



THE BOUNDARIES OF PLANT BREEDING

Executive Summary
Report of the World Café
12 September 2019

A
BIGGER
CONVERSATION

In association with

IFAM
EU GROUP

This executive summary, written by Beyond GM, summarises the discussion and conclusions of the world café, The Boundaries of Plant Breeding. For the full discussion, references and extended reading list please see the main report.

The event was co-hosted by A Bigger Conversation (Beyond GM) and IFOAM EU, and held in Brussels on 19th September 2019.

We'd like to thank all our attendees who participated so fully in a frank and open discussion.

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A Bigger Conversation is an initiative of Beyond GM in the UK. While the Beyond GM campaign reaches out to citizen stakeholders, the A Bigger Conversation aims to bring together experts and forward thinkers – including scientists, academics, farmers, breeders and grassroots leaders – representing a wide range of views to establish a more in-depth dialogue around key issues around genetic engineering, food and farming. For more about A Bigger conversation see main report.



IFOAM EU is the European umbrella organisation for organic food and farming. It fights for the adoption of ecologically, socially and economically sound systems based on the principles of organic agriculture – health, ecology, fairness and care. With more than 210 member organisations its work spans the entire organic food chain and beyond: from farmers and processors, retailers, certifiers, consultants, traders and researchers to environmental and consumer advocacy bodies.

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INTRODUCTION – PURPOSE AND GOALS

The basic question of this world café – whether there should be boundaries in plant breeding – arose in response to the seemingly unlimited applications of new genome editing techniques. But it's also rooted in the longer history of genetic engineering in plant breeding, which appears not to recognise the validity of boundaries, be they conceptual, species-based, risk-based or culturally-based.

In organic plant breeding, for instance, the notion of maintaining the integrity of the genome and the cell arises from a belief in the integrity of living organisms, 'naturalness' and 'respecting boundaries'. In contrast, breeding that relies on genetic engineering, and perhaps especially genome editing techniques, is more frequently portrayed as having 'limitless possibilities' and scope – and by implication no boundaries, and no values-based limits that might restrain technological advances.

In truth, there is a spectrum of different approaches to breeding in agriculture and clear philosophical, epistemological and practical differences between them.

But there are also aspects of modern plant breeding where declared goals align and where there is, or ought to be, the possibility of agreement.

The clearest example is that across the board, all plant breeders and researchers make claims of pursuing 'sustainability' and 'environmental protection' whilst using similar terminology and appealing for cohesive efforts to tackle climate change and 'feeding the world'.

Having said that, the notion of boundaries and limits is foundational to the concept of sustainability – so how does that square with notions of unlimited possibilities for some types of plant breeding? And where does plant breeding actually sit in the larger spectrum of sustainability?

"Plant breeding serves the agricultural system, whether it is organic or an industrial monoculture. It can define what the varieties are but agriculture as a whole defines how you use the soil, the environment etc. So my question is, is plant breeding important? Is it a driving force? I am a plant breeder so this is quite an important question to me!"

STRUCTURE OF THE DAY

In September 2019, in Brussels, we convened a diverse group of plant breeders and those engaged in issues relating to plant breeding to discuss the boundaries of plant breeding in agriculture. Those attending were at a senior level in their professions and the meeting was characterised by curiosity and good-natured enquiry on all sides.

The meeting was organised as a day-long world café covering four broad themes. Participation was by invitation only and the meeting was held under the Chatham House Rule.

As per the world café format, there were four tables where small groups were encouraged discuss a specific theme around plant breeding in agriculture in hour-long sessions. Each session began with a short introduction from the table host outlining the theme and objectives of that table. The groups then rotated through different tables throughout the day. There were introductory and concluding remarks at either end of the day.

The themes put forward for discussion were:

- **Concepts and boundaries** How much do we understand each other when we talk about concepts like 'natural' and 'sustainable' in plant breeding? Are there assumptions that would benefit from challenge and/or deeper exploration?
- **Acceptable risk** Genetic engineering of food crops brings with it a level of risk. How do we decide what level of risk is acceptable?
- **Resilient plant breeding** In a rapidly changing world, which is highly vulnerable to climate change, how can plant breeding, as a discipline and as a structured R&D and marketing system, build resilience? Can it, and if so, do the new genetic engineering techniques have a role?

"I don't want to fight about if one technique is more risky than another or more natural than another. That's not important to me. It's about allowing a pluriformity of values, I encourage you to go ahead and be a responsible citizen in your work. But allow me space to find my way – and let's stay in contact."

- **Citizen engagement and discourse** Citizens are the 'end users' of plant breeding. Some view their engagement with and understanding of the processes involved as crucial, while others argue that citizen involvement may complicate an already complex picture.

For each theme several key questions were posed and these discussions are explored in greater depth in the main report. These questions were for guidance and as a starting point only; many discussions took a different direction, based on the interests of the participants and the insights that arose as the conversation evolved.

The focus on values and worldviews allowed a much deeper and more nuanced conversation to emerge during the course of the day. The world café format allowed each table to build on the previous group's discussion and form a more complete response to the questions that were asked. We recommend reading the full report for a better appreciation of the flow of the discussion.

Emerging Themes

The Bigger Conversation meetings and events seek to challenge entrenched views by taking the spotlight off narrow commercial or R&D agendas. Hence, the questions posed for this discussion were not meant to create a battleground over different plant breeding approaches – i.e. which is better or has more merit – but rather to provoke a more well-rounded discussion. Amongst the themes that emerged, were:

- We currently face multiple challenges around food production and its impact on the wider environment. Participants recognised that the enormity and complexity of these challenges are likely to mean that there is no single answer but rather that a plurality of approaches is needed.
- Many expressed the view that they were not interested in rehashing discussions framed around right and wrong, or whose science is best, or whose plants are best, or any of the other controversies that are continually stirred up by the media and campaigners on all sides.
- Participants from all backgrounds felt keenly that the loss of diversity in science, not just in terms of the mindsets of individual scientists but also of scientific approaches, was detrimental to science as a whole.

- It was recognised that there are limits to what can be achieved solely through plant breeding in terms of improvement in plant/variety performance *per se* and in terms of the bigger picture of 'feeding the world'. Since plant breeding is both a slow process and also only one piece in the bigger puzzle of creating a sustainable food system, by itself it possesses no immediate or magical answers. To frame it as a single answer to sustainability problems is misleading and places a heavy weight of expectation on breeders of all kinds.
- Similarly, participants highlighted that the process of breeding does not take place in a vacuum. What happens in a lab is subsequently subject to cultural, environmental and socio-economic interactions that influence potential risk, putative benefit and the impacts of the process.
- There was shared frustration at how little the public and policy discourse is engaged with even the most basic mechanics of plant breeding. This is especially important given that agricultural plants are at the centre of so many concerns around sustainability, food security, resource use and climate change. In particular, for citizens to have some meaningful influence and agency around the food they eat, some understanding of the complexities, the consequences and the trade-offs involved in plant breeding may be helpful.
- Participants also expressed frustration at how media reporting is distorted by lack of expertise and understanding amongst journalists, campaigners and politicians.
- Finally, in this frustration was also a desire to connect professionally and personally and find a more cohesive approach to agricultural plant breeding.

The plant breeding discussion is, of course, rich with political, cultural and other types of context. Food system challenges, environmental degradation and political upheaval all provided a backdrop to the wider discussion. But two threads in particular – language use and regulatory uncertainty – ran through most of the day's discussions.

The complexity of language

At the start of the day we suggested that participants listen out for key words like 'sustainability' and 'natural' and take the opportunity to ask whether we all mean the same thing when using these.

Differences did emerge, especially in discussions around the concept of natural where fundamentally different perspectives surfaced over what it is and its importance in the bigger picture of agricultural plant breeding.

As the day progressed it also became clear that other aspects of language can complicate the discussion around plant breeding. For instance, in nearly all the sessions certain words were being used interchangeably despite having different meanings.

'Citizens' and 'consumers' is one example. Members of the public can identify as, and act from, either or both positions. How plant breeders, farmers, scientists and others communicate and interact with the public can also be

"I find the term 'new plant breeding techniques' (NPBT) which includes GMOs and gene editing as well as mutation breeding, particularly misleading and problematic. This is not plant breeding as we learn the term in school. It's not just confusing for me but MEPs and academics also think that NPBT just means hybridised plants. I'm not talking about limits here; my problem is with the terminology. They are not plant breeding but something else and they should have a different name."

dependent on whether they perceive themselves as speaking to the citizen or the consumer.

Similarly, in modern sustainability discourse, the concept of 'boundaries' has become synonymous with that of 'limits'. There is, of course, a significant degree of overlap in meaning, but there are also important differences that, although they were not explored on the day, became more apparent in listening to the recordings of the world café.

"Who decides what sustainability is? Risk-benefit analysis is all about weighing the risk against the benefit which is, of course, a political decision. The problem with your criteria – ethics, ecology, economy, society, good governance – is that they are all tradeable."

A boundary can be indicative of a limit – as in an area of land or a city – but it can also reflect personal and/or communal choice, which, through inclusion and exclusion, defines identity and scope of a place, a person or a philosophy. A limit can be seen more as a restriction – a rigid line that cannot be crossed – and may arise due to regulation, but also lack of knowledge, lack of investment and/or opportunity. However, both may evolve over time and with changing circumstances.

In listening to the audio recordings of the day it seemed clear that a boundary as a principle of differentiation or a set of distinctive features of something might be worth greater consideration and could provide a way forward in discussions around different approaches to plant breeding.

Finally, although the trend in regulatory discourse is to see risk as a single absolute that can be identified, assessed and managed (and even accepted), in reality risk is linked to a host of other concepts including probability, danger, hazard, safety and vulnerability. Different risks may also have different time-horizons that can render the identify/assess/manage approach ineffective. We reflect more on all these things throughout the main report and in the *Final Thoughts and Next Steps* section.

The political and policy context of genome editing

Our world café discussion took place against a volatile and rapidly changing political and policy backdrop.

It is widely held, for example, that the development of new genetic engineering techniques, known collectively as genome editing, have the potential to transform healthcare, medicines, conservation, livestock production, crop production and food processing. If so, major changes in economic structures, technology applications and production practices will follow, creating significant impacts on a wide range of societal relationships.

Inevitably therefore the technology is highly controversial with 'for' and 'against' lines being drawn much as they have been in the past decades over the older style GMOs.

However, although reminiscent of past battles, this controversy is different. In part this is because the technology itself is different to older style GMOs, at least in some key aspects. But it is also because, in the light of climate change and a growing population, it is easier to make a compelling case for wider and more direct societal benefits as opposed to narrow corporate interests.

Another aspect that has changed is the make-up of the opposing sides; some advocates and opponents have swapped sides and possibly crucially, there seems to be more acceptance of grey areas in between previously fixed positions, some of which were explored during this session.

The European Court of Justice ruling on genome editing

Genome editing is an umbrella term that covers the use of a variety of genetic engineering tools which can be

used to manipulate DNA. CRISPR/Cas (short for clustered regularly interspaced short palindromic repeats) is the most well-known of these but others include TALENs (transcription activator-like effector nucleases) and ZFNs (zinc finger nuclease).

These new tools have been presented by many researchers, the industry, policy makers, politicians and sections of the media as being so different from 'old style' GMOs that their use should not fall under existing regulations.

Some have gone further and argued that, at least some, genome editing processes are so similar to certain existing and unregulated plant breeding methods that they should be treated in the same, unregulated way.

This case is built on the fact that since the mid-20th century, conventional plant breeders have used a method called random mutagenesis (now often referred to as traditional mutagenesis) where seeds and other plant materials are treated with agents such as high-energy radiation or toxic chemicals to create genetic mutations. The resulting mutant plants are then selected for desired traits and new varieties are bred from these.

"I'm not necessarily sure we should assume that the best argument is to say if random mutagenesis is exempted then directed mutagenesis should be too. To me that's a big box to open and I wonder do two wrongs make a right?"

In the context of plant breeding, a type of genome editing known as targeted mutagenesis (or site directed mutagenesis) can alter one or more host genes of a living species, at predetermined location on the genome.

Targeted mutagenesis does not involve the insertion of foreign DNA (though in other applications of genome editing, foreign DNA, including a complete gene, can be inserted into the genome of a living organism). Instead it activates the cell's DNA repair mechanism and the mutant plants that arise from this repair are selected for their traits.

Technologies like CRISPR do not, in themselves, create new organisms. In most instances, these genome editing tools, which are sometimes described as 'genetic scissors', are used to cut both strands of the DNA helix at a pre-determined location. This cut then activates the cell's DNA repair mechanism. This combination of events allows genetic engineers to introduce a genetic modification at a specific location on the genome.

Currently there are three types of procedures that can be used following the 'cut'. In the simplest possible terms these are:

- SDN-1 the cut is made and the organism's normal cellular repair mechanisms are left to make the repair;
- SDN-2 the cut is made and a template is provided to instruct the organism how to repair itself;
- SDN-3 the cut – and sometimes multiple cuts – are made and both a template for repair and the simultaneous insertion of transgenes are applied.

It is argued by proponents of genetic engineering that SDN-1 and possibly SDN-2, are close to what could happen in nature. Governments in the US, Australia and Japan have partially accepted this argument and have deregulated SDN-1 techniques.

The counter argument is that there is rapidly mounting evidence that even a 'simple' cut and repair can

produce the intended mutation at the target site (intended on-target effect), but also unintended mutations at the target site (unintended on-target effect) or at other locations (off-target effect).

In Europe the focus of the debate moved to the European Court of Justice (ECJ) in 2016. The Court was asked to consider the degree of similarity or difference in concept, mode and impact of random (traditional) mutagenesis and modern targeted mutagenesis as presented by genome editing methods. Specifically, the ECJ was asked by the French Conseil d'Etat to clarify whether targeted mutagenesis, used in the genetic engineering of plants, falls within the scope of current European legislation on GMOs. In July 2018 the ECJ ruled that this was the case and therefore its use and the products of its use should be regulated as GMOs.

"If a new tech can be used to solve big problems – is it ethical NOT to allow it. There should be very good arguments against usage."

Furthermore, the Court affirmed that random mutagenesis is a form of genetic engineering, but that it was specifically exempt from the EU GMO regulations due a long enough record of safe use. It did acknowledge, however, that it could be regulated by Member States in accordance with overall EU law.

The judgement argues that newer techniques (many of which have yet to reach the marketplace) do not have a history of safe use and therefore, *"the risks linked to the use of those new techniques/methods of mutagenesis might prove to be similar to those which result from the production and release of a GMO through transgenesis"*.

Elsewhere the judgement states *"the development of those new techniques/methods makes it possible to produce genetically modified varieties at a rate and in quantities quite unlike those resulting from the application of conventional methods of random mutagenesis."*

Is ECJ ruling a turning point?

This ruling was, as expected, highly controversial and has been much criticised in many quarters and defended in many others. These very different views were reflected around the tables with some participants arguing that it was a "flawed judgement" since traditional and modern mutagenesis are essentially the same.

Other participants – and not just proponents of genome editing – pointed out that random mutagenesis has never been investigated or regulated for safety, and that this was an unacceptable grey area in plant breeding that merited greater scrutiny.

The ECJ ruling has certainly not ended the debate and disagreements. In fact, it has fired up more controversy. Although the ruling itself was not discussed in any detail during the session, it was a critical background influence as it represents the status quo around which all current thinking and perspectives swirl.

FINAL THOUGHTS AND NEXT STEPS

The world café on The Boundaries of Plant Breeding was a chance for breeders from different perspectives to come together in a safe space and discuss differences and find some points of agreement.

What emerged from the day is that plant breeding isn't a monolith. There is room for debate and the focus of the debate shifts over time. Likewise, the science of genetic modification is complex and evolving – but while the technology has changed, the discussion – outside of events like this – has stayed largely the same.

We observed that amongst the plant breeding fraternity the discussion is far more fluid and open than at the

policy or activist level and perhaps it is here where some kind of consensus on pathways for moving forward can be found. This, of course, requires the full spectrum of views from all plant breeding approaches being brought into the forum.

In a generally good-natured meeting, the one overt clash was over the European Court of Justice's (and the organic sector's) stance on mutagenesis. Support for the ruling conflicted with passionately held views that the urgent need to improve sustainability and climate change resilience made genome editing tools necessary.

Given this, there were real and significant differences between participants over process- or trait- (final product) based risk assessment, which remained unresolved.

Differing responses to the idea of "using all the tools in the tool box" were also revealing. There was general agreement that genome editing is "one tool in the toolbox". No-one argued, however, that it was *the* tool.

There were, however, points of agreement as well:

- There was acceptance by participants who support genome editing of the viability and value of the organic approach to plant breeding.
- The alternative (organic) participants acknowledged the value of genomic tools in lab-based research and in genome mapping as a tool of selection.
- However, there was little or no understanding by many – possibly a majority of – participants of the rationale for organic plant breeding to avoid or prohibit some approaches (tools in the toolbox) especially targeted mutagenesis/SDN-1.
- There was an implied sense from some participants that some genome editing tools, which are currently seen as problematic, might gain acceptance in the future after further consideration, research and/or experience of use. In this case issues of risk, risk assessment and regulation are more important than perceived conceptual differences over methods.
- There was a degree of willingness to accept that public perceptions are not purely 'emotional' or 'irrational' but are shaped by a complex range of factors and values which are relevant to the debate.

Several other important philosophical and practical takeaways arose from the day, and these are detailed in the headings below.

Conflicting concepts

There was broad agreement that the use of the term 'nature' as a defining concept is less relevant to plant breeders than it is to citizens and consumers. Given that citizens and consumers are the ultimate end-users of the products of plant breeding this is problematic.

There was little understanding from 'conventional' participants of the boundary established by organic plant breeders around the concept of the 'integrity of an organism'.

Even though there was firm adherence to this position by some organic plant breeders, it was not clear that everyone from the 'alternative' side shared this adherence. There was even a suggestion that concepts of sustainability and eco-efficiency might be more important in the overall picture of plant breeding.

"Maybe there could never be an economic argument that could outweigh sustainability principles."

We heard no answer to the question of whether there are, or should be, boundaries in genome editing and if so what might these be. The public face of this technology as one without bounds makes it attractive from an investment, and possibly even a political, perspective but it can be problematic when it comes to identity and to understanding where it might fit in, practically and philosophically, in a 'pluriform' approach to agriculture.

It was not clearly stated, but was implied in a number of comments, that breeders from conventional and biotech backgrounds see no validity in setting limits on breeding methods other than those set a result of pragmatic risk assessment. However, it was recognised by many that economics – structures and markets – set *de facto* limits on breeding approaches.

There was unease and no consensus over how these limits are influenced by consumer attitudes. This unease was generated by confusion over what consumers 'have a right to know' if this right encourages prejudicial publicity, as well as by the high cost of information provision and the risk of confusion.

There was general acceptance of the idea of the need for wider engagement with stakeholders – farmers and citizens – for instance through participatory breeding programmes. However, it was not clear how much of a priority this was across the board.

Exaggerated claims

There was a significant level of agreement that claims for genome editing are 'over hyped' and that, as these claims are widely publicised, they unbalance mature discussion and consideration of the technology.

There was broad concern that exaggerated claims are made, in part, to promote political, policy and economic agendas that overshadow a more realistic and nuanced scientific and public discourse around the technology and the issues it might help address.

However, there was also some acknowledgement that over-hyped and distorting claims are not restricted to the promotion of genome editing. They are also present in the promotion of other approaches. Unless we sincerely believe that 'two wrongs make a right' the entire discourse around plant breeding needs to change.

The need for regulation

There was some degree of consensus on the need for regulation of genome editing technology and its products. Even so there was a significant spectrum of opinion, with some adamant that regulation is neither needed nor desirable and some questioning where to sensibly draw the line.

"For me this focus on health and environmental risks is too narrow. It's not the whole picture. There may be other risks such as social or economic. How do we talk about those?"

Participants were split over whether SDN-1 techniques should be regulated. There was more support for regulating SDN-2 and SDN-3 approaches as GMOs but, again, this fell short of consensus.

The most commonly held view was that regulation should be consistent and the most commonly used example of inconsistency was that of random mutagenesis versus targeted mutagenesis. To exempt one from regulation and not the other was seen by many as unfair to targeted

mutagenesis and misleading about the safety or otherwise of the products of random mutagenesis.

There was dismay amongst a significant number of participants that in the face of profound environmental challenges, such as climate change and biodiversity loss, a breeding approach that many believe is akin in effects to traditional breeding or natural impacts is being ignored and by implication undermined. This was

a significant conceptual clash that was largely treated with kid gloves during the discussions.

There was some agreement, but it was not clear how much, that science alone does not provide answers as to how or why we should regulate the products of genetic engineering. The case for a much broader approach where regulations reflect societal values was, however, sympathetically received. This would incorporate philosophy, ethics and sociology and relate to clear goals for a resilient, sustainable agriculture

Labelling and citizen engagement

There was acceptance that citizens should be – and many want to be – better informed about plant breeding and agriculture and there was broad general support for the desirability of providing them with information, through labelling but also through in-store information and better outreach by plant breeders.

No one objected to the idea of citizen engagement in policy and funding decisions or in regulatory frameworks and decisions. Some even felt it could be helpful to the process of assessing the products of genome editing – though most recognised the lack of framework to facilitate this.

For this reason, interest in public engagement was tempered by concerns over how this can be achieved, what form it might take, whether it would generate confusion and how much benefit would result in reality.

Sustainability

There was universal agreement that sustainability should become a major driver for technology development and implementation.

The question of what is meant by sustainability required more time than we could devote to it. Different people had different approaches to and definitions for 'sustainability' and there was no consensus as to whether sustainability criteria should, for example, include limitation on technology and economic growth, or whether/where societal values such as accountability, fairness, quality of life, individual choice and the right to health and welfare should also be included.

Given the need for a sustainable and resilient agricultural sector this confusion is worrying.

Co-existence

"Pluriformity" or the acceptance and equal status of a range of methods in plant production, and the need for co-existence was accepted and welcomed in principle. This implies, but it was not clearly stated, the possibility of something that might be termed "equitable co-existence", which is distinct from a co-existence dominated by one side and/or forced on the other. However, what this means in practice – e.g. whether 'light touch' regulation or more robust regulation is needed to facilitate co-existence – was not examined.

The issue of what happens if one approach impacts on another e.g. through "contamination" of land, seed stocks, breeding materials, or through reputational damage which undermines credibility and value, was raised but not explored due to lack of time.

The uncomfortable truth for all sides of this debate is that:

"I think it is fruitful to think about where we want to go with agriculture and really think about the whole food system. What was clear to me and has become clearer today is that we need a diversity of approaches."

- It is stated and agreed policy in the EU, throughout all member states and even post-Brexit Britain to encourage and develop a range of agricultural systems – whether conventional, GM or organic;

- There is no possibility of any overt political shift from this position;
- There has been no meaningful discussions for well over a decade as to how this co-existence can actually work with the implementation of genetic engineering technologies.

Probably most uncomfortable of all, there is scant evidence of clear intent that any of the relevant stakeholders are willing to concede ground to bring about “pluriformity” and co-existence.

Next steps

This world café created the conditions for and facilitated a robust but respectful discussion of people perceived to hold fundamentally different positions about the use of genome editing in plant breeding. There were no Damascene moments but there was some recognition of grey between the black and white, an indication of greater understanding of differing views and positions and some declarations of shared concerns, aspirations and principles.

Consequently, the event has thrown up a numerous potential next steps to pursue issues – technical, ethical, societal, policy, regulatory – in greater depth and detail.

Within this mix, for Beyond GM there are some key next steps we will be endeavouring to follow.

- **Continuation of A Bigger Conversation meetings** With each meeting we are clarifying what lies behind and between the different positions taken on genome editing in farming and food. We are also building a network of people who are willing to engage with each other respectfully across sometimes wide conceptual divides. These are important factors for creating pluriformity and equitable co-existence.
- **Promote further engagement of this type** The character of this meeting (and others in our series) is unusual. The balance of participants brought together a mix not normally found in meetings of just “stakeholders” and lobbyists. All are prominent in their fields but have a wider perspective; they have robust opinions but are not opinionated and are respectful of others' views; they are affiliated with organisations but do not always feel compelled to represent or speak for those organisations.
- **Engage constructively with policymakers around regulatory issues** There is currently a great deal of upheaval and debate in the regulatory sphere with regard to genome editing. We believe this brings opportunity to consider regulation in a new light, particularly with regard to ethics and societal values. Our work engages us with issues in the UK and the EU and indeed we believe that regulatory issues in both places are interlinked. We will therefore continue to pursue this line under our own banner but also in coordination with like-minded groups and individuals.
- **Pursue in greater depth and detail what the conditions for “equitable co-existence” will be** There is an urgent need to understand what an equitable co-existence might look like and how it might be implemented practically and in terms of policy, regulation and politics. This will involve across the board co-operation in research, analysis, discussion and debate.
- **Explore the possibility of a civil society forum** where criteria for 'values-based' non-market aspirations could be discussed and refined and used to inform regulation and influence the direction of public sector-based plant breeding.

PARTICIPANTS

Plant breeder participants

- Edith Lammerts Van Buren – Emeritus Professor, Organic Plant Breeding, Wageningen University
- Erhard Ebmeyer – Senior Breeding Advisor, KWS Cereals
- Gary Barker – Senior Lecturer, Bioinformatics, University of Bristol
- Guusje Bonnema – Group Leader Growth and Development Group, Wageningen University
- Huw Jones – Chair in Translational Genomics for Plant Breeding, University of Aberystwyth
- Maarten Rouwet – Biotech Breeder Leafy Vegetables, Enza Zaden; organic breeding projects, Vitalis
- Michael Palmgren – University of Copenhagen, Department of Plant and Environmental Sciences
- Grietje Raaphorst-Travaille – General Director, Nordic Maize Breeding
- Monika Messmer – Department of Crop Sciences, Group Lead Plant Breeding, FiBL
- Niels Louwaars – Managing Director, Plantum
- Peter Kunz – Founder and Director Getreidezüchtung (GZPK); farmer, agronomist, biodynamic plant breeder
- Petra Jorasch – Manager Plant Breeding and Innovation Advocacy, Euroseeds (ESA)
- Ricarda Steinbrecher – Co-Director, Econexus, UK; biologist and molecular geneticist
- Stephanie Klaedtke – Researcher, Seed and Crop Diversity, LIVESEED project manager, Institut Technique de l'Agriculture Biologique (ITAB)
- Trine Antonsen – GenØk Centre for Biosafety, Tromsø, Norway
- Ulrich Quendt – Cereal Breeding Research Darzau, Germany
- Urs Niggli – Director, FiBL

Host participants

- Eric Gall – Deputy Director / Policy Manager, IFOAM EU
- Lawrence Woodward – Director, Beyond GM
- Martin Sommer – Policy Coordinator on GMOs, Patents and Seeds, IFOAM
- Thomas Haselberger – Policy Unit, IFOAM EU

Meeting organiser

- Pat Thomas – Director, Beyond GM

Moderators

- Barbara van Dyck – Research Fellow at the Science and Policy Research Unit, University of Sussex
- Juliet Leroux – Policy Advisor, Greens/EFA
- Pat Thomas – Director, Beyond GM
- Tom Wakeford – Programme Manager, ETC Group