sequence data (GRSD), as defined by

⁸ https://cpvo.europa.eu/sites/default/files/documents/cpvo_annual_report_2018.pdf

the International Chamber of Commerce⁹. As in many other industries, digital sequence information is relevant in plant breeding. It is often generated by plant breeders and can be used for various purposes such as the breeding process, customer services, quality control etc.

Public researchers also generate digital sequence information. Currently such digital sequence information is freely and openly available through mainly the INSDC databases which are used by public and private, by non-commercial and commercial users in a wide range of different sectors. Open access to digital sequence information in the mentioned databases has numerous benefits for society. It helps address food security, the conservation of biodiversity, environmental problems and sustainable agriculture challenges, to name a few. In the seed sector, digital sequence information enables more effective ways to monitor on-farm pests and diseases and ensure quality control and food safety. It also benefits the exploration, collection, and use of breeding materials to improve plant varieties for more sustainable agriculture. Another important benefit is that the current open accessibility of digital sequence information facilitates private-public partnerships.

If access and benefit-sharing rules are applied in any form to digital sequence information, it is likely that many of the societal benefits mentioned above will decrease or will not materialise anymore¹⁰. Open access to digital sequence data must be safeguarded¹¹. Instead of forcing burdensome obligations and non-enforceable rules on users in terms of monetary benefit-sharing on the use of digital sequence information, more emphasis should be placed on in-kind benefit-sharing, and, in particular, on capacity building with regard to the use of digital sequence information.

In line with the wish of having facilitated access to the broadest possible genetic diversity for further use in plant breeding, genetic resource conservation is obviously of high importance for plant breeders. Private seed companies engage in such conservation, evaluation and maintenance work in various ways, through private sector initiatives and also through public-private partnerships. These projects supporting the conservation and sustainable use of genetic resources happen in various forms and take place at national, regional or international level. The types of voluntary benefit-sharing activities include, amongst others, conservation and sustainable use of plant genetic resources; dissemination of information (awareness raising); involvement in international cooperation; dissemination of technology (technology transfer) and capacity building¹². All of these activities are consistent with the broader aims of the CBD.

Genetic resource conservation in all possible forms is of key importance and should not be made dependent on benefit-sharing regimes. Clear and mutually supportive conservation strategies at national and European level are needed as well as funds that help finance this conservation work.

⁹ <https://iccwbo.org/content/uploads/sites/3/2019/06/icc-submission-to-cbd-digital-sequence-information-benefit-sharing.pdf>

¹⁰ It is also to be noted that the scope of the CBD and the Nagoya Protocol covers genetic material and does not extend to immaterial data

¹¹ <https://iccwbo.org/content/uploads/sites/3/2018/06/7-joint-stakeholder-statement-on-digital-sequence-information-01-08-201.pdf>

¹² <https://www.euroseeds.eu/seeding-benefits/>

Agroecosystems

- Euroseeds believes that integrating biodiversity in agroecosystems is important for farm resilience and the conservation of biodiversity in farming. Biodiversity is an important tool for farmers and can in combination with seeds and other tools in the toolbox of the farmer be used to build resilient integrated cropping systems that can fulfil the social, environmental and economic needs of society. Integrating biodiversity in farming systems is however not a goal in itself. It should be implemented to support farm functioning in order to fulfil sustainability needs.

Total Utilised Agricultural Area in Europe has decreased during the last decade. Despite the recent increase and stabilisation of area devoted to permanent grassland and permanent crops, the continuous decline in agricultural area is due to less available arable land¹³.

At the same time, forest coverage in Europe has increased since the 1990s at a much higher rate than the decline of agricultural area. Today, the area covered by forest account for 182 million hectares in comparison to 178 million hectares of agricultural land¹⁴.

- **Common Agricultural Policy (CAP)**

Since the last CAP reform¹⁵, farmers receive the green direct payment only if they comply with three mandatory practices that benefit the environment (soil and biodiversity in particular). The three actions farmers have to put in place are:

- crop diversification: a greater variety of crops makes soil and ecosystems more resilient. To this end, breeders have provided the necessary tools to adapt certain crops to very diverse climatic conditions, thus allowing farmers successfully grow them from Southern to Northern Europe. By increasing crop alternatives into the crop rotation system, agriculture generates both economic value and agricultural diversity;
- maintaining permanent grassland: grassland supports carbon sequestration and protects biodiversity (habitats);
- if sustainably and preferably extensively cultivated dedicate 5% of arable land to areas beneficial for biodiversity: Ecological Focus Areas (EFA), for example trees, hedges or land left fallow that improves biodiversity and habitats. Ecological Focus Areas in the EU accounted for 8 million hectares in 2015 (7,5% of arable land)¹⁶.

Some other CAP measures also contribute to enhance EU biodiversity¹⁷, mainly through agri-environment-climate measures included in Rural Development Programmes. These measures include, for instance, support for conservation and sustainable use of genetic resources in agriculture.

¹³ <https://ec.europa.eu/eurostat/databrowser/view/tag00025/default/table?lang=en>

¹⁴ <https://www.europarl.europa.eu/factsheets/en/sheet/105/the-european-union-and-forests>

¹⁵ https://ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy/income-support/greening_en

¹⁶ https://ec.europa.eu/info/news/ecological-focus-areas-show-potential-helping-biodiversity-2017-mar-29_en

¹⁷ https://ec.europa.eu/info/sites/info/files/food-farming-fisheries/key_policies/documents/ext-eval-biodiversity-final-report_2020_en.pdf

- **Conservation and sustainable use of genetic resources**

- Genetic resources can be conserved *in situ* or *ex situ*. Euroseeds believes that all conservation efforts must be improved. Both, *ex situ* and *in situ* conservation are complementary to each other and they should stand on an equal footing.

In any case, Euroseeds considers that plant breeding is one of the most effective ways of sustainable use of genetic resources. In order to improve access to genetic resources, better characterisation of plant reproductive material available *ex situ* (i.e. gene banks and other sources) is needed. At the same time, *in situ* conserved material should be made available for commercial plant breeding, as currently it is extremely difficult to make use of such conserved material and realise the potential social, economic and environmental benefits.

- **Organic farming**

- Euroseeds believes the focus in the biodiversity strategy should not be on specific farming systems but on the sustainability performance of farmers in general. All farming systems can use biodiversity sustainably and contribute to its conservation if provided with the right incentives. The biodiversity strategy should therefore not focus on organic farming, agroecology and agro-forestry to ensure conservation of biodiversity and its sustainable use.
- Euroseeds is of the opinion that organic farming, agroecology or agroforestry have a role to play in meeting the demands of European consumers. We however believe that facilitation of consumer demand can be left to the market and therefore we do not support the European Commission's aim to increase the shares of these farm systems for the purpose of biodiversity conservation. The current policy proposals of the Commission discriminate between different types of farmers. There is no reason to believe that the one type of farming performs better than the other if both are given the right incentives to increase biodiversity of their farming system.

Euroseeds' member companies are the biggest suppliers of seeds for organic farming¹⁸. Breeding companies have been able to provide enough high-quality seed for the growing demand of seeds for organic farming. As expected, the type of plant reproductive material provided has evolved over the years to adapt to the increased demand of seeds propagated under certified organic conditions and this trend is expected to continue.

This trend needs to be continuously underpinned by making use of the latest breeding methods that help drive economic performance of more sustainable farming systems, including organic farming.

Between 2010-17 there was an increase in the amount of EU agricultural land dedicated to organic farming by almost 70%. The total amount of EU farmland devoted to organic production today is 7%. The size of the EU market for organic products is estimated at almost €34.3 billion in retail sales in 2017. This domestic consumption is complimented by a robust import sector¹⁹.

¹⁸ https://www.liveseed.eu/wp-content/uploads/2017/10/LIVESEED_general_presentation.pdf

¹⁹ https://ec.europa.eu/info/news/organics-sector-rise-both-domestic-production-and-imports-see-large-increases-2019-mar-07_en

Over the medium term, this growing economic challenge for conversion to organic farming, as well as further developments of environmentally friendly conventional farming, could, however, slow down the growth of organic production²⁰. In order to increase EU organic production, higher yields are needed to assure the economic sustainability of the EU's organic production.

- **Integrated Pest Management**

A fundamental part of the research carried out by breeders relates to improved varieties more resistant to pests and diseases. This has been recognised in the general principles of Integrated Pest Management which include, where appropriate, the use of varieties resistant/tolerant to pests and diseases and standard/certified seed and planting material as one of the main ways to prevent and/or suppress harmful organisms²¹.

Research has shown good possibilities for plant breeding innovation to e.g. develop vine varieties resistant to oidium and downy mildew. This would allow for a considerable reduction of fungicide use in Europe and other parts of the world²².

Moreover, depending on the persistence and risk of certain pests and diseases, seed treatment also offers the possibility, according to the principles of Integrated Pest Management, to apply reduced doses of plant protection products in a more targeted and efficient way.

The European Seed Treatment Assurance scheme (ESTA) is a quality assurance scheme that guarantees that treated seeds are processed according to high environmental standards²³ as also acknowledged by a number of national authorities and the EU Commission's guidance document for the authorisation of plant protection products for seed treatment. Together with proper sowing equipment, this scheme helps reducing dust drift, thus ensuring a healthier environment for insects and pollinators.

- **Land abandonment**

Finally, placing 10% of agricultural land under non-productive and landscape features will increase pressure on the remaining productive land. Moreover, the pressure will be even higher if a 30% conversion of conventional land to organic farming (ranging between 40% to 85% of yields obtained with conventional farming²⁴) is encouraged. The combination of both effects could result in approximately 10 to 20% reduction of crop production in the EU and consequent price effects as well as growing imports from third countries.

Moreover, agricultural land abandonment in the EU within 2015-2030 may affect about 11% of the land. This figure represents that more than 20 million ha of agricultural land in the EU are under

²⁰ https://ec.europa.eu/info/sites/info/files/food-farming-fisheries/farming/documents/agricultural-outlook-2019-report_en.pdf

²¹ <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32009L0128&from=EN>

²² <https://geneticliteracyproject.org/2018/12/11/crispr-edited-wine-grapes-could-cut-pesticide-use-in-europe-but-regulatory-hurdles-remain/>

²³ <https://www.iso.org/standard/60857.html>

²⁴ https://ec.europa.eu/info/sites/info/files/food-farming-fisheries/farming/documents/market-brief-organic-farming-in-the-eu_mar2019_en.pdf

high potential risk of abandonment due to biophysical land suitability, farm structure and agricultural viability, population and regional specifics²⁵.

The negative consequences of all these measures and events on food security and availability can only be solved by increased yields thanks to technological innovation. In this respect, plant breeding innovations must play a key role in increasing productivity and competitiveness as well as sustainability and preservation of biodiversity.

Soils and pollution

Soil is the support system for nutrients, microorganism communities, water, and organic matter, which are all essential for food production. Furthermore, it plays an important role in making crops and food systems more resilient or mitigating climate change by conserving soil carbon.

Without plant breeding in the last 15 years, an additional area of almost 6,5 million ha of grassland would have to be ploughed in the EU in order to compensate for production losses in green maize and temporary grasses. This corresponds to approximately 10 percent of the EU's entire permanent grassland (Eurostat, 2009) still serving as a carbon sink and being rich in biodiversity, what is a conservative assessment since subsequently missing forage from grassland could not be taken into account with the approach chosen²⁶.

Research on well performing crop varieties which provide additional environmental benefits such as better interaction with the soil microbiota or that help to keep organic matter in soil are some of the challenges for the sector on soil and biodiversity.

In this respect, seed treatment is an essential part of the precision farming techniques, aiming at applying the accurate quantity of plant protection products (be they chemical or biological), fertilisers/nutrients or biostimulants to the development of the plant. These seed technologies help to reduce water contamination by run-off or drift. Research on how to increase sustainability in seed protection, e.g. more biodegradable polymers that will replace microplastics, biocontrol products or biostimulants, will benefit the seed sector, farmers and the environment.

Energy and transport

In order to achieve the EU goals on bioeconomy (including decarbonisation)²⁷, sufficient European biomass needs to be available for all types of productions (Food, Feed, Fuel, Fibre, Flower and Fun). The offer of biomass needs to respond to both, industry expectations (quality and quantity) and citizens demands (production methods and environmental footprint, among others). In this context, plant breeding innovations are the starting point for sustainable yields but also to obtain targeted plant varieties with new or improved traits that fit to the specific application. New and improved crops are also investigated for new applications.

²⁵ <https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/agricultural-land-abandonment-eu-within-2015-2030>

²⁶ http://www.plantetp.org/system/files/publications/files/hffa_research_paper_03_16_final_unprotected.pdf

²⁷ https://ec.europa.eu/clima/sites/clima/files/docs/pages/com_2018_733_analysis_in_support_en_0.pdf

Moreover, plant breeding and related seed innovation will provide the base for the continued development, production and use of more bio-based products and processes for a greener European economy. The future bioeconomy can provide a major socioeconomic contribution and its benefits include improved public health, environmental sustainability and the productivity of industrial processes.

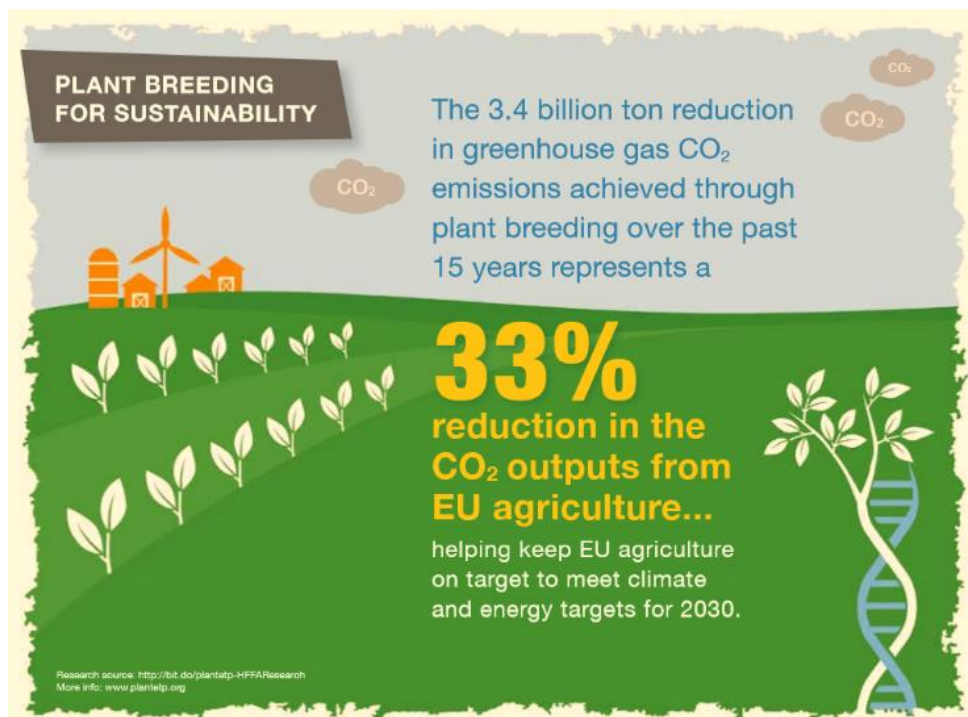
The bioeconomy’s success will, however, strongly depend on continued and targeted plant science research together with partners from the value chain to deliver biomass, specifically from European sources, and the development of new seed innovations that provide the genetic foundation for new business models.

This has been the case, for instance, for potatoes or oilseed crops, which provide a food output as well as value-added outputs for industrial purposes or feed. There is a large-scale output of products targeting different markets and research on bioeconomy should also focus on bringing value to this agro-diversity.

Adaptation to and mitigation of climate change

Agriculture is a contributor to GHG emissions through land use and land use change -inside and outside the EU (in the latter case, mainly owing to feed imports)– as well as through energy consumption.

As climate evolves over time, “the most important climate change adaptation tools for crop production are thus breeding and cultivar delivery systems that rapidly and continuously develop new varieties and replace old ones²⁸.



²⁸ https://wrr-food.wri.org/sites/default/files/2019-07/WRR_Food_Full_Report_0.pdf

GHG emissions on a per hectare basis underestimate the impact of expanding low-yield agriculture on overall GHG emissions as it requires farmland expansion²⁹. GHG emissions should be assessed per unit of output.

Apart from GHG emissions, agriculture's other contribution to climate change and its mitigation is carbon sequestration (and the loss of this). Any serious assessment must account for the deforestation that may occur as a result of expanding arable and pastureland under the scenario of lower EU production (forests are usually greater carbon sinks than agricultural lands).

Water scarcity is considered as a major issue in the context of climate change in areas prone to droughts. In this respect, it is considered very important to promote alternative cropping systems, less water-demanding or drought-tolerant / drought-resistant crops, varieties and hybrids, and minimum tillage techniques to improve soil moisture³⁰.

Freshwater

There is a large diversity of innovations used across the EU that may affect water management in the agricultural sector. In this respect, plant breeding and other related seed technologies have a clear positive potential effect on water, both in quality and quantity (i.e. pest resistant and drought-tolerant crops, treated seed and precision farming). Most of these innovations are widely used by farmers in Europe³¹.

Agriculture has a high dependence on water supplies of good quality. In the EU, the sector accounted for 51% of total water use in 2014, and farming's needs are particularly high in some Member States and regions where there is seasonal scarcity and where the sector's competition with other water users is particularly marked³².

In this respect, plant breeding in the EU for major arable crops in the last 15 years has contributed to saving scarce water resources in Europe. Without plant breeding 55 billion m³ of water would be additionally needed³³.

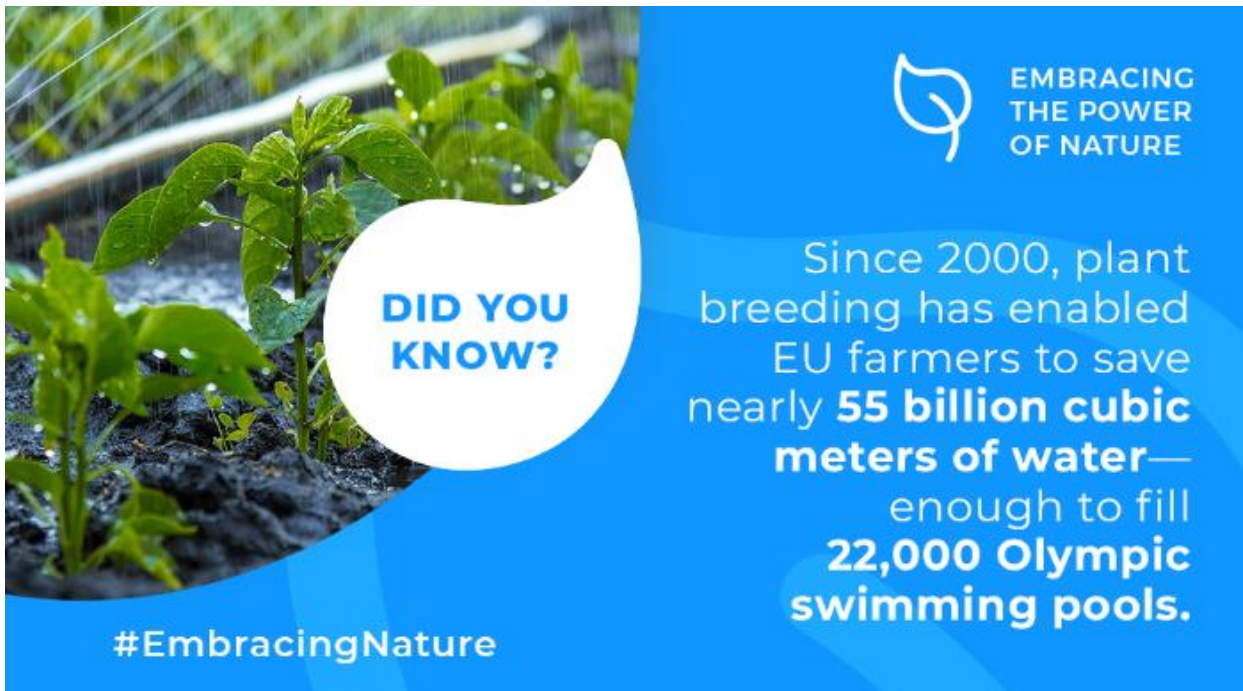
²⁹ https://ec.europa.eu/info/sites/info/files/food-farming-fisheries/farming/documents/medium-term-outlook-2018-report_en.pdf

³⁰ https://ec.europa.eu/info/sites/info/files/food-farming-fisheries/key_policies/documents/ext-eval-water-final-report_2020_en.pdf

³¹ https://ec.europa.eu/info/sites/info/files/food-farming-fisheries/key_policies/documents/ext-eval-water-final-report_2020_en.pdf

³² https://ec.europa.eu/info/sites/info/files/food-farming-fisheries/key_policies/documents/env_background_final_en.pdf

³³ http://www.plantetp.org/system/files/publications/files/hffa_research_paper_03_16_final_unprotected.pdf



DID YOU KNOW?

EMBRACING THE POWER OF NATURE

Since 2000, plant breeding has enabled EU farmers to save nearly **55 billion cubic meters of water**— enough to fill **22,000 Olympic swimming pools.**

#EmbracingNature

At the same time, nutrients such as nitrogen are essential elements for living organisms, including plants, animals and bacteria. They are used as fertilisers in agriculture to support high yields and quality products. Due to some negative effects derived from the overuse of these resources (water pollution, higher GHG emissions), it is important to consider nitrogen use efficiency of plants within the sustainability criteria.

In this respect, a good example of improved nitrogen use efficiency thanks to breeding is the development of dwarf and semi-dwarf cereal varieties. Moreover, yield stability has increased substantially across environments largely due to the adoption of management-responsive, high-yielding, disease-resistant semi-dwarf wheat cultivars throughout much of the world³⁴.

Some other possible solutions to improve nutrient efficiency are already in place in the EU by precision agriculture. They include processing techniques, nutrient recycling (e.g. through recycling of manure and crop residues) and fine-tuning the fertilisation of cropland and grassland (including adequate determination of crop needs, the use of new precision fertilisation technologies and improved water and soil management)³⁵.

Plant health is of particular importance since, unlike other plant products, seed and other reproductive material is used as a planting material for further multiplication. If seed is infected with pests or diseases, these harmful organisms may be introduced to a place of production and spread within the growing crop. This may then need additional applications of plant protection products and can lead to severe yield and quality losses.

³⁴ <http://www.fao.org/3/y4011e04.htm>

³⁵ https://ec.europa.eu/environment/water/water-nitrates/pdf/Closing_mineral_cycles_final%20report.pdf

Research

- Euroseeds believes that research and innovations in plant breeding provide many benefits in relation to sustainability by improving crop genetic diversity, responding quicker to climate change effects, creating new varieties more resistant and tolerant to pests and diseases and resource efficiency.

Innovative solutions such as new breeding methods help to make genetic diversity more accessible to breeding by increasing speed and efficiency of incorporating genetic diversity from different sources including plant genetic resources into modern cultivars³⁶.

Soil is the support system for nutrients, microorganism communities, water, and organic matter, which are all essential for food production. Furthermore, it plays an important role in making crops and food systems more resilient or mitigating climate change by conserving soil carbon.

Research on well performing crop varieties which provide additional environmental benefits such as better interaction with the soil microbiota or that help to keep organic matter in soil are some of the challenges for the sector on soil and biodiversity. It could also be interesting to study interactions between plant's genome and mycorrhizae for a better use efficiency of soil nutrients and a better plant health.

In addition, improved varieties more resistant to pests and diseases which require less input use (pesticides, fertilisers) also contribute to good soil health conditions and benefit the entire rural ecosystem, taking into account consumer as well as general societal demands.

Seed protection is a fundamental part of the Integrated Pest Management, which also contributes to promote resource efficiency and keeps/improves biodiversity, while at the same time reduces water contamination by run-off or drift. Research on how to increase sustainability in seed protection, e.g. via treatment methods, biocontrol products or biostimulants, will benefit the seed sector, farmers and the environment.

The conservation of plant genetic resources is essential to ensure that a wide range of diversity is available for future use to help safeguard the survival of humankind. Research projects in this field are important. Contributing to such research efforts, Euroseeds is a partner in the H2020 Farmers' pride consortium and a member of the External Advisory Board of the H2020 GenRes Bridge project.³⁷

Europe's plant breeders and seed producers develop the high-quality seeds that are required for sustainable and competitive farming in Europe. Ensuring that seeds are healthy is the precondition for healthy crops and crucial for food safety and security as well as sustainability, even more so in the context of climate change.

As an example, plant breeding and certified seed are of utmost importance when establishing strategies to control and manage Ergot (*Claviceps* spp.) in cereals and grasses³⁸. Ergot is a fungal disease of cereals and grasses which results in lower yields and contamination of harvest by alkaloids, which is of public health concern.

³⁶ <https://www.frontiersin.org/articles/10.3389/fpls.2019.01468/full>

³⁷ <http://www.farmerspride.eu/>; <http://www.genresbridge.eu/>

³⁸ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4379517/>

A fundamental part of the research carried out by breeders relates to improved varieties more resistant to pests and diseases. This has been recognised in the general principles of Integrated Pest Management which include, where appropriate, the use of varieties resistant/tolerant to pests and diseases and standard/certified seed and planting material as one of the main ways to prevent and/or suppress harmful organisms³⁹.

Some examples of bred tolerant/resistant varieties which are currently widely used by EU farmers are:

Crop	Pest or disease
Sugar beet	Leaf spot disease caused by <i>Cercospora beticola</i> (fungal disease)
Tomato	Tomato spotted wilt virus (TSWV) disease
	Tomato mosaic virus (ToMV) disease
Pepper	Root-knot nematodes (<i>Meloidogyne</i> sp.)
	Powdery mildew caused by <i>Leveillula taurica</i> (fungal disease)
Cereals	Barley yellow dwarf virus (BYDV) disease
Potatoes	Potato cyst nematodes (<i>Globodera</i> spp)

Moreover, depending on the persistence and risk of certain pests and diseases, seed treatment also offers the possibility, according to the principles of Integrated Pest Management, to apply reduced doses of plant protection products in an efficient way.



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³⁹ <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32009L0128&from=EN>