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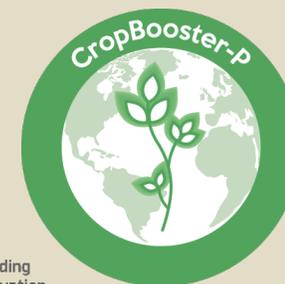
# CropBooster-P: A roadmap for future European plant research

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**Dr. Philippe Nacry**

12<sup>th</sup> October 2021



European  
Commission

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for Research & Innovation



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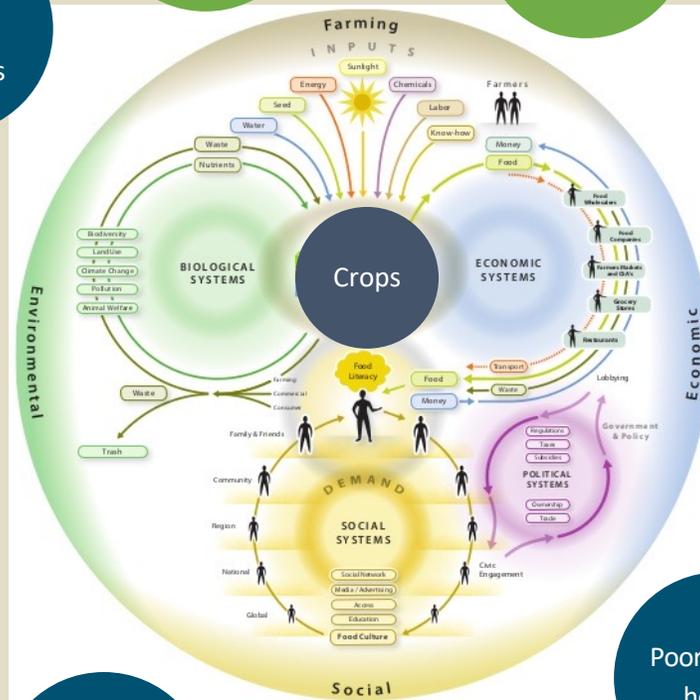
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# Crops in a food system under pressure



Climate change

Increasing demand

Decline in water resources

Growing bioeconomy

Declining land resource

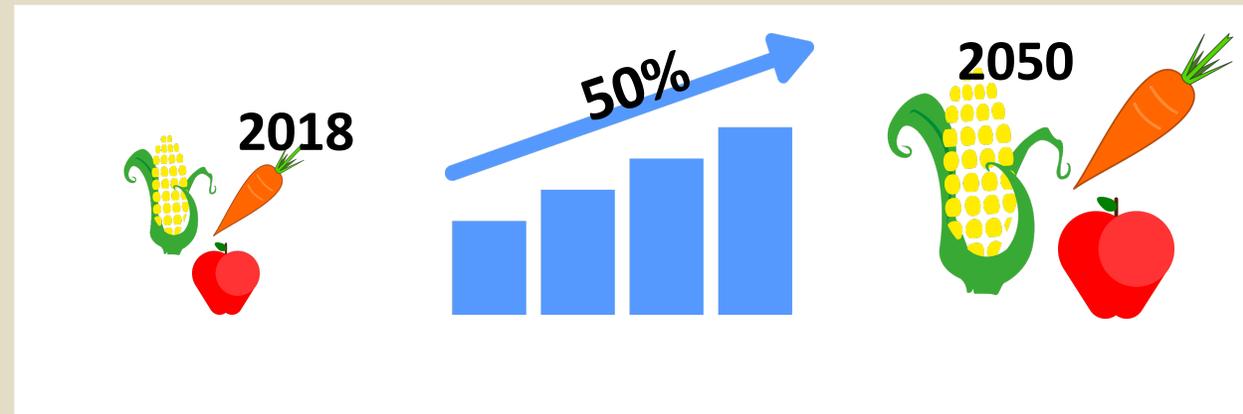
Just transition

Biodiversity loss

Environmental degradation

Food & health inequalities

Poor dietary health



## Crops yield will have to double by 2050

Image: Shift(2016)





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# CropBooster-P - Future Proofing Crops



## Aims

- Develop a roadmap for future proofing our food system and the European bioeconomy – **paves the way for future research and innovation.**
- Focusing on the potential for plant improvement to help enhance **yield**, enhance **nutritional quality**, and ensuring environmental **sustainability**.

**Yield:** Increasing the total amount of edible or usable material produced by the plant.

**Nutritional quality:** Increasing the amount of plant components which are beneficial to human health (or decreasing the amount of those which are harmful to human health).

**Sustainability:** Improving how plants use resources and cope with stresses like heat or drought.



We need to match future research programs to the values, needs and expectations of society



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# CropBooster-P Consortium



- Wageningen University & Research (Project Coordinator) <https://www.wur.nl>
- VIB <http://www.vib.be/en/Pages/default.aspx>
- CNR <http://www.disba.cnr.it>
- EPSO <https://epsoweb.org>
- Heinrich Heine University Düsseldorf <https://www.uni-duesseldorf.de/home/en/home.html>
- University of Nottingham <https://www.nottingham.ac.uk>
- Julius Kühn Institut <https://www.julius-kuehn.de/en/>
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- University of Copenhagen <https://www.ku.dk/english/>
- INRA <http://institut.inra.fr/en>
- ETP Plants for the Future <http://plantetp.org/>
- Lancaster University <https://www.lancaster.ac.uk/>
- Universitatea de Stiinte Agricole si Medicina Veterinara Cluj Napoca <http://www.usamvcluj.ro/eng/>
- Euroseeds <https://euroseeds.eu/>
- ACTA [http://www.acta.asso.fr/en/the-network/access-by-institute/institute-details/i/detail/arvalis\\_institut\\_du\\_vegetal/presentation.html](http://www.acta.asso.fr/en/the-network/access-by-institute/institute-details/i/detail/arvalis_institut_du_vegetal/presentation.html)

#### Associate partners:

- Sorbonne Université <https://www.sorbonne-universite.fr/en>
- Arvalis <https://www.arvalis-infos.fr/index.html>



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# Overview of how the Roadmap is developed

## Setting the option space for Yield, Nutrition and Sustainability

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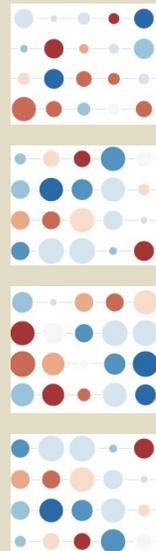
**Future worlds**  
2050

**Alternative outcomes**

technologies



EU crops



**WP 1**

## Multidimensional assessment of the option space

**WP 2**

Economic, Social and Environmental Impact

**WP 3**

Societal Needs and Expectations

**WP 4**

International Cooperation

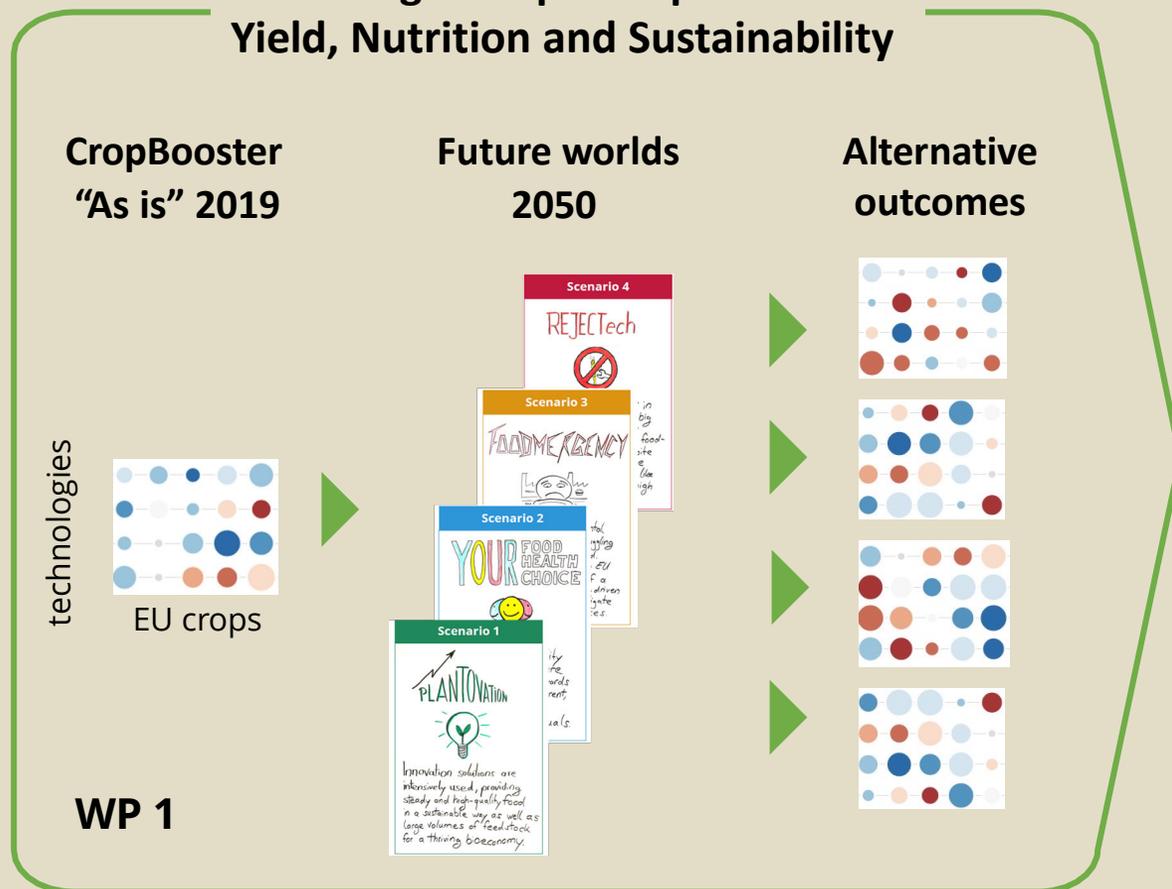
## Strategy Development

**WP 5**

- Roadmap to future proof the EU crops
- Improved societal awareness and engagement
- In depth anticipation of economic, social and environmental impacts

# Overview of how the Roadmap is developed

## Setting the option space for Yield, Nutrition and Sustainability



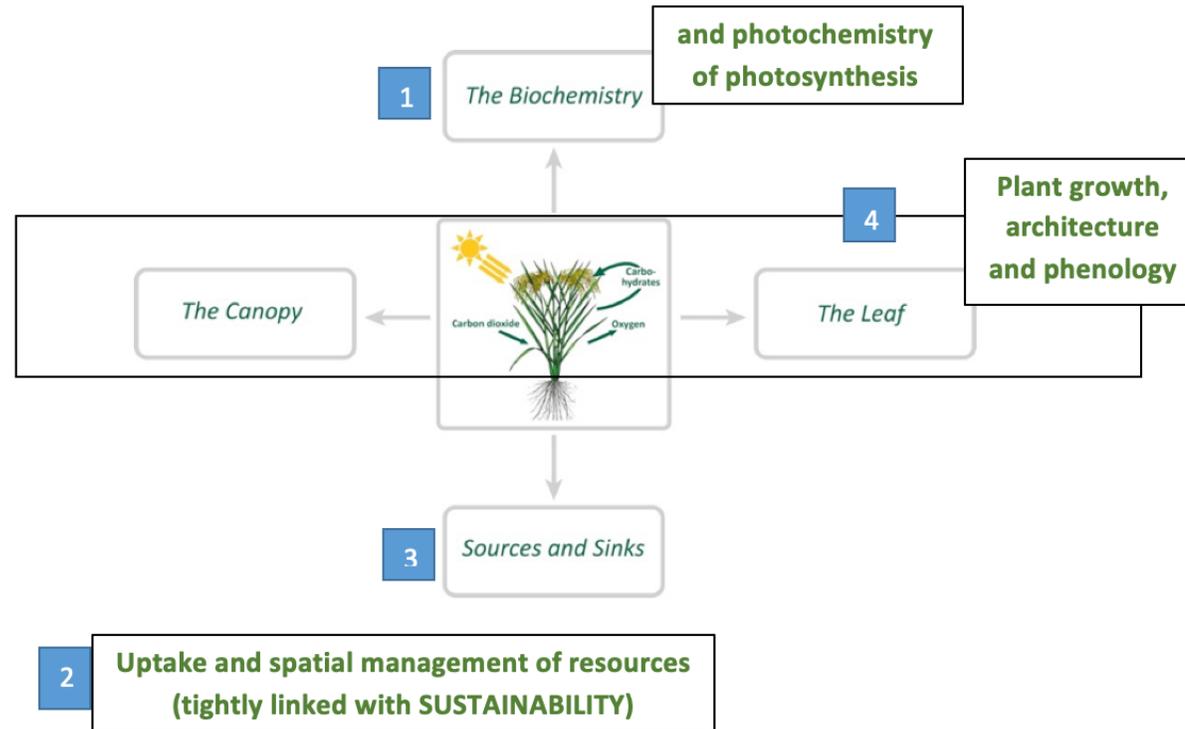
### 3 stages:

- (1) Setting the option space - **Generate matrices**
- (2) Run your plan against a range of possibilities - Create Future worlds - (**Scenario building analyses**)
- (3) How does this **affect the matrix** and what is the output?
  - Indicate for each scenario which crops and technologies show most potential
  - Based on that, provide guidance toward future plant research in Europe
    - Develop breeding strategies for (underdeveloped) crops
    - Direct funding to strategic areas
    - ...

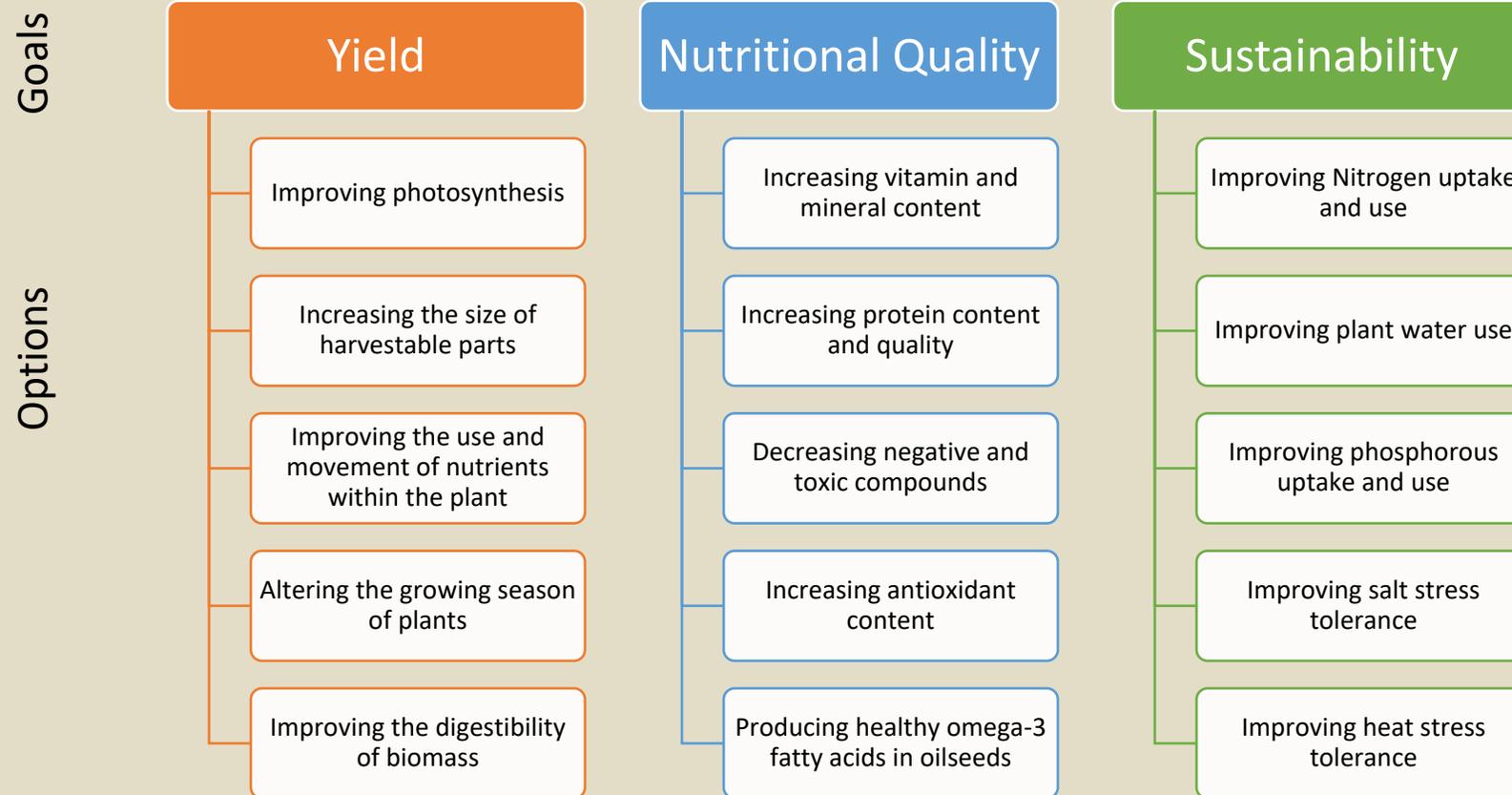
# WP1: Setting the option space – Generate matrices

Define key options to improve **Yield**,  
Nutritional Quality  
and Sustainability

**What determines/affects YIELD POTENTIAL (genetic basis) – YIELD DETERMINANTS?  
Which plant traits/functions are heritable/transferable and do we have to take into account in this  
project because they may determine plant YIELD POTENTIAL?  
YIELD POTENTIAL <-> actual yield (YIELD POTENTIAL+ ENVIRONMENTAL CONSTRAINTS (e.g abiotic stresses - SUSTAINABILITY))**

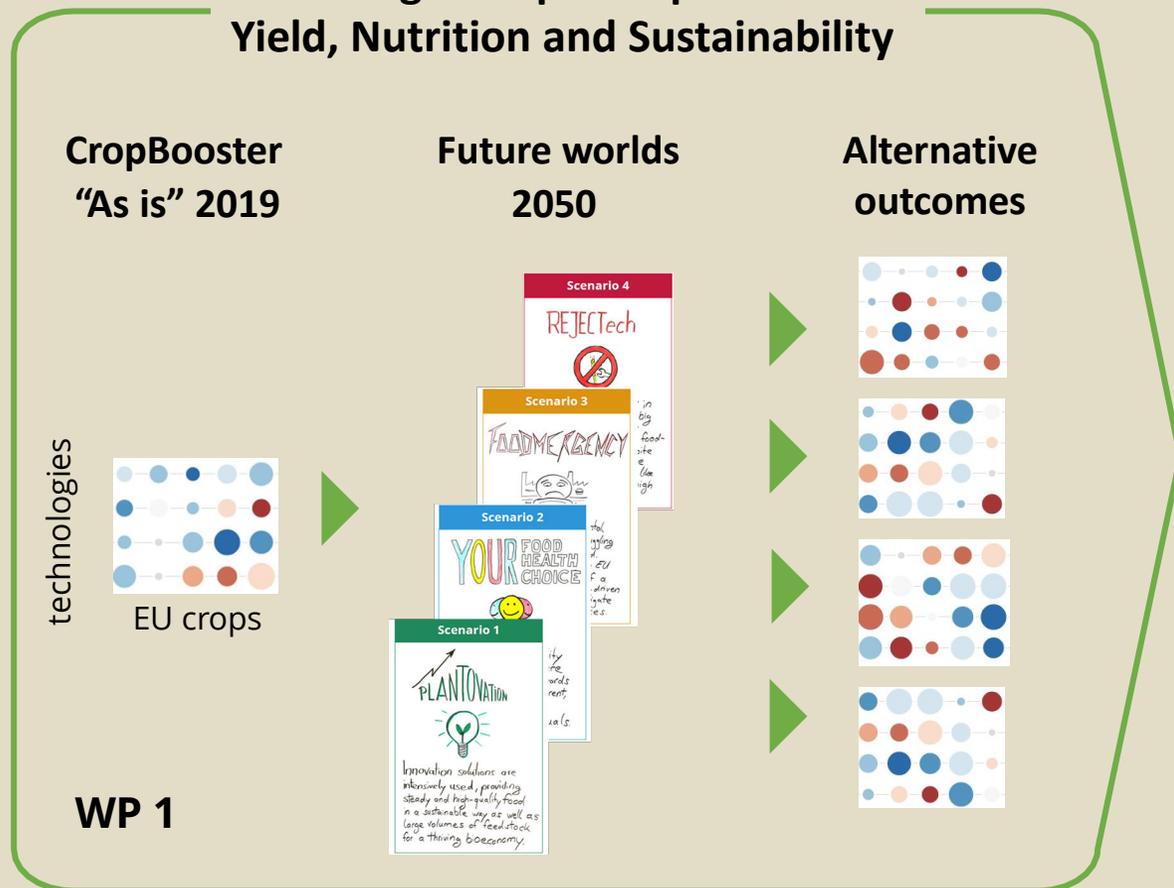


# WP1: Setting the option space – The 15 cropboosting options



# Overview of how the Roadmap is developed

## Setting the option space for Yield, Nutrition and Sustainability

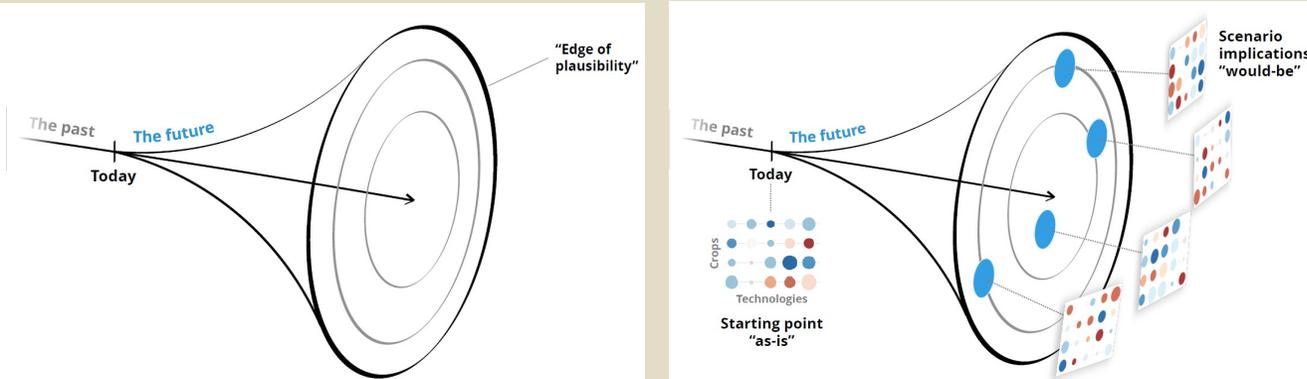


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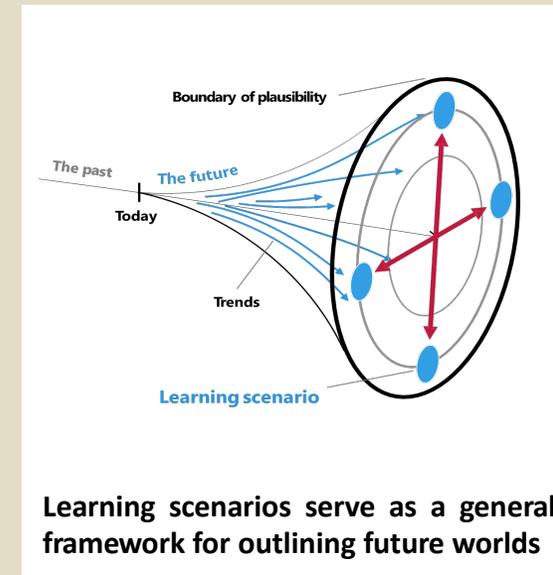
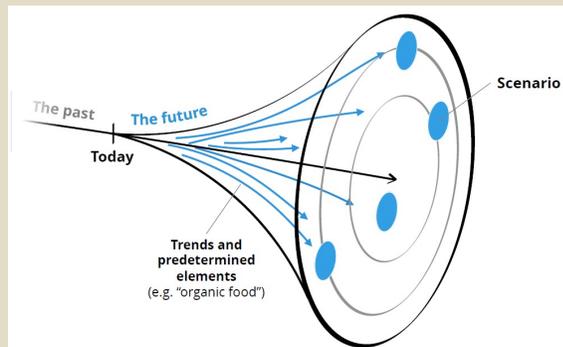
# WP1: Scenario building analyses

The future can be imagined as a funnel of possibilities



Based on Trends and Key Uncertainties, create different scenarios

Once scenarios are created, determine their implications on the project



- X **Scenarios are not predictions:** one can't predict complex (social) systems in the long-term
- X **Scenarios are never implausible** e.g. based on inconsistent combination of outcomes or on extremely unlikely events
- ✓ **Scenarios differ** from each other to cover a **wide range of possibilities;** key uncertainties play out differently
- ✓ **Scenarios are unlikely but plausible**



Cornelissen et al., 2020

# WP1: Scenario building analyses

**Scenario 1**

Innovation solutions are intensively used, providing steady and high-quality food in a sustainable way as well as large volumes of feedstock for a thriving bioeconomy.

When biotech innovation thrives

**Scenario 2**

Health and sustainability concerns drive agriculture and food businesses towards being diverse and transparent, meeting the needs and preferences of individuals.

When consumers become king

**Scenario 3**

Due to severe environmental degradation, the EU is struggling to fulfill basic food demand. In response to the crisis, the EU has seen the introduction of a large-scale and technology-driven agricultural system to mitigate the most dire consequences.

When food runs out

**Scenario 4**

Consumers have little trust in politicians, scientists and big industry. Society is highly polarized and rejects new food-related technologies – despite the dissatisfaction with the current state of affairs like limited food choice and high prices.

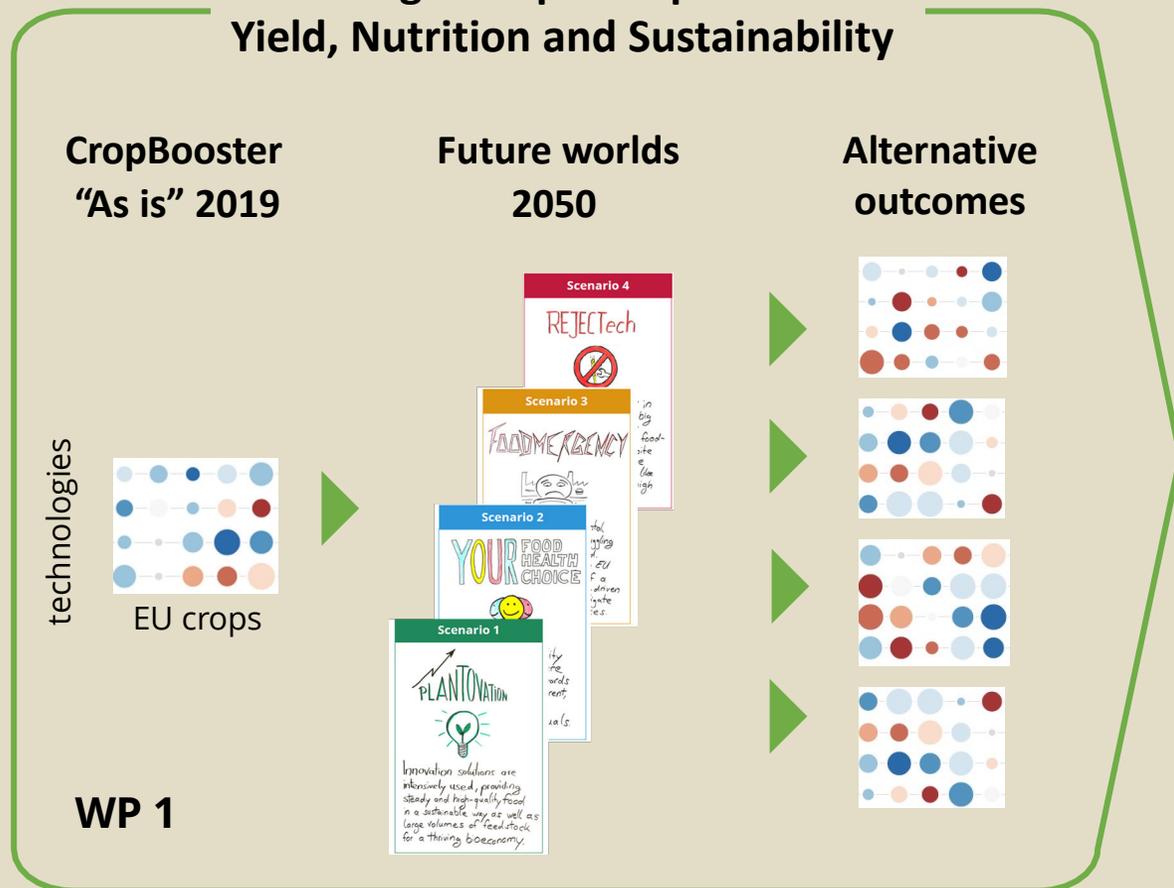
When science loses society

*Cornelissen et al., 2020*



# Overview of how the Roadmap is developed

## Setting the option space for Yield, Nutrition and Sustainability



### 3 stages:

(1) Setting the option space - **Generate matrices**

(2) Run your plan against a range of possibilities - Create Future worlds - (Scenario building analyses)

**(3) How does this affect the matrix and what is the output?**

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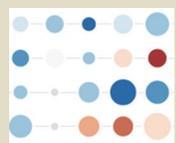
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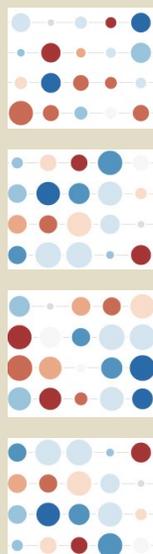
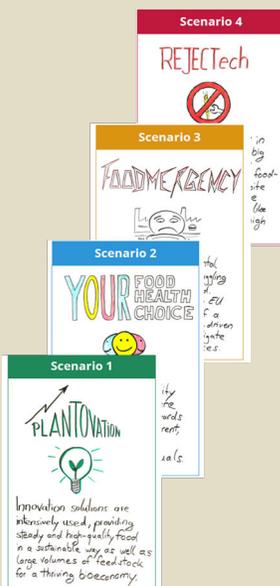
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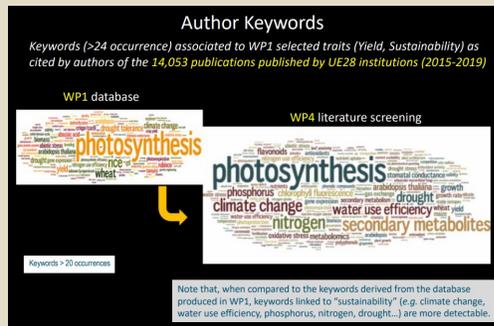
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WP 5

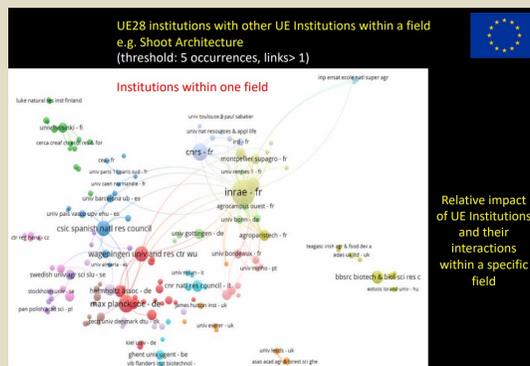
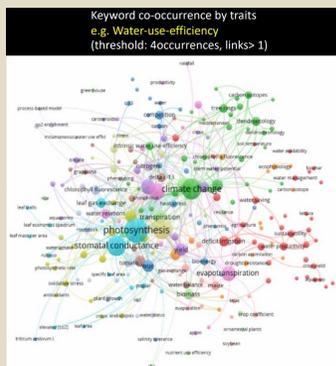
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# WP4: International cooperation

- Aim: identify the main European institutions which publish in the fields corresponding to the traits identified in WP1 as being able to improve yield, sustainability and nutritional quality.
- Query the web of science (>10,000 publications for yield, sustainability and nutritional quality)



- Main actors in all fields and their interactions → **Focus group coordinators**
- Gathering a team of experts → Identification of key authors → **Focus groups**
- Networking activities with the different research communities and experts for sustainable improvement of crop yield, and nutritional quality (link with WP1)



- Status quo of research in the field
  - Current know-how
  - Most relevant latest research results
  - 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 ?
  - Projects with application relevance
  - What needs to be done to support the translation of research results into societal and economic value?

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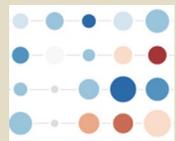
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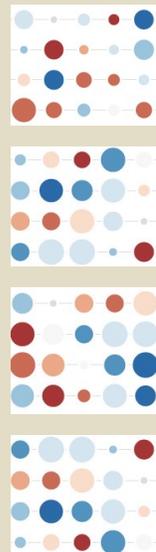
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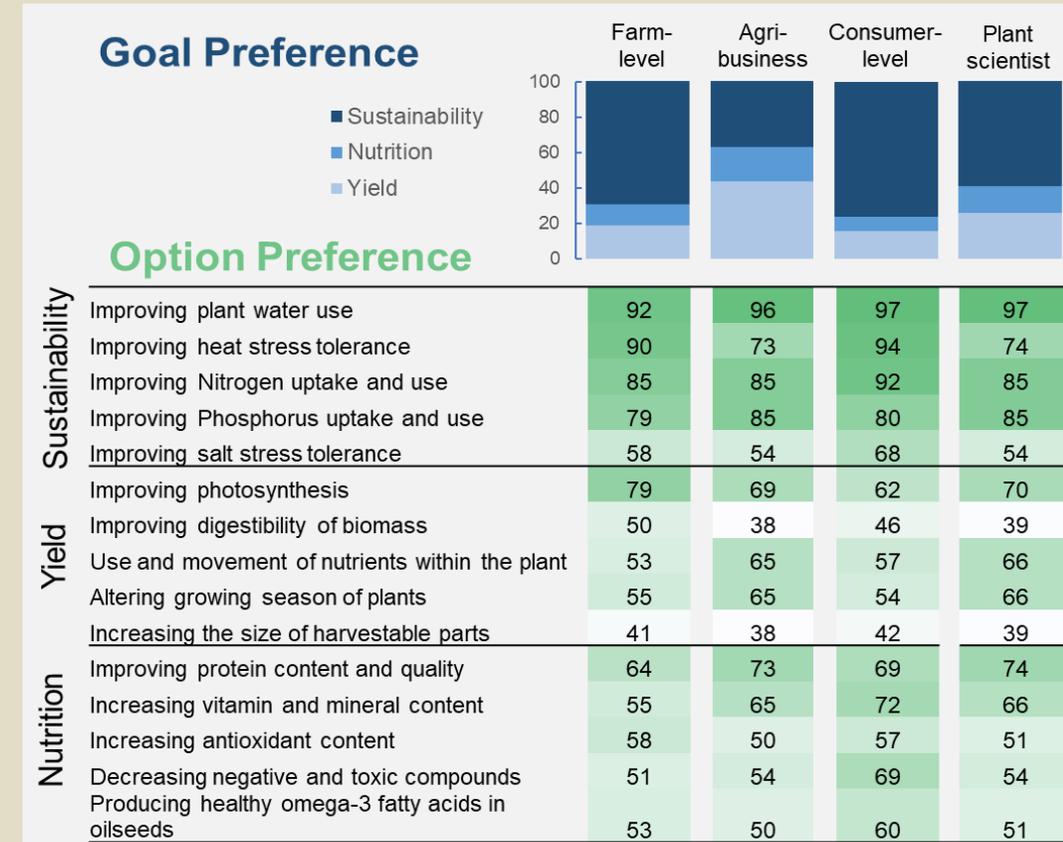
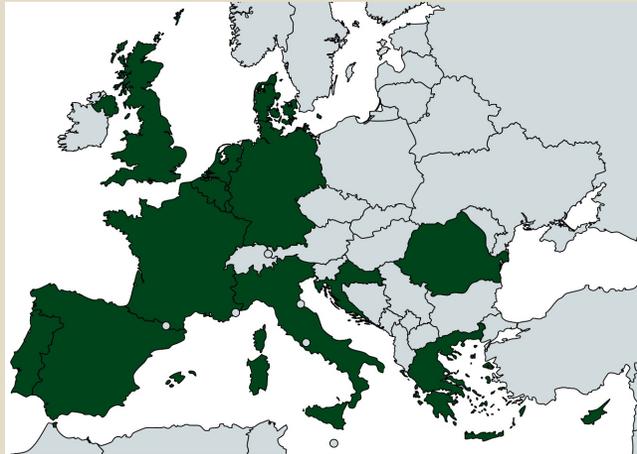
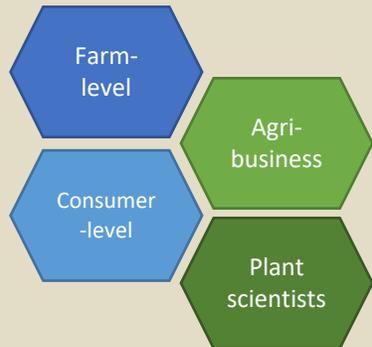
## Strategy Development

WP 5

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# WP2: Assessing socio-economic and environmental impacts

- Aim: Assess the **potential economic, social and environmental impact** of our toolbox of plant improvement options for improving yield, sustainability and nutritional quality.



Which goals – Yield, Nutrition, Sustainability – do people feel are most important?

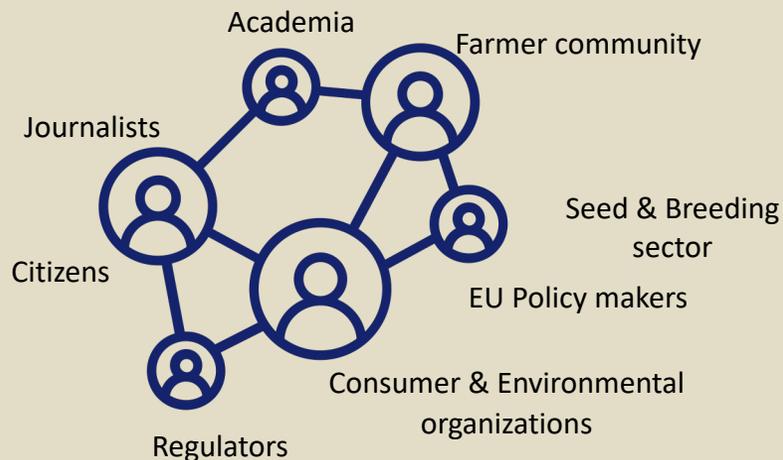
Which options are most important?

Do different stakeholder groups have different opinions?

# WP3: Assessment of societal values, needs and expectations

- Aim: Improving the dialogue between science and society – **an outreach strategy**

**Contribute to develop a strategy** to improve **communication** with different target groups and promote/facilitate **adoption and acceptance of innovation relating to crop production and improvement**



## Major questions (an excerpt):

- **How and with whom** do you communicate about plant breeding or genome editing in plants?
- Is there a **public discourse** in your country?
- **How** should genome editing be communicated?
- What is your **experience** with your communication?
- Could genome editing contribute to achieve the policy goals set by the EC?

**Not influencing/manipulating somebody's opinion but to increase awareness and understanding for an issue under debate, to facilitate an differentiated and science based opinion forming process.**

External stakeholders and the project's SHG  
Interviews, workshops, questionnaires...

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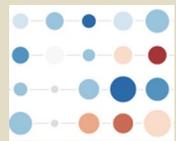
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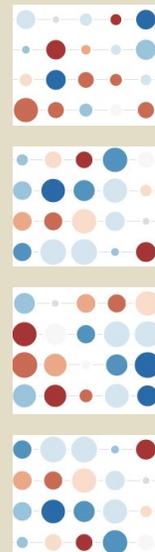
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# Acknowledgements

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## **WP1 team:**

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Philippe Nacry (INRAE)

Martin Parry (Lancaster University)

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**WP3: Ralf Wilhelm (Julius Kühn Institute)**

**WP4: Norbert Rolland (INRAE)**

**WP5: Jeremy Harbinson (Wageningen University)**



**Coordinator: René Klein Lankhorst (Wageningen University)**



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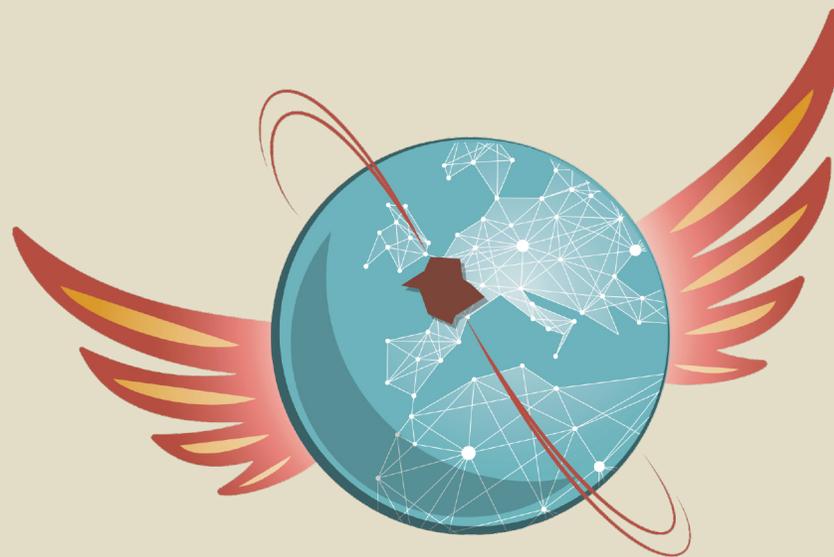
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