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#### **CropBooster-P** Deliverable 4.1 Title: Network maps of research networks available for further scientific interactions.

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Deliverable leader: UDUS

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#### 1. SUMMARY

On the basis of results from WP1 and WP2 individual research fields were defined that are associated with "Yield" (five research fields), "Nutritional Quality" (five research fields) or "Sustainability" (six research fields). Within these research fields, the landscape of interactions in Europe was mapped, between researchers, research institutions, countries and research fields. The strengths of these interactions were quantified, and three important and several interconnected aspects could be addressed:

- which researchers excel, by their numbers of publications, in a given research field,
- which institutions are strong in a research field and, moreover, in more than one of these fields,
- which research fields are not adequately covered in Europe's research institutions, and
- how strong are the interactions between hubs of plant research in Europe?

The implications of these results for structuring the European plant research landscape are obvious. Already existing research centers and their interactions have to be further strengthened, and additional research centers have to be established at a broader European scale and incorporated into the existing networks, adjusting the European plant research agenda to the EU strategic goal setting, including all relevant scientific expertise and creating synergistic effects.

Moreover, the scope and intensity of Public-Private-Partnerships (PPPs) in Europe has been evaluated, in scientific fields relevant for CropBooster-P. The focus of the analysis has been put on PPPs in Central- and South-European countries, and also on the interaction of such PPPs of individual countries with other European countries. PPPs play a very crucial role for science integrating the aspect of transfer of research results into economic exploitation, in all these countries. Major players could be identified in the public as well as in the private sector in each of the countries analyzed. Such major players are always involved in several such partnerships. Across country borders, PPPs are mainly built between partners from France, Germany, The Netherlands and Belgium. For the establishment of Public-Private Partnerships within individual countries as well as for building consortia across country borders, the "driving forces" are seen in the search for complementary scientific expertise, the ambition to transfer scientific excellence into economic value and the opportunity to get these mutual interests supported by public funding programs. This system should be further strengthened and extended to Southeast- and East-European countries.

Expert panels ("Focus Groups") have been formed for each individual research field (see above), to elaborate and propose strategic research actions that are expected to contribute to reaching the EU strategic goals as outlined in the so called "Green Deal" and the "Farm to Fork" concepts. The reports of the "Focus Groups" will be discussed with stakeholders at a meeting to be organised in March 2021. Inputs received from the stakeholders will be incorporated into the reports and an aggregated final report will then be forwarded to WP5, as a basis for proposing a detailed future plant research agenda, with priorities set according to the strategic goal setting of the EU Commission.



# 2. Mapping the existing research communities using existing formal and informal EU networks (Task 4.1)

2.1. Mapping the research communities from mostly academic organisations and creating a network model (Task 4.1-1)

In WP1, based on an extensive literature survey, research fields were identified that could serve as options to improve crop yield, the nutritional quality of crops and their harvested parts as well as provide steps to a more sustainable agriculture under the threats due to the global climate changes. These research field/options were then used in WP2 to assess the economic, social and environmental impact of the research options. Consequently, the same research fields/options and their association with yield nutritional quality and sustainability (see the respective chart in the annex 2.1) were used as search categories in literature surveys by WP 4.1 to map the landscape of interactions in Europe between:

- researchers
- institutions
- countries
- research fields

The strengths of these interactions were quantified, and therefore three important and several interconnected questions can be inferred from the data obtained:

- which researchers excel, by their numbers of publications, in a given research field,
- which institutions are strong in a research field and, moreover, in more than one of these fields,
- which research fields are not adequately covered in Europe's research institutions, and
- how strong are the interactions between hubs of plant research in Europe?

The implications of these results for structuring the European plant research landscape are obvious. Already existing research centers and their interactions have to be further strengthened, and additional research centers have to be established at a broader European scale and incorporated into the existing networks, adjusting the European plant research agenda to the EU strategic goal setting, including all relevant scientific expertise and creating synergistic effects.

# Addendum 2.1

<u>Work package 4: International Cooperation</u> [Months: 1-36] INRAE, WR, VIB, WU, CNR, EPSO, UDUS, UNOTT, CNRS, UCPH, ULANC, USAMV CLUJ, ESA, ACTA

**Task 4.1.** This task aims to map the existing research communities using existing formal and informal EU networks (M1-M18->M24). Task leader: UDUS; other partners: WR, VIB, CNR, EPSO, UNOTT, CNRS, UCPH, INRA, ULANC, USAMV, ESA, SORBONNE, ARVALIS

•Research communities (physiologists, geneticists, breeders, modellers, agronomists, socio-economists, pathologists, etc...) who are mostly coming from academic organisations (Research Institutes and Universities).

•Create a network model of existing or lacking interactions from the mapping of national or international communities and projects, and their distribution within Europe.

•Applied Research communities (Private companies, R&D services of Cooperatives, Technical Institutes, networks of Experimental Stations etc.).

•Selecting people from all partners at European level (including 13 SHG members) to assemble an expert panel.



# Task 4.1-1 Mapping the Research Communities from mostly Academic Organisations and Creating a Network Model

Method: Screening of the scientific production (WoS) during five years (2015-2019) using key terms linked to traits (Yield, Sustainability, Nutritional quality) selected during the WP1.

**Proof of concept**: Use of the > 600 publications referenced during WP1 (WP1 database) to select traits (Yield, Sustainability, Nutritional quality).

Dominique Fournier, INRAE, Montpellier, France Jacqueline Martin-Laffon, CNRS, Grenoble, France Bertrand Muller, INRAE, Montpellier, France Philippe Nacry, INRAE, Montpellier, France Norbert Rolland, INRAE/CNRS, Grenoble, France



**Proof of concept for the literature screening:** Use of the > 600 publications referenced during WP1 to select traits (Yield, Sustainability, Nutritional quality).

Method: Analysis of experts' publications 617 UT 612 publications referenced in the Web of Science and use of addresses to identify institutions and units

Main Was Catagorias	Publicatio	
Main wos categories	ns	
Plant Sciences	390	
Multidisciplinary Sciences	82	
Biochemistry & Molecular Biology	73	
Agronomy	62	
Genetics & Heredity	56	
Cell Biology	45	
Biotechnology & Applied Microbiology	40	
Horticulture	34	
Biology	15	
Agriculture, Multidisciplinary	8	
Biochemical Research Methods	8	
Ecology	8	
Food Science & Technology	8	
Chemistry, Multidisciplinary	7	
Environmental Sciences	6	
Energy & Fuels	5	
Nutrition & Dietetics	5	
TOTAL	852	

**Research fields** - WoS Categories

852 > 612 since some publications are present in more than one category

# Author Keywords (WP1 database)



*Keywords associated to WP1 selected traits (Yield, Sustainability, Nutritional quality) as cited by authors of the > 600 publications present within the WP1 (database)* 



# Network of keyword co-occurrence (WP1 database)





*Network of keyword co-occurrence* help defining research fields associated to WP1 select traits (Yield, Sustainability, Nutritional quality)

# Main authors and their interaction (WP1 database) Co-publications between the main authors (at least 3 co-publications)





Most main authors, in the WP1 database, are from an EU28 country

Country	Main institutions	Publications
FR	Inra - FR	86
UK	BBSRC Biotech & Biol Sci Res Council - UK	54
FR	CNRS - FR	47
UK	Univ Nottingham - UK	31
DE	Max Planck Soc - DE	23
ES	CSIC Spanish Natl Res Council - ES	17
FR	Univ Montpellier - FR	15
DE	Univ Dusseldorf - DE	14
FR	Montpellier Supagro - FR	14
UK	Lancaster Univ - UK	14
NL	Wageningen Univ and Res Ctr WUR - NL	13
UK	Univ Essex - UK	12
FR	AgroParisTech - FR	11
FR	Univ Clermont Auvergne - FR	11
FR	Univ Bordeaux - FR	10
FR	Limagrain - FR	8
DE	Leibniz Assoc - DE	8
FR	Univ Paris 11 Paris Sud - FR	8
UK	Univ Manchester - UK	7
IT	CNR Natl Res Council - IT	7
UK	Univ Sheffield - UK	7
UK	Aberystwyth Univ - UK	7
UK	Univ Oxford - UK	7
FR	ARVALIS Inst Végétal - FR	6
UK	Univ Glasgow - UK	6
DE	Univ Gottingen - DE	6
BE	Ghent Univ UGent - BE	6
UK	NIAB Natl Inst Agr Bot - UK	6
SE	Umea Plant Sci Ctr - SE	6
FR	Univ Paris 07 Paris Diderot - FR	6
FI	Univ Turku - Fl	6
CZ	Acad Sci Czech Rep - CZ	5
FR	Univ Lyon 1 Claude Bernard - FR	5
FR	CEA - FR	5
FR	Univ Evry Val d Essonne - FR	5
DE	Univ Potsdam - DE	5
UK	Univ Warwick - UK	5

# Publications by European institutions



From analysis of publications (WP1 database), it is possible to identify main European institutions and Universities

# Co-publications between **European institutions** (WP1 database)



From analysis of co-publications, it is even possible to identify **networks of interaction between laboratories within an institution** (and thus to identify main actors in the fields)

# *e.g.* Co-publications between French institutions (WP1 database)



# Publications by countries

However, in the WP1 database, only half (52%) of the publications are co-authored by an author from an EU28 country, and part of them were published before 2015)



# Analysis of publications Web of Science<sup>™</sup> 2015-2019

#### Aim of first step:

•Research communities (physiologists, geneticists, breeders, modellers, agronomists, socioeconomists, pathologists, etc...) who are mostly coming from academic organisations (Research Institutes and Universities).

The aim of this study was to **identify the main European institutions** which publish in the fields corresponding to the different traits identified during WP1 as being able to improve yield.

Method: **Construction of thematic equations** based on the combination of an equation # 1 "trait" with an equation # 2 "plant production" and an equation # 3 "European country": cf. Annex

These equations were used to query the Web of Science<sup>™</sup> (Science Citation Index Expanded, Social Sciences Citation Index. Arts & Humanities Citation Index, Conference Proceedings Citation Index), the terms being searched for in titles (TI), summaries (AB) and keywords authors (AK).

The publications considered in this study are citable publications, such as Article, Review, Proceeding Papers and Letters.

A total of 14,053 publications were collected and analyzed for "yield" and "sustainability" (step 1) (+ > 10,000 publications for "nutritional quality", step 2).



# Selected research fields for the literature screening (According to WP1 and WP2)

# Step 1: "Yield" and "Sustainability"



# - Yield and sustainability: General analysis (Keywords)

# Part of UE28 in the publications collected and analyzed

Traits identified by experts in WP1	Publications UE28	Publications World	Publications UE28 / World
Nutrient-uptake	3 070	8 822	35%
Secondary-metabolism	3 040	8 880	34%
Growth-rate	1 960	7 119	28%
Nutrient-metabolism- transport	1 655	5 585	30%
Biochemistry-carbon- assimilation	1 372	3 491	39%
water-use-efficiency	1 226	4 371	28%
Nutrient-use-efficiency	824	3 001	27%
Photochemistry	669	1 543	43%
Photoprotection	556	1 288	43%
Shoot-architecture	492	1 454	34%
Primary-metabolism	455	973	47%
Source-Sink Balance	414	1 209	34%
Leaf-anatomy	263	885	30%
Source Web of Science Clarivate Analytics – 2015-2019 – Treatment INRAE/CNRS 2020 - Article, Review, Proceeding Papers or Letters			



Note that, in these research fields, publications signed by EU28 scientists represent between 27% and 47% of global scientific production.



# Origin of the 14,053 publications at EU28 scale





Analysis of publications Web of Science<sup>™</sup> 2015-2019



# Author Keywords

*Keywords (>24 occurrence) associated to WP1 selected traits (Yield, Sustainability) as cited by authors of the 14,053 publications published by UE28 institutions (2015-2019)* 

## WP1 database



Note that, when compared to the keywords derived from the database produced in WP1, keywords linked to "sustainability" (*e.g.* climate change, water use efficiency, phosphorus, nitrogen, drought...) are more detectable.



# Network of keyword co-occurrence helps defining main research fields







The network represents the co-occurrences of the main author keywords (minimum 20 occurrences, or 370 keywords) and the links indicate the existence of at least 5 publications with the 2 terms (threshold: 5, files Vosviewer network-Keywords-DE-20min-link-5-map.txt and network-Keywords-DE-20min-link-5-net.txt).

eu

# Keyword co-occurrence by traits *e.g.* Biochemistry-Carbon-Assimilation (threshold: 4 occurrences, links> 1)







# 2.Enhancing photosynthesis by boosting light & carbon use efficiencies -> Yield & Sustainability

# Main authors

Photochemistry Biochemistry, carbon assimilation Photoprotection



Author		Citations	Total link
Author	Documents +	Citations	strength
fernie, alisdair r.	39	614	74
ruban, alexander v.	38	774	64
croce, roberta	30	390	53
bassi, roberto	26	427	51
aro, eva-mari	23	471	51
van grondelle, rienk	23	200	34
bauwe, hermann	18	289	51
lawson, tracy	18	513	18
timm, stefan	16	298	51
weber, andreas p. m.	15	261	30
tikkanen, mikko	15	355	29
tcherkez, guillaume	15	147	15
aranjuelo, iker	14	80	4
suorsa, marjaana	13	377	36
dall'osto, luca	13	178	32
moustakas, michael	13	163	16
gessler, arthur	13	115	7
brestic, marian	12	547	23
zivcak, marek	12	547	23
niyogi, krishna k.	12	567	21
urban, otmar	12	84	18
morosinotto, tomas	11	127	33
centritto, mauro	11	87	32
chmeliov, jevgenij	11	147	30
valkunas, leonas	11	147	30
haworth, matthew	11	132	25
yin, xinyou	11	87	24
parry, martin a. j.	11	262	23
ballottari, matteo	11	125	22
garab, gyozo	11	133	20
carmo-silva, elizabete	11	195	17
long, stephen p.	11	393	10
niinemets, ulo	11	128	9
flexas, jaume	11	237	8

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# Keyword co-occurrence by traits e.g. Improving heat tolerance (threshold: 4occurrences, links> 1)





#### 1. Improving Heat tolerance-> Sustainability & Yield

Main authors

#### Heat stress





# Keyword co-occurrence by traits e.g. Water-use-efficiency (threshold: 4occurrences, links> 1)







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#### 1. Increasing the use efficiencies of water -> Sustainability & Yield

# Main authors

## Water-use-efficiency





Etc...

# Main actors (institutions) in all fields



Publications by EU28 institutions (threshold: at least 200 publications, 2015-2019 period).

Main actors in UE28 (> 200 publications)	Publications 2015-2019	Publications with UE28	% publications with UE28
INRAE - FR	1012	351	34,7%
CNRS - FR	885	345	39,0%
CSIC Spanish Natl Res Council - ES	690	281	40,7%
Max Planck Soc - DE	574	271	47,2%
Wageningen Univ and Res Ctr WUR - NL	496	231	46,6%
Helmholtz Assoc - DE	413	194	47,0%
CNR Natl Res Council - IT	405	141	34,8%
Leibniz Assoc - DE	331	126	38,1%
Swedish Univ Agr Sci SLU - SE	323	159	49,2%
Univ Copenhagen - DK	297	118	39,7%
BBSRC Biotech & Biol Sci Res Council - UK	266	98	36,8%
Univ Gottingen - DE	247	64	25,9%
Acad Sci Czech Rep - CZ	245	118	48,2%
CREA Council Agr Res & Agr Economics - IT	215	60	27,9%
Univ Montpellier - FR	210	73	34,8%
Univ Napoli Federico II - IT	210	72	34,3%
Cirad - FR	206	40	19,4%
Ghent Univ UGent - BE	201	95	47,3%
Aarhus Univ - DK	200	80	40,0%

Partner of CropBooster-P

Source Web of Science Clarivate Analytics – 2015-2019 – Treatment INRAE CNRS 2020 - Article, Review, Proceeding Papers or Letters

# Collaborations of the main institutions (which have at least 200 publications).

The links shown correspond to a minimum of 10 co-publications between the institution and its partner.



database produced in WP1

# Network of collaboration at country level

# *e.g.* Germany with UE28 countries









# Network of collaboration at country level

# *e.g.* Netherlands with UE28 countries



# Network of collaboration at institution scale

## e.g. WUR with UE28 institutions



# e.g. CNRS with UE28 institutions





# Network of collaboration at institution scale

Etc...

## e.g. CNR with UE28 institutions



## *e.g.* CSIC with UE28 institutions





# Network of collaboration at institution scale

#### e.g. INRAE with UE28 institutions



# e.g. Max Planck Soc with UE28 institutions





Network of collaboration at laboratory scale within an institution helps identifying main scientists in each field



# e.g. INRAE laboratories with INRAE laboratories





# UE28 institutions with other UE Institutions within a field e.g. Biochemistry-Carbon-Assimilation (threshold: 5 occurrences, links> 1)



Relative impact of UE Institutions and their interactions within a specific field
# UE28 institutions with other UE Institutions within a field e.g. Nutrient-metabolism-transport (threshold: 5 occurrences, links> 1)





Relative impact of UE Institutions and their interactions within a specific field

#### UE28 institutions with other UE Institutions within a field e.g. Water Use Efficiency (threshold: 5 occurrences, links> 1)





Relative impact of UE Institutions and their interactions within a specific field

#### UE28 institutions with other UE Institutions within a field e.g. Shoot Architecture (threshold: 5 occurrences, links> 1)





Relative impact of UE Institutions and their interactions within a specific field

UE28 institutions with other UE Institutions within a field e.g. Improving heat tolerance (threshold: 5 occurrences, links> 1)







#### Mains actors in all fields (Yield, sustainability) and their interactions





At scientist scale in all fields

Partners of CropBooster-P

# Mains actors in a specific field and their interactions e.g. Biochemistry-Carbon-Assimilation (threshold: 4 occurrences, links> 1)







#### At scientist scale within a field: network of interaction in this field OK

#### Enhancing photosynthesis by boosting light & carbon use efficiencies -> Yield & Sustainability

Photochemistry Biochemistry, carbon assimilation Photoprotection

# List of main actors within a specific field and their impact



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Author		Citations	Total link
Addior	Documents	citations	strength
fernie, alisdair r.	39	614	74
ruban, alexander v.	38	774	64
croce, roberta	30	390	53
bassi, roberto	26	427	51
aro, eva-mari	23	471	51
van grondelle, rienk	23	200	34
bauwe, hermann	18	289	51
lawson, tracy	18	513	18
timm, stefan	16	298	51
weber, andreas p. m.	15	261	30
tikkanen, mikko	15	355	29
tcherkez, guillaume	15	147	15
aranjuelo, iker	14	80	4
suorsa, marjaana	13	377	36
dall'osto, luca	13	178	32
moustakas, michael	13	163	16
gessler, arthur	13	115	7
brestic, marian	12	547	23
zivcak, marek	12	547	23
niyogi, krishna k.	12	567	21
urban, otmar	12	84	18
morosinotto, tomas	11	127	33
centritto, mauro	11	87	32
chmeliov, jevgenij	11	147	30
valkunas, leonas	11	147	30
haworth, matthew	11	132	25
yin, xinyou	11	87	24
parry, martin a. j.	11	262	23
ballottari, matteo	11	125	22
garab, gyozo	11	133	20
carmo-silva, elizabete	11	195	17
long, stephen p.	11	393	10
niinemets, ulo	11	128	9
flexas, jaume	11	237	8

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## Mains actors in a specific field and their interactions *e.g.* Shoot-Achitecture (threshold: 2 occurrences, links> 1)





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Etc...

## Mains actors in a specific field and their interactions *e.g.* Nutrient use efficiency (threshold: 2 occurrences, links> 1)



Contacted Focus group coordinator





Main actors within a field: lack of interaction in this field? ww.CropBooster-P.eu

#### Mains actors in a specific field and their interactions *e.g.* Heat stress (threshold: 3 occurrences, links> 2)



Etc...





Main actors within a field: lack of interaction in this field? ww.CropBooster-P.eu

# Selected traits for the literature screening (According to WP1) Step 2: Nutritional quality



#### - Nutritional quality: General analysis (> 10,000 publications)

*Keywords* Network of **keyword co-occurrence** defines **research fields** 



- Nutritional quality: General analysis

#### List of **main institutions** in **all fields** linked to **Nutritional quality**



¢	Name	Rank	Country/Region	♥ Web of Science Documents	Times Cited	Category Normalized Citation Impact	% Documents in Q1 Journals	% Docs Cited	% Documents in Top 1%
			(i)	<i>(i)</i>	(i)	<i>i</i>	<i>(i)</i>	<i>(i)</i>	<i>(i)</i>
	▶ INRAE	1	FRANCE	473	6,262	1.95	64.37%	85.2%	4.65%
	* Wageningen University & Research	2	NETHERLANDS	431	6,079	1.98	70.87%	85.85%	5.8%
	<ul> <li>Consejo Superior de Investigaciones Científicas (CSIC)</li> </ul>	3	SPAIN	427	5,279	1.83	71.48%	82.44%	3.98%
	Consiglio Nazionale delle Riœrche (CNR)	4	ITALY	266	2,768	1.5	55.56%	84.96%	3.01%
	* Centre National de la Recherche Scientifique (CNRS)	5	FRANCE	253	3,826	1.91	67.84%	82.21%	4.74%
	Ghent University	6	BELGIUM	190	2,070	1.57	68.12%	85.79%	2.63%
	University of Copenhagen	7	DENMARK	172	2,829	1.78	70.73%	86.05%	4.07%
	Universidade do Porto	8	PORTUGAL	169	3,094	2.22	73.21%	85.21%	2.37%
	University of Naples Federico II	9	ITALY	165	2,103	1.89	72.28%	81.82%	6.06%
	* Swedish University of Agricultural Sciences	10	SWEDEN	160	1,734	1.4	56.52%	85%	3.75%
	<ul> <li>Consiglio per la Riœrca in Agricoltura e l'analisi Dell'economia Agraria (CREA)</li> </ul>	11	ITALY	157	1,424	1.34	52.21%	83.44%	1.91%
	University of London	12	ENGLAND	153	3,638	2.56	73.83%	83.66%	3.92%
	CIRAD	13	FRANCE	149	1,867	1.82	62.5%	83.22%	6.04%
	University of Milan	14	ITALY	148	1,587	1.32	52.58%	85.14%	1.35%
	* Universite de Montpellier	15	FRANCE	139	1,459	1.68	61.73%	76.26%	5.76%
	<sup>•</sup> Universita degli Studi di Bari Aldo Moro	16	ITALY	136	1,495	1.6	54.95%	87.5%	2.94%
	Instituto Politecnico de Braganca	17	PORTUGAL	128	1,489	1.36	79.78%	89.06%	2.34%
	Helmholtz Association	18	GERMANY (FED REP GER)	126	3,762	3.55	75.58%	88.1%	11.9%
	Rothamsted Research	19	ENGLAND	125	2,491	2.59	78.65%	90.4%	10.4%
	University of Bologna	20	ITALY	120	1,288	1.5	61.18%	82.5%	2.5%



- Nutritional quality: General analysis

# List of **main authors** in **all fields** linked to **Nutritional quality**

¢	Name	Rank	Affiliation	Country/Region	♥ Web of Science Documents	Times Cited	Category Normalized Citation Impact
			0	<i>(i)</i>	<i>(i)</i>	<i>(i)</i>	(i)
	Ferreira, Isabel C. F. R.	1	Instituto Politecnico de Braganca	PORTUGAL	11	906	1.51
	Barros, Lillian	2	Instituto Polítecnico de Braganca	PORTUGAL	60	746	1.59
	Barba, Francisco J.	3	University of Valencia	SPAIN	46	778	2.21
	Rouphael, Youssef	4	University of Naples Federico II	ITALY	31	568	3.47
	Lorenzo, Jose M.	5	n/a		27	310	2.08
	Calhelha, Ricardo C.	6	Instituto Politecnico de Braganca	PORTUGAL	23	150	1.14
	Hercberg, Serge	6	Institut National de la Sante et de la Recherche Medicale (Inserm)	FRANCE	23	219	1.35
	Hercberg, Serge	6	Hopital Universitaire Aviœnne - APHP	FRANCE	23	220	1.52
	Smolen, Sylwester	9	Agricultural University Krakow	POLAND	22	109	0.83
	Oliveira, M. Beatriz P. P.	9	Universidade do Porto	PORTUGAL	22	324	1.6
	Putnik, Predrag	11	University of Zagreb	CROATIA	21	396	2.21
	Fernandes, Angela	11	Instituto Politecnico de Braganca	PORTUGAL	21	179	1.07
	Kovacevic, Danijela Bursac	11	University of Zagreb	CROATIA	21	392	2.21
	Hercberg, Serge	11	Universite de Paris	FRANCE	21	194	1.54
	Hercberg, Serge	11	INRAE	FRANCE	21	219	1.48
	Casal, Susana	16	Universidade do Porto	PORTUGAL	20	189	0.91
	Kesse-Guyot, Emmanuelle	16	Institut National de la Sante et de la Recherche Medicale (Inserm)	FRANCE	20	219	1.22
	Kesse-Guyot, Emmanuelle	16	INRAE	FRANCE	20	219	1.22
	Zannini, Emanuele	19	University College Cork	IRELAND	19	253	1.21
	Smith, Pete	19	University of Aberdeen	SCOTLAND	19	626	4.67
	Arendt, Elke K.	19	University College Cork	IRELAND	19	274	1.17





#### - Nutritional quality: Proteins

#### Keywords

#### Network of **keyword co-occurrence** in **the field "Proteins"**



#### - Nutritional quality: Proteins

٥

Name

#### List of **main institutions** in **the field "Proteins"**

Country/Region



% Docs

Cited

%

Documents

in Top 1%

1.68%

3.96%

4.49%

3.64%

1.85%

4%

8.89%

2.33%

2.38%

0%

0%

2.78%

2.94%

2.94%

6.25%

0%

6.25%

9.38%

Category

Normalized

Citation

Impact

Times

Cited

▼ Web of

Science

Documents

%

Documents

in Q1

Journals

# Partners of CropBooster-P

		<i>(i)</i>	<i>i</i> )	(i)	(i)	<i>i</i>	<i>i</i>
Consejo Superior de Investigaciones Científicas (CSIC)	1	SPAIN	119	1,037	1.39	73.91%	74.79%
▶ INRAE	2	FRANCE	101	1,296	1.67	53.62%	80.2%
Wageningen University & Research	3	NETHERLANDS	89	1,433	2	75.76%	87.64%
Consiglio Nazionale delle Riœrche (CNR)	4	ITALY	55	555	1.74	60.61%	80%
University of Milan	5	ITALY	54	576	1.49	42.42%	81.48%
<ul> <li>Consiglio per la Riœrca in Agricoltura e L'analisi Dell'economia Agraría (CREA)</li> </ul>	6	ITALY	50	538	1.49	59.38%	74%
University of Naples Federico II	7	ITALY	45	570	1.97	75%	71.11%
University of Copenhagen	8	DENMARK	43	379	1.45	76%	76.74%
Universita degli Studi di Bari Aldo Moro	9	ITALY	42	438	1.7	75%	85.71%
Universidade do Porto	10	PORTUGAL	41	269	1.46	68.18%	85.37%
Centre National de la Recherche Scientifique (CNRS)	11	FRANCE	39	582	1.28	71.43%	87.18%
Poznan University of Life Sciences	12	POLAND	36	262	1.44	36.36%	77.78%
Swedish University of Agricultural Sciences	13	SWEDEN	34	342	1.05	61.9%	73.53%
Technical University of Munich	13	GERMANY (FED REP GER)	34	464	1.55	48.15%	88.24%
Aarhus University	15	DENMARK	32	295	1.93	73.68%	75%
University of Helsinki	15	FINLAND	32	492	1.72	64%	93.75%
Instituto Politecnico de Braganca	15	PORTUGAL	32	268	1.49	73.68%	87.5%
Rothamsted Research	15	ENGLAND	32	653	2.56	84.21%	81.25%

Rank





#### Institutions and their interactions in the field "Proteins"





#### Nutritional quality: Fatty acids – Omega3 -

Partners

CropBoos

	Main institu	tions	in the fie	eld <b>"Fa</b>	tty a	cids — (	Omego	3″	***	~
¢	Name	Rank	Country/Region	♥ Web of Science Documents	Times Cited	Category Normalized Citation Impact	% Documents in Q1 Journals	% Docs Cited	% Documents in Top 1%	% Docum in Top :
			()	(i)	<i>i</i> )	<i>i</i> )	(i)	()	<i>(i)</i>	()
	Consejo Superior de Investigaciones Cientificas (CSIC)	1	SPAIN	32	236	1.53	60%	75%	3.13%	21.88
	▶ INRAE	2	FRANCE	19	148	1.05	64.29%	78.95%	0%	15.79
	Warsaw University of Life Sciences	2	POLAND	19	128	0.71	12.5%	89.47%	0%	5.269
	Universidade do Porto	4	PORTUGAL	18	148	3.26	69.23%	94.44%	5.56%	33.33
	Instituto Politecnico de Braganca	5	PORTUGAL	15	130	1.09	62.5%	86.67%	0%	13.33
	Consiglio Nazionale delle Riœrche (CNR)	5	ITALY	15	105	1.74	25%	86.67%	6.67%	20%
	Centre National de la Recherche Scientifique (CNRS)	7	FRANCE	14	271	3.05	33.33%	85.71%	7.14%	7.149
	University of Perugia	8	ITALY	13	118	2.4	60%	69.23%	15.38%	30.77
	University of Barcelona	8	SPAIN	13	70	0.66	70%	92.31%	0%	0%
	University of Turin	10	ITALY	12	92	2.05	37.5%	75%	8.33%	25%
	Universite Clermont Auvergne & Associes	10	FRANCE	12	86	0.89	66.67%	75%	0%	8.339
	University of Pisa	12	ITALY	11	92	1.2	33.33%	63.64%	9.09%	18.18
	Wageningen University & Research	12	NETHERLANDS	11	377	3.97	100%	90.91%	27.27%	45.45
	Universidade de Aveiro	12	PORTUGAL	11	169	1.42	62.5%	81.82%	9.09%	27.27
	Technical University of Denmark	15	DENMARK	10	63	0.77	60%	70%	0%	0%
	Ghent University	15	BELGIUM	10	200	5.06	71.43%	90%	30%	30%
	University of Naples Federico II	15	ITALY	10	103	1.55	87.5%	100%	0%	20%
	<ul> <li>Consiglio per la Riœrca in Agricoltura e L'analisi Dell'economia Agraria (CREA)</li> </ul>	15	ITALY	10	70	1.04	25%	70%	0%	20%



- Nutritional quality: Biomass digestibility

#### Network of keyword co-occurrence in the field "Biomass digestibility"





### - Nutritional quality: Biomass digestibility

#### Main institutions in the field "Biomass digestibility"



Partners of CropBooster-P



3	Name	Rank	♥ Web of Science Documents	Country/Region	Times Cited	Category Normalized Citation Impact	% Documents in Q1 Journals	% Docs Cited	% Document in Top 1%
			(i)	()	<i>(i)</i>	(i)	(i)	<i>(i)</i>	<i>(i)</i>
	Wageningen University & Research	1	29	NETHERLANDS	381	1.42	82.61%	75.86%	3.45%
	▶ INRAE	1	29	FRANCE	64	0.88	37.5%	55.17%	0%
	Poznan University of Life Sciences	3	21	POLAND	134	1.8	25%	85.71%	4.76%
	Consejo Superior de Investigaciones Científicas (CSIC)	4	20	SPAIN	204	1.18	57.14%	95%	0%
	Universita degli Studi di Bari Aldo Moro	5	16	ITALY	177	2.11	100%	75%	6.25%
	Aarhus University	6	13	DENMARK	162	2.41	70%	84.62%	7.69%
	Universite Clermont Auvergne & Associes	7	11	FRANCE	30	0.65	33.33%	63.64%	0%
	Consiglio Nazionale delle Riœrche (CNR)	7	11	ITALY	94	1.23	44.44%	90.91%	0%
	Swedish University of Agricultural Sciences	9	10	SWEDEN	102	1.36	60%	60%	10%
	Polish Academy of Sciences	9	10	POLAND	39	0.87	66.67%	90%	0%
	University of Copenhagen	11	9	DENMARK	97	0.78	66.67%	33.33%	0%
	University of Liege	11	9	BELGIUM	43	1.01	16.67%	66.67%	0%
	University of Helsinki	11	9	FINLAND	170	2.49	83.33%	100%	0%
	Centre National de la Recherche Scientifique (CNRS)	11	9	FRANCE	51	1.25	50%	66.67%	0%
	Aristotle University of Thessaloniki	15	8	GREECE	31	0.92	14.29%	100%	0%
	University of Milan	15	8	ITALY	74	1.66	33.33%	100%	0%
	Montpellier SupAgro	15	8	FRANCE	25	0.84	50%	75%	0%
	University Hohenheim	15	8	GERMANY (FED REP GER)	28	0.74	80%	50%	0%
	▶ VetAgro Sup	15	8	FRANCE	24	0.54	33.33%	50%	0%
	▶ CIRAD	15	8	FRANCE	19	0.66	50%	75%	0%
	University of Naples Federico II	21	7	ITALY	45	0.85	60%	85.71%	0%

#### **Nutritional quality: Biomass digestibility**

### Main institutions and their networks in the field "Biomass digestibility"





#### Nutritional quality: strong links to soil factor

#### Network of keyword co-occurrence



#### Nutritional quality: strong links to abiotic stresses

#### Network of keyword co-occurrence



#### Global analysis, Sustainability & Yield & Nutritional quality (i.e. >24,000 publications) -> recent over-representation of keywords linked to climate change





Targeting "Mitigating the effects of global climate change" -> Sustainability & Yield & Nutritional quality (*i.e.* >24,000 publications)



# Annex 1: Examples of equations used to screen the scientific production (WoS 2015-2019), using key terms linked to traits (Yield, Sustainability, Nutritional quality) selected during WP1

	Trait	Equation
1a 1b 1c	Photochemistry, light harvesting Biochemistry – Carbon assimilation Stomatal aperture photorespiration Photoacclimatation Photoprotection	(photochemistry OR "light harvesting") ("carbon assimilation" OR "carbon fixation") (Stomat* NEAR/2 (aperture OR opening)) ((photorespiration) (photoacclimation OR "photo acclimation") (photoprotection OR "NPQ" OR ("Non Photochemical Quenching"))
1d 1e	shoot architecture, Canopy profile Leaf anatomy	(((shoot OR canopy OR twig OR crown) near/1 architecture) OR "canopy profile" OR "stem architecture" OR "tree architecture" OR "plant architecture") (leaf NEAR/2 (anatomy or anatomical or histological))
<mark>1f</mark> 1g	Growth rate Nutrient uptake/assimilation vs use	("growth rate") ((Nutrient OR micronutrient OR macronutrient OR nitrogen OR nitrate OR phosphorus OR potassium OR iron OR sulphur OR sulfur OR calcium OR zinc OR copper OR manganese)
1h	Nutrient use efficiency	NEAR/1 (uptake OR assimilation OR availability OR bioavailability)) (((Nutrient OR micronutrient OR macronutrient OR nitrogen OR "N" OR "P" OR phosphorus OR potassium OR iron OR sulphur OR sulfur OR calcium OR zinc OR copper OR manganese)) NEAR/0 ("use efficiency" OR "utilisation efficiency" OR "utilization efficiency" OR "remobilization efficiency" OR "remobilisation efficiency")) OR ("NUE" OR "PUE" OR "PNUE" OR "PPLIE")
1i 1j 1k 1I	Water use efficiency Primary metabolism Secondary metabolism Nutrient metabolism, transport, remobilization and partitioning	<ul> <li>("water use efficiency" OR "WUE")</li> <li>("primary metaboli*")</li> <li>("secondary metaboli*")</li> <li>((Nutrient OR micronutrient OR macronutrient OR nitrogen OR "N" OR "P" OR phosphorus OR potassium OR iron OR sulphur OR sulfur OR calcium OR zinc OR copper OR manganese OR sucrose) NEAR/2 (partitioning OR translocation OR remobilization OR remobilisation OR transport OR transfer OR metabolism OR storage)) + excluding 2 WoS Categories</li> <li>("Microbiology" and "Agriculture Dairy Animal Science")</li> </ul>
1m	Source sink balance	( (source NEAR/3 sink) OR ((Source AND sink) AND (senescence OR ((grain OR seed) NEAR/1 (development OR filling)))) ) NOT ("wastewater treatment plant" OR "power plant" OR metallurg* OR "waste heat recovery" OR "solar power plant" OR geotherm* OR "heat pump" OR "electric power" or "electrical power" OR "batteries storage system" OR "recycle water network" OR "tobacco industr*" OR "sewage sludge")

Annex 1: Examples of equations used to screen the scientific production (WoS 2015-2019), using key terms linked to traits (Yield, Sustainability, Nutritional quality) selected during WP1

#### #2 Equation « Plant production »

TS= (plant OR Crop OR Cereal OR Vegetable OR Forage OR Legume OR oilseed OR Camelina OR Arabidopsis OR Alfafa OR "medicago sativa" OR Barley OR "hordeum vulgare" OR Brassica OR Carrot OR "daucus carota" OR Citrus OR Clover OR trifolium OR Eucalyptus OR "Field bean" OR "vicia faba" OR Grapevine OR vitis OR Sunflower OR "helianthus annuus" OR Hemp OR cannabis OR Laminaria OR Lettuce OR "lactuca sativa" OR Lupin\* OR Maize OR "zea mays" OR Millet OR "Panicum miliaceum" OR Miscanthus OR Oat OR "avena sativa" OR Olive OR olea OR Onion OR "allium cepa" OR Parsnip OR "Pastinaca sativa" OR Pea OR "pisum sativum" OR Pomegranate OR "punica granatum" OR Poplar OR populus OR Porphyra OR "seaweed" OR Potato OR "solanum tuberosum" OR Rapeseed OR Raspberry OR Rice OR "oryza sativa" OR Ryegrass OR "Lolium perenne" OR Saccharina OR Sitka OR Soybean OR "glycine max" OR Sorghum OR Spinach OR "spinacia oleracea" OR Spruce OR Strawberry OR fragaria OR Sugarcane OR Sugarbeet OR "beta vulgaris" OR Tomato OR "solanum lycopersicon" OR Switchgrass OR "Panicum virgatum" OR Ulva OR Wheat OR tritic\* OR Tobacco OR "nicotiana tabacum" OR Willow OR salix OR Walnut OR Hazelnut OR Forestry OR forest OR vegetation OR Vineyard OR rainforest OR orchard OR botanical OR peanut OR apple OR cupressus OR cotton OR cucumber OR "common bean" OR "oil palm" OR prunus OR grass)

#### **#3 Equation countries UE28**

CU=("Austria" OR "Belgium" OR "Bulgaria" OR "Croatia" OR "Cyprus" OR "Czech Republic" OR "Denmark" OR "Greenland" OR "Estonia" OR "Finland" OR "France" OR "Guadeloupe" OR "Martinique" OR "Reunion" OR "French Guiana" OR "Fr polynesia" OR "New caledonia" OR "La Reunion" OR "Wallis Futuna" OR "United Kingdom" OR "England" OR "Wales" OR "Scotland" OR "North Ireland" OR "Brit Virgin Isl" OR "Cayman Islands" OR "Jersey" OR "Falkland Island" OR "Germany" OR "Greece" OR "Hungary" OR "Ireland" OR "Italy" OR "Lithuania" OR "Latvia" OR "Latvia" OR "Latvia" OR "Latvia" OR "Latvia" OR "Slovenia" OR "Malta" OR "Netherlands" OR "Neth Antilles" OR "Poland" OR "Portugal" OR "Romania" OR "Slovenia" OR "Slovenia" OR "Spain" OR "Catalonia" OR "Sweden" )





#### 2.2. Mapping public-private partnership interactions inside EU countries (Task 4.1-2)

Various sources/databases were screened to obtain an impression on the scope and intensity of Public-Private-Partnerships (PPPs) in Europe, in scientific fields relevant for CropBooster-P. In this context, the focus has been put on PPPs within France, Germany, Spain, Italy, The Netherlands, United Kingdom, Belgium and Denmark, and also on the interaction of such PPPs of individual countries with other European countries.

PPPs play a very crucial role for science integrating the aspect of transfer of research results into economic exploitation, in all these countries. Major players could be identified in the public as well as in the private sector in each of the countries analyzed. Such major players are always involved in several such partnerships. For the overall steering of such PPPs, specific independent public organizations have been established in France, Spain and in Denmark. Across country borders, PPPs are mainly built between partners from France, Germany, The Netherlands and Belgium.

For the establishment of Public-Private Partnerships within individual countries as well as for building consortia across country borders, the "driving forces" are seen in the search for complementary scientific expertise, the ambition to transfer scientific excellence into economic value and the opportunity to get these mutual interests supported by public funding programs. The system of establishing PPPs is considered an essential element for generating economic value from academic research. Therefore, the "driving forces" should be further stimulated, and experiences gained with this system in central European and Southern European countries should be used to strengthen the establishment of this system in Southeastern and Eastern European countries, as well.

# Addendum 2.2

# Task 4.1-2 Mapping Public-Private Partnership Interactions inside EU Countries



•Applied Research communities (Private companies, R&D services of Cooperatives, Technical Institutes, networks of Experimental Stations etc.).

#### Method:

- Screening of the scientific production (WoS) during five years (2015-2019) (funding e.g. REMIX – H2020 – 727217, BACI – H2020 – 640176, FACCE SURPUS – H2020 – 652614, GoodBerry – H2020 – 679303, MycoKey – H2020 – 678781, PAPETS - FP7 – 323901, Innovine - FP7 – 311775, Watbio - FP7 – 311929...)

- List of actors coming from the biotechnology industries also inventoried using available **lists of previously funded projects by EU, DFG, ANR... + GABI** funded projects in Germany, **Biovegen** projects in Spain, private companies involved in the French Investments for the Future (**PIA**), private partners of the **French GIS-BV** (public private partnership for plant biotechnologies)...

> Günter Strittmatter, Heinrich-Heine-Universität Düsseldorf, Germany Peter Westhoff, Heinrich-Heine-Universität Düsseldorf, Germany Francesco Loreto, CNR, Roma, Italy Erik Murchie, UNOTT, Nottingham, UK Rene Klein Lankhorst, WUR, Wageningen, NL Pablo Vera, IBMCP CSIC, Valencia, Spain Gonzaga Ruiz de Gauna, Biovegen, Madrid, Spain Peter Rogowsky, INRAE, Lyon, France Norbert Rolland, INRAE/CNRS, Grenoble, France Mathias Pribil, Univ. Copenhagen, Denmark



#### Major Players in Private-Public-Partnerships:

#### Inside Germany, and interaction of German PPPs with EU countries

#### Germany/Private Sector

- KWS SAAT SE & Co. KGaA
- Saaten Union Biotec GmbH
- BASF SE
- Norddeutsche Pflanzenzucht Hans Georg Lembke KG
- Bayer CropScience AG
- Nordasaat Saatzuchgesellschaft mbH





- Leibniz-Institut für Pflanzengenetik u. Kulturpflanzenforschung Gatersleben
- MPI f. Pflanzenzüchtungsforschung Köln
- MPI f. mol. Pflanzenphysiologie Golm
- Heinrich-Heine-Universität Düsseldorf
- Justus-Liebig-Universität Gießen
- Georg-August-Universität Göttingen
- Forschungszentrum Jülich
- Universität Hohenheim
- Christian-Albrechts-Universität zu Kiel
- Martin-Luther Universität Halle-Wittenberg



# Major Players in Private-Public-Partnerships:

# Inside France, and interaction of French PPPs with EU countries

#### France / Private Sector

- Bayer CropScience
- BASF SE

2

- Vilmorin
- Limagrain
- Innolea
- RAGT Semences
- Florimond Desprez
- Momont / KWS France
- Euralis/Caussade
- Syngenta
- Gautier Semences
- MAS Seeds
- Agri Obtentions
- Secobra
- Danone
- Nestlé
- Roquette
- Vegenov BBV
- Arvalis
- Vegepolys Valley
- Terres Inovia
- Sofiproteol
- Gnis







- INRAE
- CNRS
- Cirad
- CEA
- IRD
- Institut Agro (fusion of SupAgro and AgroCampusOuest in Montpellier)
- Université Paris-Saclay (incl. AgroParisTech + Université Paris-Sud)


# Inside Spain, and interaction of Spanish PPPs with EU countries



#### 3 **Spain / Private Sector**

# Under the umbrella of BIOVEGEN:

- 86 companies
- 10 private associations





Under the umbrella of BIOVEGEN:

• 17 public research organizations



# Inside Italy, and interaction of Italian PPPs with EU countries

# 4 Italy / Private Sector

- Agroservice S.p.A.
- Apsovementi S.p.A.
- Blumen Group S.p.A.
- C.G.S. Sementi S.p.A.
- CO.NA.SE.
- Ente Nazionale Idrocarburi S.p.A.
- ENZA Zaden Research & Development B.V.
- F.lli Menzo s.a.s.
- ISI Sementi S.p.A.
- KWS Italia S.p.A.
- Seminis<sup>®</sup>
- SIS Società Italiana Sementi



#### 4 Italy / Public Sector

- CREA
- CNR
- Università di Bologna
- Università di Udine
- Università di Napoli
- Università di Viterbo
- Università di Bari
- Fondazione Edmund Mach



# Inside The Netherlands, and interaction of Dutch PPPs with

# **EU countries**



#### ) The Netherlands / Private Sector

- Rijk Zwaan
- Nunhems (BASF)
- Bejo Seeds
- ENZA Zaden
- HZPC
- KeyGene
- Syngenta Seeds
- Averis Seeds
- C Meijer BV
- Joordens Zaden
- Agrifirm
- The Quinoa Company
- Avebe
- Agrico
- Bayer Vegetable Seeds
- Solynta



#### 5 The Netherlands / Public Sector

- Wageningen University & Research
- Radboud University Nijmegen
- Utrecht University



# Inside United Kingdom, and interaction of British PPPs with

# **EU countries**



#### 6 United Kingdom / Private Sector

- Yara
- British Beet Research
  Organization
- ADAS
- Agrii
- KWS





- James Hutton Institute
- University of Nottingham
- University of Lancaster
- NIAB/EMR University of Cambridge
- Sainsbury Laboratory
- John Innes Center, Norwich
- Earlham Institute, Norwich
- SRUC, Scottland
- Rothamsted Research



# Inside Denmark, and interaction of Danish PPPs with EU countries



#### Denmark / Private Sector

- DLF Seeds and Science
- NordicSeed
- Sejet plant breeding
- Danespo
- Danish Technological Institute, DTI
- Danish Agriculture and Food Council
- SEGES
- Danish Agricultural Advisory Service (DAAS)
- Yara Danmark
- Nordic Sugar
- DLG
- Carlsberg





- NordGen
- NordForsk
- Nordic Public-Private Partnership (PPP)
- University of Copenhagen
- Aarhus University
- Aalborg University
- DTU



# Public-Private-Partnerships in Europe: Summary



- Strong interactions F/D, F/NL, F/E, NL/D, B/NL, D/GB, GB/NL, D/I, I/NL
- Independent organizations for steering in E and DK
- Major players visible in all countries, at public and at private level













# 3. Linking research communities identified during task 4.1 by organising joint meetings between plant scientists (Task 4.2)

3.1. Organising groups of experts (focus groups) for identifying research areas with innovation potential for the improvement of yield and nutritional quality of cultivated plants and of sustainability in agricultural production (Task 4.2-1)

Increasing crop yield, improving the nutritional quality of plants and their harvested parts, and to make plant production more sustainable are key goals of CropBooster – and coincide with EU strategic goals as outlined in the so called "Green Deal" and the "Farm to Fork" concept. Therefore, research fields that contribute to reaching these goals also guided the formation of an expert panel composed of subpanels ("Focus Groups with coordinators as shown on the respective chart in Annex 3.1. The coordinators are free to select research experts from all over Europe for their groups, and may also include experts from industry and consulting firms. The coordinators and their focus groups are given the task

- to outline the status quo of research in the respective fields,
- to identify future challenges in the fields which should be addressed with high priority, and
- to propose action points for a future research program in the field in meeting the requirements of the Green Deal and the underlying Farm-to Fork Strategy of the EU.

The reports of the "Focus Groups" will be discussed with stakeholders at a meeting to be organised in March 2021. Inputs received from the stakeholders will be incorporated into the reports and an aggregated final report will then forwarded to WP5 as a basis for proposing a detailed future plant research agenda, with priorities set according to the strategic goal setting of the EU Commission.

# Addendum 3.1

## <u>Work package 4: International Cooperation</u> [Months: 1-36] INRAE, WR, VIB, WU, CNR, EPSO, UDUS, UNOTT, CNRS, UCPH, ULANC, USAMV CLUJ, ESA, ACTA

# Task 4.2. This task aims to link research communities identified during task 4.1 by organizing joint meetings between plant scientists (M12-M24 ->M28).

Task leader: INRAE; other partners: WR, VIB, WU, CNR, EPSO, UDUS, UNOTT, JKI, CNRS, UCPH, ULANC, USAMV, ACTA, ESA

•Organize networking activities with the different Research communities to identify experts for sustainable improvement of crop yield, and nutritional quality (link with WP1).

•Organize a joint meeting between European plants scientists from different disciplines and ongoing research programs to inventory areas of sustainable improvement of crop yield, and nutritional quality.

•Assemble an expert panel to review strategies (see task 4.3)









# **Focus groups**

•Organize networking activities with the different Research communities to identify experts for sustainable improvement of crop yield, and nutritional quality (link with WP1).

To limit the number of these "Focus groups", and thanks to the literature screening and to the work performed in the frame of the WP1, only seven "Focus groups" were originally planned:

- Nutrient use efficiency
- Water use efficiency
- Photosynthesis: light capture and carbon assimilation
- Nutritional quality and secondary metabolism
- Shoot and root architecture and the canopy
- Source/sink balance
- Environmental abiotic stresses due to climate change: adaptation and mitigation

However, first contacts performed at Germany and France (INRAE and CNRS) scale did not allow to identify experts able to coordinate groups combining both nitrogen and phosphorus assimilation, or even, shoot and root architecture...



## Focus groups & their coordinators

# (According to WP1, WP2, and literature screening in WP4)



# **Focus Groups: Tasks of Coordinators**

- 1. Gathering a team of experts
- •Organize networking activities with the different Research communities
- 2. Report (end of January 2021)
- Status quo of research in the field
  - o Current know-how
  - Most relevant latest research results
  - o Trends in research, new technology applied or potentially applicable
- Future challenges in the field to be addressed with high priority
  - What are the most relevant unsolved questions (questions scientific questions, societal and economic challenges)
  - Aspects/opportunities for application of research results
- Action points for a future research program in the field
  - What needs to be done to solve the scientific questions and to meet the societal and economic challenges ?
  - o Projects with application relevance
  - What needs to be done to support the translation of research results into societal and economic value?
- 3. Presentation/discussion of report at Versailles-Meeting (23-25 March 2021)

4. Coming to a joint proposal of action points adjusted between all Focus Goups

•Organize a joint meeting between European plants scientists from different disciplines

CropBoostando

# Perspectives (WP4, tasks 4.2 and 4.3)

# Goals of the focus groups

Identify research areas with innovation potential for the improvement of yield & nutritional quality of cultivated plants and of sustainability in agricultural production

+

Discuss the research agenda with stakeholders to come to an adjusted strategy paper

# Goal of the strategy paper

Basis for WP5 to focus and prioritize the strategic concept •Organize networking activities with the different Research communities

•Organize a joint meeting between European plants scientists from different disciplines

•Assemble an expert panel to review strategies (see task 4.3)



# Planning Milestones and Deliverables year 3

D4.1 Network map of research networks available for further scientific interactions. M22 (September 2020, End of November 2020)

MS10 (WP3) 1st social actor consultation. M24 (November 2020)

D5.4 Report describing the framework for expressing the moral correctness of the programme M24 (November 2020/February 2021)

MS18 (WP5) Research Plan Workshop organized. M25 (December 2020/May 2021)

D5.3 Report describing programme management structure M25 (December 2020/April 2021)

D3.1 Consultation report on the first consultation step. M26 (January 2021)

MS15 (WP4) Expert panel assembled to define scientific and technical strategies. M27 (February 2021 = Focus group coordinators Nov. 2020)

MS16 (WP4) Joint meeting organized between European plant scientists and expert panel identified. M27 (23-25 March 2021)

MS17 (WP4) Draft review papers and research visions to feed WP5. M27 (February 2021 = Reports of Focus group coordinators Feb. 2021 OK)

MS11 (WP3) 2nd social actor consultation. M28 (March 2021/April 2021)

MS19 (WP5) Draft report ready and sent for review. M28 (March 2021/September 2021)

D2.4 Integrated impact assessment outcomes report to the commission. M30 (May 2021/August 21)

D5.6 Research plan for a future European crop yield programme M30 (May 2021/November 2021)

MS20 (WP5) Draft white paper submitted to programme members and SHG for review. M32 (July 2021/January 2022)

D4.2 White paper and scientific basis of a strategic research agenda M33 (August 2021/November 2021)

D3.2 Consultation report on the second consultation step. M34 (September 2021)

MS21 (WP5) Revised version submitted to programme members and SHG for review. M34 (September 2021/February 2022)

D3.3 Recommendation dossier on mid-term outreach measures to increase public awareness and understanding of novel technologies. M36

(November 2021/February 2022)

D5.7 White paper describing the route to improved crop yields in Europe, including the future consortium M36 (November 2021/April 2022)





#### 4. Contributors

#### WP4.1

- Dominique Fournier, INRAE, Montpellier, France
- Rene Klein Lankhorst, WUR, Wageningen, NL
- Francesco Loreto, CNR, Roma, Italy
- Jacqueline Martin-Laffon, CNRS, Grenoble, France
- Bertrand Muller, INRAE, Montpellier, France
- Erik Murchie, UNOTT, Nottingham, UK
- Philippe Nacry, INRAE, Montpellier, France
- Mathias Pribil, Univ. Copenhagen, Denmark
- Peter Rogowsky, INRAE, Lyon, France
- Norbert Rolland, INRAE/CNRS, Grenoble, France
- Gonzaga Ruiz de Gauna, Biovegen, Madrid, Spain
- Günter Strittmatter, Univ. Düsseldorf, Germany
- Pablo Vera, IBMCP CSIC, Valencia, Spain
- Peter Westhoff, Univ. Düsseldorf, Germany

WP4.2

- Catherine Bellini, INRAE, Versailles, France & Univ. Umea, Sweden
- Massimiliano Corso, INRAE, Versailles, France
- Sylvie Dinant, INRAE, Versailles, France
- Emmanuel Gaquerel, Univ. Strasbourg, France
- Hermanus Höfte, INRAE, Versailles, France
- Maria von Korff-Schmising, Univ. Düsseldorf, Germany
- Anne Krapp, INRAE, Versailles, France
- Patrick Laufs, INRAE, Versailles, France
- Jacques Le-Gouis, INRAE, Clermont-Ferrand, France
- Loïc Lepiniec, INRAE, Versailles, France
- Pierre Martre, INRAE Montpellier, France
- Céline Masclaux-Daubresse, INRAE, Versailles, France
- Bertrand Muller, INRAE, Montpellier, France
- Johnathan Napier, Rothamsted, UK
- Laurent Nussaume, CEA, Cadarache, France
- Norbert Rolland, INRAE/CNRS, Grenoble, France
- Günter Strittmatter, Univ. Düsseldorf, Germany
- Sébastien Thomine, CNRS, Gif sur Yvette/Paris Saclay, France
- Roberto Tuberosa, Univ. Bologna, Italy
- Andreas Weber, Univ. Düsseldorf, Germany
- Peter Westhoff, Univ. Düsseldorf, Germany