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CropBooster-P

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Introduction

The Executive Committee and all further members of the CropBooster-P Consortium have expressed their commitment to execute the developed Research Agenda to future-proof Europe's crops. In order to do so a large, pan-European research program is proposed, "The CropBooster Program" (1) carried out by a consortium of approx. 100 partners from all EU Member States and Associated States. The foreseen run-time of this program is 10 years, followed by another phase of an estimated 6-10 years in which industry will translate the results of the program into new elite breeding material. For this reason, as strong interaction from day 1 on will be required between the CropBooster Program and industry.

In order for the program to be successful and to have maximal impact, it is needed that it is organized as a "unitary program" with a centralized Management and Government Structure, and a predetermined funding for a period of 10 years. After consulting with various bodies at the European Commission, stakeholder representatives in Brussels and national governments, currently the most likely organization form for the proposed CropBooster Program seems to be an Institutional Partnership. Future activities of the CropBooster-P management thus will be geared towards establishing such a partnership probably in the Horizon Europe period 2025 – 2027.

As a result of this, also the Management Structure and the Governance of the future CropBooster Program currently is shaped according to the structures of existing partnerships. As such, however, the described Management Structure and Governance of the CropBooster Program should be considered a proposal, and subject to the actual funding instrument that in future will be available for the realization of this program.

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The Consortium

The CropBooster Program is envisioned to be executed in a large, pan-European consortium of an estimated 100 institutions from all EC Member States plus Associated States. The Research Agenda of the CropBooster Program is firmly rooted in the thoughts and ideas of the Photosynthesis 2.0 Consortium which was established in 2016 (2). This consortium currently is in a dormant state but can probably be reactivated quite easily. Together with the current CropBooster-P Consortium, institutes that participated in the CropBooster-P Focus Groups, the CAPITALISE Consortium (3) (the "sister project" of the CSA CropBooster-P) and a number of plant phenotype installations belonging to EMPHASIS (4) a potential core-consortium for the CropBooster Program consisting of 85 partners, both Institutes and Institutional Units, thus already is in place (see also figure 1). This core-consortium will form the crystallization point for the future CropBooster Program Consortium.

The potential core-consortium currently consists of the following partners:

The Netherlands:

- Wageningen University & Research
- Free University of Amsterdam
- The Netherlands Plant Eco-Phenotyping Centre (NPEC)
- Ceratium BV

France (Partners are listed at the levels of Institutes or Institutional Units):

- ACTA, Les instituts techniques Agricoles
- AGAP Institut (Amélioration Génétique et Adaptation des Plantes méditerranéennes et tropicales), Montpellier (CIRAD, INRAE, Institut Agro Montpellier, Montpellier University)
- AGIR (AGroécologie - innovations - TeRritoires), Toulouse (INRAE)
- Agroécologie, Dijon (INRAE, Institut Agro Dijon, Bourgone University, Bourgone Franche-Comté University, CNRS)
- ARVALIS Institut du Végétal, Ouzouer-le-marché
- Auzeville Experimental Unit, Toulouse (INRAE)
- BFP (Biologie du Fruit & Pathologie), Bordeaux (INRAE, Bordeaux University)
- BIA (Biopolymères Interactions Assemblages), Nantes (INRAE)
- BIAM (Institut de Biosciences et Biotechnologies d'Aix-Marseille), Cadarache (CEA, CNRS, Aix Marseille University)
- DiaScope Experimental Unit, Montpellier (INRAE)
- EMMAH (Environnement Méditerranéen et Modélisation des Agro-Hydrosystèmes), Avignon (INRAE, Avignon Pays de Vaucluse University)
- GDEC (Génétique Diversité Ecophysiologie des Céréales), Clermont-Ferrand (INRAE, CNRS, Clermont-Auvergne University)

- GQE (Génétique Quantitative et Évolution), Le Moulon (INRAE, CNRS, Université Paris-Saclay, AgroParisTech)
- I2BC (Institut de Biologie Intégrative de la Cellule), Gif sur Yvette (CEA, CNRS, Paris-Saclay University)
- IBMP (Institut de Biologie Moléculaire des Plantes), Strasbourg (CNRS, Strasbourg University)
- IBPC (Institut de Biologie Physico-Chimique), Paris (CNRS, Sorbonne University)
- IGEPP (Institut de Génétique, Environnement et Protection des Plantes) Rennes (INRAE, Institut Agro Rennes Angers, Rennes 1 University)
- IJPB (Institut Jean-Pierre Bourgin), Versailles (INRAE, AgroParisTech)
- IPS2 (Institut des Sciences des Plantes - Paris-Saclay), Saclay (INRAE, CNRS, Paris-Saclay University, Paris University, Evry University)
- IPSIM (Institut des Sciences des Plantes de Montpellier), Montpellier (INRAE, CNRS, Institut Agro, Montpellier University)
- IRHS (Institut de Recherche en Horticulture et Semences), Angers (INRAE, Agrocampus Ouest, Angers University)
- LEPSE (Laboratoire d'Écophysiologie des Plantes Sous Stress Environnementaux), Montpellier (INRAE, Montpellier University)
- LIPME (Laboratoire des interactions plantes - microbes - environnement), Toulouse (INRAE, CNRS)
- LPCV (Laboratoire de Physiologie Cellulaire et Végétale), Grenoble (CNRS, INRAE, CEA, University Grenoble Alpes)
- MISTEA (Mathématiques, informatique, statistique pour l'environnement et l'agronomie), (INRAE, INRIA, SupAgro Montpellier)
- P3F (Unité de Recherche Pluridisciplinaire Prairies et Plantes Fourragères), Lusignan (INRAE)
- PHACC Experimental Unit, Clermont-Ferrand (INRAE)
- Station Biologique de Roscoff (CNRS, Sorbonne University)
- Terres Inovia, Dijon
- URGI (Unité de Recherche en Génomique et Bioinfomatique), Versailles (INRAE)

Germany:

- Heinrich Heine University Dusseldorf
- LMU Munchen
- Forschungszentrum Jülich
- MPIMP Golm
- Julius Kühn Institute
- IPK
- University of Potsdam

Italy:

- CNR
- University of Verona

- ENEA
- CREA
- Politecnico di Milano
- ITT
- University of Padua
- Scuola Superiore Sant'Anna

UK:

- Queen Mary University of London
- Imperial College London
- University of Leeds
- University of Essex
- Lancaster University
- University of Nottingham
- University of Cambridge
- James Hutton Institute
- Ceratium

Belgium:

- University of Liege
- VIB
- EPSO
- Euroseed
- ETP Plants for the Future

Denmark:

- University of Copenhagen

Sweden:

- Umeå University
- Uppsala University

Finland:

- University of Turku

Lithuania:

- Vilnius University

Estonia:

- Estonian University of Life Sciences

Czech Republic:

- University of South Bohemia

- CEITEC
- ELI-Beamlines

Hungary:

- Biological Research Centre
- ELI-ALPS

Romania:

- Universitatae de Stiinte Agricole si Medicina Veterinara Cluj Napoca

Spain:

- Universidad de les Illes Balears
- Universitat Autonoma de Barcelona
- CREAF
- CSIC

Portugal:

- Universidade nova de Lisboa

Switzerland:

- ETH Zurich
- University of Zurich
- University of Neuchatel
- University of Lausanne

Israel:

- Hebrew University of Jerusalem
- Volcani Center
- Ben-Gurion University of the Negev

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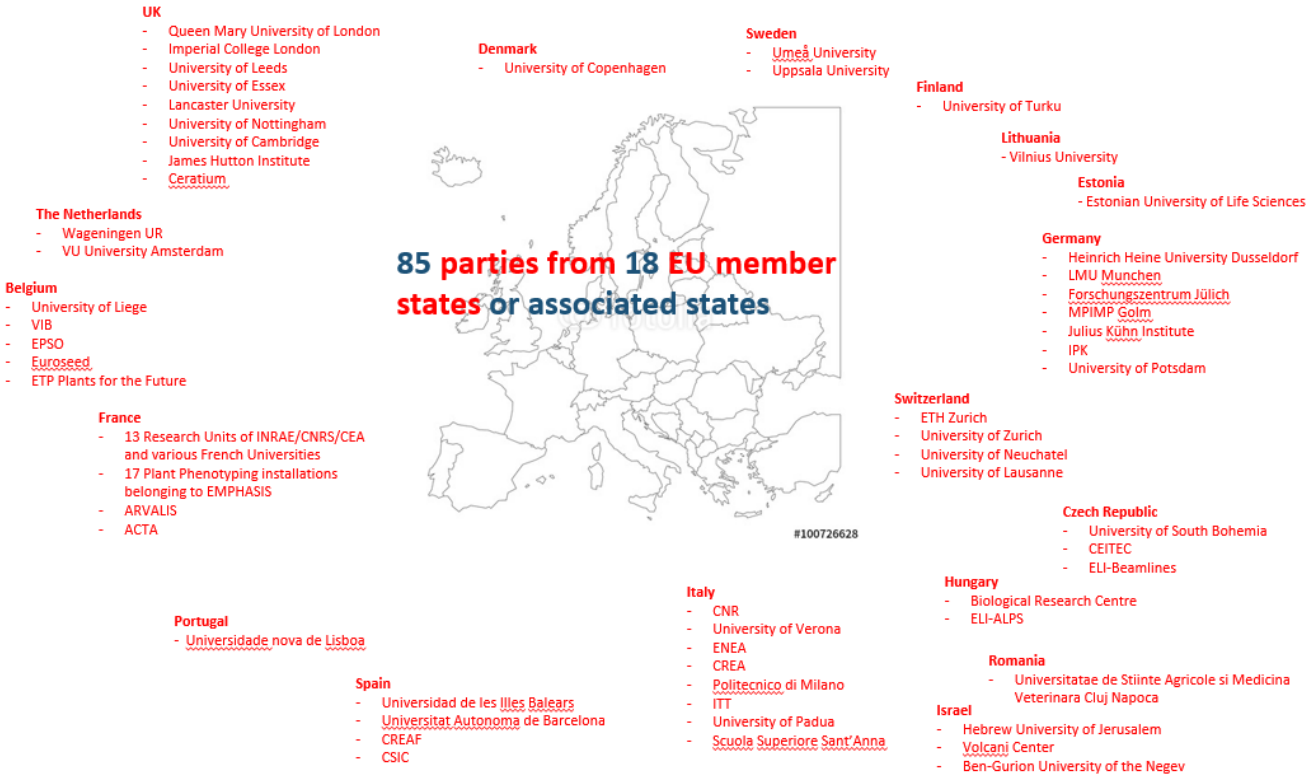

Figure 1: Potential core-consortium for the CropBooster Program

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Extending the Consortium

The new CropBooster programme will be open and extended to have a complete portfolio of required expertise and access to infrastructures, and adequate coverage in terms of crops, countries and farming/growing practices. This is also outlined in the White Paper/SRA.

Cropbooster; ensuring competition and renewal within the programme.

Cropbooster will be a large programme of long duration. This has implications for how we will allocate research budgets in the first instance and how the programme will be renewed to shift focus based on results.

The CropBooster-P White Paper (D5.7) provides a detailed framework for CropBooster that is based on the input of a large number of the best plant scientists, social scientists, marine biologists, plant breeders, biomathematicians and physicists in Europe and beyond. Implementing this plan will depend on a new team developed by the Management Bodies of CropBooster through open calls. The team that produced CropBooster-P will not necessarily be the team that will define and lead the detailed programme for CropBooster. We envisage that once appointed by the Management Bodies of CropBooster, the Governing Board and the Executive Team of CropBooster will devise work-packages detailing the research and development tasks needed for the fulfilment of CropBooster. Teams comprised of European science leaders and relevant industry participants would then bid to carry out these Research and Innovation packages. As the programme develops, new work-packages would be devised and bids requested that would bringing new blood and new ideas, into the programme. This would be matched by development of the Governing Board under the guidance of the General Assembly, with new members replacing old, and bringing with them new ideas. By this means there will be competition and renewal within Cropbooster. One constraint that would limit the flexibility of the Governing Board to appoint purely on the basis of scientific need and excellence is that emerging from funding. If Cropbooster would be 100% funded by the European Commission then it would be able to appoint scientific teams from across the EU and non-EU partner countries without any restriction other than those emerging from scientific need. If the programme were to be partly directly funded by member states more in the style of a Partnership this is likely to require the appointment of scientific teams that parallel the geographical bias of the funding (e.g. ERANETS and Eurostars). Another constraint arises from the investment in high value capital items, such as phenotyping systems, that will be needed by Cropbooster. Alongside the institution hosting the facility, Cropbooster (working closely with the EMPHASIS programme) should retain some control over any high value facilities that it builds as these are not portable in any meaningful way so the operational quality of these facilities should be ensured by Cropbooster in proportion to the investment made.

Cropbooster; a multidisciplinary and pan-European programme.

Our ambition is that CropBooster will be an inclusive programme both scientifically and geographically; we believe that this is necessary to achieve the scientific goals of the programme and inclusivity will be a responsibility of the Governing Board of the programme.

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Scientific inclusivity emerges from our vision of Cropbooster as a fundamentally interdisciplinary programme that will depend on the cooperation of plant scientists and modellers, marine biologists, physicists, soil scientists, engineers and coders, biomathematicians, agronomists, plant breeders and economists and social scientists. This diversity of expertise will be necessary for the project to achieve its goal, which is to future proof our crops, ensuring that these crops will be resilient and adapted to the future climates of Europe. Sustainability not only means durable production in environmental terms but also in economic terms; agriculture must be both if it is to support a vibrant and affluent rural economy. We see that any reasonable interpretation of the goals of the future CropBooster programme inevitably leads to the conclusion that a successful programme must be scientifically inclusive and multidisciplinary.

Alongside being scientifically inclusive we believe that Cropbooster must be a pan-European endeavour. Europe makes use of a diversity of crop plants (already summarised) and we expect that these crops will change to meet the future economic needs of Europe and beyond for food, non-food, and environmental management uses. These crops are grown in a diversity of soils and climates, and these climates are changing. The future climates of Europe will also be, to some extent, similar to current climates within and adjacent to Europe. For these reasons alone we need to have a pan-European programme; Cropbooster must operate throughout Europe if we are to make the best of the crop production opportunities that exist in Europe and prepare for the future. The inclusivity that arises from our vision of Cropbooster will be hard-wired into the General Assembly and the Governing Board - their leadership will create the multidisciplinary, pan European programme. This desire for geographical inclusivity could be at least partly tied to national or regional science, agriculture, food and climate programmes and priorities.

Management Structure and Governance

The Management Structure and Governance of the future CropBooster Program is based on previously successful models for Partnerships and EJPs. The current Management Structure and Governance must be considered as a proposal and example and can be adapted to appropriate future funding schemes for large scale programs. Such an adapted Management and governance concept will become a central aspect of the future Consortium Agreement for this program.
The proposed Management Structure and Governance has the following main functions:

General Assembly (GA): This board will include one representative from each partner (signatory of the Partnership Grand Agreement, GrAg). It will meet only for Extraordinary General Meetings (EGM) to take decisions on contractual matters e.g. amendments to the GrAg (e.g., addition of new members, termination of existing partners and amendments to the Description of Action). Each member will have one vote. As all signatories are legally bound by

the GrAg (and by any amendments to the GrAg), they must have the right to vote on any amendments.

Governing Board (GB): This is the operating decision-making body of the partnership. In particular, the GB adopts the annual work plans of the Partnership, reports to the EC and other funders and fosters the political commitment. Membership consists of 1 (or 2 – tbd) members per country plus 1 (or 2 – tbd) members representing the Regions Mirror Group (RMG). The voting power of the representative(s) from the RMG should be equal to that of one country. The GB elects one Chair and 2 Vice-Chairs for a period of 5 years. In addition to full members, the following will be invited to GB meetings as observers (without a vote): x representatives of EC (1 each from the DG's involved in or related with the Program); Chair of the Stakeholder and Science Advisory Board; and the Chairs of each of the colleges of the Enlarged Stakeholder Board. External guests may be invited as speakers for particular agenda items by the Chairs of the GB, including representatives of countries willing to join the Partnership in the future. The role of observers is diverse (e.g. provide advice to the GB, candidate for membership and therefore presenting opportunities of/for the country, presenting new developments beyond Europe, etc..). Conflict of Interest and/or confidentiality will be managed by making relevant parts of the GB meeting open for voting members only. One or more representatives of the OT will be responsible for note taking, logistics etc.

Executive Team (ET): The ET includes the Partnership Coordinator, Chair and Vice Chairs of the GB; Operational Team members; and Work Package leaders. The role of the ET is to ensure that the GB decisions are implemented throughout the activities of the Partnership.

Operational Team (OT): The OT will ensure the implementation of activities in the partnership and support to all boards, in particular on administrative matters (protocols, preparing meeting agendas, administrative matters related to the Grant Agreement, etc.). The OT will cooperate and support with the GB to establish a one voice strategic communication at the program level. The OT is led by a Head of OT and includes other support staff.

Industry Board (IB): Membership consists of 1 representative per Industrial Partner that has signed the GrAg. The role of the IB is to provide advice and direction on the strategy and main activities of the Partnership, and to oversee the translation of scientific research to industry. The IB elects a chair amongst its members for a period of 2 years.

Science and Stakeholder Advisory Board (SSAB): Membership consists of high-level scientists in the remit of the Partnership (elected by the GB) and non-academic stakeholders (elected by enlarged stakeholder board). Membership renewed by one-third every two years. The role of the SSAB is to provide advice and suggestions on the strategy and main activities of the Partnership; be consulted on the main documents produced by the Partnership; review the outputs and impacts of the Partnership, and suggest possibilities for improvement. The

SSAB will also contribute to the dissemination of information related to the Partnership towards relevant scientific bodies and stakeholders.

Enlarged Stakeholder Board (ESB): The ESB will be organised into 4-6 thematic colleges, representing the broad stakeholder types. An open call for interest will be published, and all relevant organisations free to apply. The ESB will be renewed regularly through open call. One representative and one deputy representative will be elected by each college and these will be stakeholder members of the Advisory Board. The ESB should include one college one for Research Infrastructures and one for other major initiatives (e.g., JPIs, other partnerships). The role of the ESB is to inform the stakeholders about the main activities and outputs of the Partnership. The members can contribute to the identification and co-building of research needs to be addressed by the Partnership. Members of this board also bring their own field expertise to contribute to bridging the gaps between research and innovation, and to improve science-based knowledge transfer. The ESB will provide advice and suggestions on the strategy and main activities of the Partnership.

Ethics Advisory Board (EAB): This board will include external experts and will address issues related to ethics and the use and protection of personal data. The GB may ask the EAB for advice on conflict of interest issues.

Mirror Groups:

a. *National Mirror Groups (NMGs)*:
   Participating countries are strongly advised to constitute an NMG, bringing together the national GB member(s) and other relevant stakeholders. The role of the NMGs is to ensure national coordination, contribute to the objectives of the Partnership and benefit from it. The composition of an NMG is at the discretion of each participating country. NMGs could include representatives of Research Infrastructures, relevant national and regional authorities and research institutions (whether participating in the Partnership or not), as well as the national and regional members of the Partnership and the GB member that reports NMG views and positions during GB meetings. The establishment of National Mirror Groups ensures that the activities, strategies and needs of that country are considered when taking decisions at the Partnership level and when designing the annual work plans.

b. *European Mirror Group (EMG):*
   This group should bring together a wider network of EC bodies that have an interest in the activities of the Partnership. This would include DG's who act as observers at the GB, as well as other relevant DGs (DG-AGRI, DG-RTD, DG-SANTE, DG CLIMA; DG ENV; DG REGIO; DG INTPA; JRC etc.). This should facilitate a two-way flow of information, from the GB to the relevant DGs/JRC and from the DGs/JRC to the GB.

c. *Regions Mirror Group (RMG):*
   This group should bring together the regional representatives of the Partnership, allowing them to discuss issues specifically of relevance to regions. They should elect

two members who will act as observers at the GB, facilitating a two-way flow of information.

d. *RPO & RI Mirror Group (RRMG):*
This group should bring together the Research Performing Organizations (RPOs) and Research Infrastructures (RIs) members of the Partnership allowing them to discuss issues specifically of relevance to their members. They should elect two members who will act as observers at the GB, facilitating a two-way flow of information.

Interaction with other Partnerships will be vital in order to ensure synergies and avoid redundancy between different Partnerships. One of the colleges in the enlarged stakeholder board will represent other major initiatives. In addition, it may be useful to establish a group with representatives of each of the Partnerships, that will meet on a regular basis to exchange information and identify how best to optimize the interaction between the Partnerships.

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