Plant Breeding Fit for the Future

Wednesday 12th October 2022





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9.35am – 9.50am Opening words – Ruth Bastow (CHAP) and Jo Lewis (Soil Association Policy Director

9:50 – 10:20am Setting the scene: A tipping point for change.

In this session, we explore the current agricultural landscape in the UK and the once-in-a-generation changes it is experiencing. **Presenter** - Tim Benton (Chatham House)

10:20 – 11:00 The role and potential of plant breeding.

An invitation to look at current plant breeding practices, what works well and what are the limitations which should be addressed to make sure the industry is ready for a resilient future. Chair – Hannah Senior (PBS)

10:20 – 10:35am Making 'the grade'. Paul Gosling (AHDB)
10:35 – 11:00am Panel perspectives. Bruce Pearce (Garden Organic),
Jo Matthews (Germinal), and Jen Bromley (Vertical Futures)

REFRESHMENT BREAK

11.00-11.30

11:30 -12:30 Enabling plant breeding for the future. An opportunity to reimagine the UK plant breeding system and explore how should it look like to make it futureproof. Chair – Liz Bowles (Farm Carbon Toolkit)

11:30 – 11:45am What could the future look like? Tom MacMillan (RAU) 11:45 – 12:30pm Panel perspectives. Charlotte Allender (University of Warwick), Kate McEvoy (Real Seeds), Katherine Denby (University of York)

LUNCH BREAK

12.30-13.30

13:30 -15:30 Stakeholder breakout rooms. Work with us to co-design this new future, particularly from a plant breeding perspective. Bring your ideas and share your perspectives on this challenge as we seek to build potential solutions.

REFRESHMENT BREAK

15.30-16.00

16:00 – 16:45 Feedback and action plan - Ruth Bastow and Jo Lewis *Pulling the threads together, this final session shares themes from the breakout discussions and brings together the ideas from the day.*

CLOSE

Opening words

Ruth Bastow (CHAP) Jo Lewis (Soil Association Policy Director)





Setting the scene: A tipping point for change



Tim Benton (Chatham House)





The role and potential of plant breeding







Recommended List system 'Making the Grade'

Dr Paul Gosling (AHDB)





RECOMMENDEDLISTS



Recommended List system 'Making the Grade'

Dr Paul Gosling AHDB Recommended Lists Manger





Statutory requirements

- National Listing and Plant Breeders Rights are part of a mandatory requirement for official registration of new varieties in the UK
- Prior to Brexit the UK system was part of the EU Common Catalogue of varieties
- It is overseen by defra through the Animal and Plant Health Agency (APHA)



National Listing

- A variety must be on the UK National List for seed to be sold
- National Listing is a process that determines if a variety is
 - Distinct Uniform and Stable

and that it has

• Value for Cultivation and Use

Varieties must meet minimum standards for agronomic characteristics and disease resistance in order to be added to the National List



Plant breeders' rights

PBRs were introduced in the 1960s with the aim of allowing plant breeders to secure financial returns from plant breeding

PBR means that nobody can, without permission, use a variety for:

- production or reproduction
- selling or offering for sale
- exporting or importing

Intellectual property rights associated with seed development secure the revenue to continue plant breeding



Selecting varieties - the NL?

- Cereals, potatoes, fodder beets, fodder grasses and legumes, vegetables, maize etc.
 - 279 varieties of winter wheat
 - 184 varieties of carrot
 - 67 varieties of beetroot
 - 142 varieties of spring barley
 - 479 varieties of maize
 - 564 varieties of potato
 - 29 varieties of gherkin
- It is not a practical system for variety selection



Descriptive and Recommended lists

Descriptive

Subset of the 'major' NL varieties

- Peas and Beans
- Winter triticale
- Winter rye
- Spring linseed
- Spring oilseed rape
- Forage maize

Recommended

Subset of the 'Best' NL varieties

- Wheat
- Barley
- Oats
- Sugar beet
- Winter oilseed rape
- Fodder grasses
- Fodder legumes



Recommended Lists

Select the best of the new varieties based on

- Yield
- Pest and disease resistance
- Agronomic qualities
- End use quality

Different crop lists test different characteristics e.g. establishment is measured in sugar beet but not cereals



Recommended List testing

- Is a test of genetic potential
- Provides a 'level playing field' fair comparison of varieties
- Involves end users to ensure that varieties will have a market
 - allows farmers to access premium markets
- Empowers farmers to select the best of all available varieties
- Provides vital information for crop husbandry decisions
 - e.g. pest resistance, disease resistance, resistance to bolting, susceptibility to lodging



Weaknesses

- Test conditions don't replicate farm conditions
- Cannot test all factors of interest to growers
- Cannot test varieties in all conditions
- Multiple stakeholders mean it can be slow to respond to changes in farming practices

Strengths

- Long history means it is understood by stakeholders
- Has industry 'buy in'
- Protects farmers
- Gives farmers choice
- Ensures food supply chain has a secure supply of correct quality
- Provides an income for ongoing plant breeding



Challenges and opportunities for cereal and oilseeds RL?

- Production systems are diversifying
- Variety types are diversifying
- Breeders are introducing more and more new traits
- New crops
- •GE and precision breeding techniques?
- Staying relevant to levy payers



The role and potential of plant breeding Panel perspectives

Bruce Pearce (Garden Organic), Jo Matthews (Germinal), and Jen Bromley (Vertical Futures)







REFRESHMENT BREAK





Enabling plant breeding for the future







Tom MacMillan (RAU)









Prof Tom MacMillan, Royal Agricultural University tom.macmillan@rau.ac.uk

July 2022



How will we use land & what will we grow?





- Multiple outcomes
- Diverse crops
- Macro & micro variation
- Sparing & sharing
- All input-limited
- Plus:
 - BECCS
 - Horticulture
 - Soilless

Can we get better at innovation?



🔵 North America 😑 Asia 🌑 Oceania 💭 Europe, NW 🔵 United Kingdom 🛑 Mediterranean 🔵 Europe, Central

Public agricultural R&D intensity (Public ag R&D/Ag GDP, 1960-2013, %)

Sources: USDA ERS; Scimago

6.2



Methods



Myrtille Lacoste ^{[],2}^[2], Simon Cook ^[],³, Matthew McNee⁴, Danielle Gale ^[], Julie Ingram ^[],⁵, Véronique Bellon-Maurel^{6,7}, Tom MacMillan^{®8}, Roger Sylvester-Bradley⁹, Daniel Kindred^{®9}, Rob Bramley (50 10, Nicolas Tremblay (51), Louis Longchamps (512, Laura Thompson (513, Julie Ruiz (514, Fernando Oscar García ^{[0] 15,16}, Bruce Maxwell¹⁷, Terry Griffin ^{[0] 18}, Thomas Oberthür ^{[0] 19,20}, Christian Huyghe²¹, Weifeng Zhang²², John McNamara²³ and Andrew Hall[©]²⁴



310.000

430,000

A versus B in reseeded pasture: 100 animals each, 50% with tracking collars + drone-based imagery of pasture variation

Pesticide timing

Grain yield

Grazing

No application

2.5 t ha⁻¹ lime

Fences

patterns

Flowering

Target vines

200 m

Nitrogen rate (kg ha⁻¹) 100

135

170

200

235

2020

Funding



Strategy

Consistent calls for greater integration



Scientific

STEM & research skills More co-ordinated public R&I funding

Strategic

Long-term investment in R&I infrastructure & talent Training & incentives for KE & commercialisation

Infrastructure for KE & commercialisation

Mission-oriented R&I funding

Social

Develop R&I priorities with users / stakeholders

Agree performance indicators & metrics

Improve regulatory conditions for innovation

Skills





www.ceiagri.org/

Prof Tom MacMillan, Royal Agricultural University tom.macmillan@rau.ac.uk

July 2022

The role and potential of plant breeding Panel perspectives



Kate McEvoy (Real Seeds), Charlotte Allender (University of Warwick), Katherine Denby (University of York)





LUNCH BREAK









BREAKOUT ROOMS







FIRST ROUND

Mind the Gap - the ingredients required to allow plant breeding for a sustainable future, and how to realise them	Holly	Alpren
	Heather	Briggs
	Lindsey	Compton
	Rob	Соу
	Katherine	Denby
	Simon	Griffiths
	Mike	Grimmer
	Kate	McEvoy
	David	Miller
	Keith	Norman
	Ken	Pallett
	Michael	Shuldham
	Christopher	Stopes
	Charlotte	White

Optimising Performance - what traits support resilience and how do we characterise/establish a preeding pipeline that enables this	Luke	Bell
	Ruth	Bryant
	Helen	Cockerton
	Sandy	Cowan
	Louisa	Dever
	Aoife	Dillon
	SAMEH	ELSAYED
	Clare	Leaman
	Henny	Lowth
	Teresa	Rush
	Julian	Smith
	Tom	Thirkell
	Paul	Totterdell
	Victoria	Woolley

Quick Wins & Long Shots - how innovation and technology can support plant breeding today & for the future	-			Future Landscapes: the role of populations vs varieties	Charlotte	Allender
	IOM	Allen-Stevens			Jacob	Bishop
	Dominic	Amos			Samantha	Brooke
	John	Bloomer			Beatrice	lfie
	Jennifer	Bromley			Matthew	Kerton
	Stuart	Cree			lohn	Letts
	Virk	Daljit			Joanna	Matthe
	Ed	Flatman			Sarah	Palmer
	СС	Foo			Geraint	Parry
	Steven	Jacobs			William	Pelton
	Nicolas	Kral			Paul	Townso
	Derek	Stewart			Robin	Warren

SECOND ROUND

	Charlotte	Allender			Tom
	John	Bloomer		Optimising Performance - what traits support resilience and how do we characterise/establish a breeding pipeline that enables this	Holly
	Sandy	Cowan			Dominic
	Stuart	Cree			Jacob
	SAMEH	FISAVED			Jennifer
	John	Lotts			.s Samantha
Mind the Gap - the ingredients required to allow plant breeding for a sustainable		Letts			Lindsey
	Joanna	Matthews			Katherine
future, and how to realise them	Sarah	Palmer			Ed
	William	Pelton			CC
	Teresa	Rush			Simon
	Derek	Stewart			Grimmer
	Paul	Totterdell			Robin
	Paul	Townson			
	Daljit	Virk			

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	Keith	Norman	
	Geraint	Parry	
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	Christopher	Stopes	
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Closing words

Ruth Bastow (CHAP) Jo Lewis (Soil Association Policy Director)



