Trends in Plant Science

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REVIEWS

Science & Society

Give CRISPR a Chance: the GeneSprout Initiative

Nick Vangheluwe,[1,2,*,@] Gwen Swinnen,[1,2] Ramon de Koning,[3] Prisca Meyer,[4,@] Maarten Houben,[4,@] Michiel Huybrechts,[5] Nikita Sajeev,[6,@] Juriaan Rienstra,[6,@] and Damian Boer[6,@]

Did you know that a group of early-career researchers launched an initiative enabling open dialog on new plant breeding techniques, such as genome editing? We developed a wide-ranging initiative that aims to facilitate public engagement and provide a platform for young plant scientists to encourage participation in science communication.

On the Origin of GeneSprout

Demand for food and resources will continue to grow worldwide, while natural resources required for food and biomass systems are becoming limited [1]. There is a broad scientific consensus that innovations, such as plant genome editing, are urgently needed and have the potential to make a critical contribution to making food systems more sustainable and resilient to climate change. The strength of genome editing lies in its ability to allow precision breeding through the introduction of a specific DNA alteration, resulting in a certain favorable trait within only one or two plant generations [2].

In July 2018, the Court of Justice of the European Union stated in case C-528/16 that organisms made with 'new mutagenesis techniques' are not exempt from the genetically modified organism (GMO) Directive (2001/18/EC)[i]. In the scientific community, it is generally considered that this judgment implies that plants edited with new plant breeding techniques (further referred to as genome editing) must comply with the provisions of the GMO legislation. Many of us fear that we will not be able to benefit from potential applications of genome-edited crops in Europe because of the high threshold imposed by the GMO legislation and the political unwillingness to authorize GMOs for cultivation. After the court ruling, there has been a polarized debate between strong voices both in favor of and opposed to plant genome editing (Box 1).

As citizens and early-career researchers, we want to make society, policy makers, and politicians aware that we are very concerned. We regret the ongoing polarized debate on technological innovation in agriculture and we fear that this will limit the potential benefits of scientific progress and its applications for society and the environment. This affects the new generation of plant scientists, who are passionate about creating new insights and developing solutions for the challenges in food production that we are facing globally in the 21st century.

As a result, the GeneSprout Initiative was launched in autumn 2018, originating in The Netherlands (Figure 1A). We are a group of young researchers committed to stimulating and facilitating open dialog in a constructive and open-minded manner on genome editing. Moreover, we strive to provide scientists, policy makers, and the general public alike with correct and relevant information to help them develop truly informed opinions. The GeneSprout Initiative presents an easy-access platform, specifically aimed at young plant scientists to provide tools for facilitating science communication and public engagement.

Providing Information through Narratives

Scientists are trained to write in a scientific style using the passive voice with generalized and impersonal language. A logical scientific format typically emphasizes rigorous research. Yet, it is not effective when communicating science to a lay

Box 1. Frequently Misused Terminology and Misconceptions of Plant Genome Editing

'Genome Editing is not Allowed in Europe'

It is often said that genome editing is not allowed in Europe. This is a misconception because genome editing is in fact allowed in Europe. Currently, genome-edited crops are subject to the provisions of the GMO directive *cf.* ruling of the Court of Justice of the European Union case C-528/16 [3]. This implies that, if you want to place a genome-edited crop on the European market, a very high regulatory threshold will apply, and you will be faced with political unwillingness to authorize GMOs for cultivation in Europe.

'Deregulating Genome-Edited Crops'

The verb 'deregulate' means 'to remove government rules and control'. There is a general misconception that genome-edited crops would not be regulated anymore if they were not subject to the provisions of the GMO-directive (2001/18/EC). This is not true. Such organisms would still be subject to other EU legislation, such as the European General Food Law [Directive (EC) 178/2002], which imposes procedures to guarantee food safety, and the European Environmental Liability Directive (2004/35/EC).

'What about Off-Target Effects?'

Scientists frequently discuss the issue of potential off-target alterations resulting from genome editing. These are often referred to as 'off-target effects'. The use of the word 'effect' implies that every off-target alteration will result in an unintended and possibly undesirable effect, which is not the case because of redundancy in the genetic code [6]. Therefore, we propose to adopt 'off-target changes' instead. Genome editing is continuously being improved to increase efficiency and decrease the frequency of off-target alterations. Moreover, scientists and plant breeders have the ability to select plants in which only the desired DNA alteration has occurred, without off-target changes [2].



Figure 1. The GeneSprout Initiative Aims to Inform and Facilitate Open Dialog on new Plant Breeding Techniques such as Genome Editing. (A) Logo of the GeneSprout Initiative. (B) Cartoon of a cauliflower to publicize a game on the history of plant breeding: 'Who is the grandparent of cauliflower?' (C) Picture of the side event: 'CRISPR for Us: A Chat with Young Professionals', which took place at the CRISPRcon conference in Wageningen on 20–21 June 2019.

audience. Journalists, environmental activists, and politicians appear to be more successful than scientists in formulating their messages to connect with diversified audiences. This can partially be attributed to the use of narratives or storytelling [3].

Narratives developed from scientific knowledge can assist with public communication because they promote a greater comprehension and engagement within scientific debates. They can also be used to ameliorate the negative consequences of misinformation spread through public channels, such as social media. Framing is unavoidable in science communication and involves simplifying complex topics by placing greater emphasis on certain aspects over others. It is worth noting that the objective should be to improve public understanding rather than to impose a predefined opinion [3].

Given the potential of narrative formats of communication, we propose to describe genome editing not as a technology per se but in the context of plant breeding history. Plants have been domesticated by humans to be more productive and adapted to agricultural practices since the dawn of civilization. Through examples, such as the domestication of strawberry, we can contextualize how genome editing is just another innovation in the history of plant breeding [4].

The GeneSprout Initiative is committed to increasing open access information on new plant breeding techniques. We have a website that provides a platform to share online resources[ii]. Moreover, we have prepared activities and games for science communication events. For example, we created the game 'Who is the grandparent of cauliflower?' (Figure 1B). In this game, you are provided with randomized pictures of domesticated plants (i.e., the grandchildren) and their ancestors (i.e., the grandparents). The purpose is to correctly allocate the 'grandchild' with its 'grandparent'. In this way, we provide information that is not only open access, but also easily accessible in a fun way.

Facilitating Open Dialog

Attitudes towards technological innovation in agriculture are sharply contrasted among society. The decision by the European Court of Justice on the regulatory status of genome-edited crops triggered a public outcry by some and was widely hailed by others. The ongoing debate cannot entirely be attributed to informational deficits, because substantial efforts have been carried out to provide accessible information on these innovations.

It is important to clarify what aspect of genome editing is being debated: scientific evidence or societal considerations, such as values, interests, and concerns (see also Box 1). A careful balance is required between impartially presenting all available

scientific evidence, mapping societal contexts, and analyzing possible interactions [5]. Moreover, personal biases can systematically cause distorted perceptions of facts and opinions, resulting in failure to objectively weigh evidence, assessments, and points of view [5].

As an alternative to the polarized debate, we propose facilitating open dialogs to enable people to find their voice. Through listening and dialog, new perspectives are found that can unite. There is a meaningful role for early-career researchers, because they are the new generation of plant scientists whose future will be affected by the ongoing policy developments and who will be able to profit from changes that will foster the development of more nutritious and resilient crops while protecting resources and the environment. Moreover, this generation of researchers grew up with new media platforms that enabled them to be recognized and communicate as individuals without the need for a publishing body. We have experienced firsthand that identifying common values, interests, and concerns can contribute to establishing common ground when discussing technological innovations in agriculture. Topics such as the environment or food quality standards are gaining more attention from a growing fraction of the general public. For instance, we hosted the event 'CRISPR for Us: A Chat with Young Professionals', which included a variety of young professionals, including a politician, science communicator, entrepreneur, and two academic researchers (Figure 1C)[iii]. Throughout our interactions, we have become more aware of how personal biases affect the assessment of scientific evidence and which societal considerations people with diverse areas of expertise have in common.

Hosting Positive Activism Events

Activism is about creating social, political, and environmental change and is as a result much aligned with our purpose of actively promoting scientific progress. We want to raise public awareness that we, young plant scientists, are conducting research to build up knowledge and to develop solutions for and with society.

On 5 March 2019, we co-organized a positive activism event, together with Science for Democracy, in front of the European Parliament in Brussels. Together with more than 100 early-career researchers from across the country, we consumed rice pudding prepared with genome-edited rice. We distributed flyers that highlighted our message and informed passersby about the potential of genome-editing applications for agriculture. This event was actively shared on social media with the hashtag #GiveCRISPRaChance and we were able to engage many more fellow researchers to spread the word. In the past summer, students from eight EU member states, who met during their MSc studies at Wageningen University, launched the initiative 'Grow Scientific Progress'. Together, they submitted a detailed proposal to the European Commission in the format of a European Citizens' Initiative[iv]. In this proposal, they outlined legal changes to the current regulatory framework to facilitate responsible innovation for new plant breeding techniques. These initiatives highlight how early-career researchers can become an active part of policy development and public awareness.

Concluding Remarks

Here, we have illustrated a plethora of possibilities for how young scientists can engage in science communication. Early-career researchers are able to reach out to all stakeholders, including the general public, policy makers, and politicians, to inform and raise awareness for the potential benefits of new technologies in plant science, such as genome editing.

Are you an early-career researcher or student and are you concerned about the future role of technology and innovation in more sustainable food and biomass systems? We encourage you to have a look at the activities of the GeneSprout Initiative on our website and hopefully you will feel inspired to participate in science communication[ii].

Resources

[i]https://curia.europa.eu/jcms/upload/docs/application/pdf/2018-07/cp180111en.pdf
[ii]www.genesproutinitiative.com/
[iii]https://crisprcon.org/crisprcon-2019/
[iv]www.growscientificprogress.org/

[1]Ghent University, Department of Plant Biotechnology and Bioinformatics, Technologiepark 71, B-9052 Ghent, Belgium
[2]VIB-UGent Center for Plant Systems Biology, Technologiepark 71, B-9052 Ghent, Belgium
[3]Laboratory of Plant Genetics, Vrije Universiteit Brussel, 1050 Brussels, Belgium
[4]KULeuven, Division of Crop Biotechnics, Willem de Croylaan 42 box 2427, 3001 Leuven, Belgium
[5]UHasselt, Environmental Biology, Centre for Environmental Sciences, 3590 Diepenbeek, Belgium
[6]Wageningen Seed Laboratory, Laboratory of Plant Physiology, Laboratory of Biochemistry, Wageningen University, 6708 PB Wageningen, The Netherlands

*Correspondence:
info@genesproutinitiative.com (N. Vangheluwe).
@Twitter: @nvgheluw (N. Vangheluwe), @priscameyer1 (P. Meyer), @ActuallyMaarten (M. Houben), @nikita_sajeev (N. Sajeev), @jurstra1 (J. Rienstra), and @that_damian (D. Boer).

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References

1. Shukla, P.R. *et al.*, eds (2019) *Climate Change and Land: An IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystems*, IPCC
2. Zhang, Y. *et al.* (2020) A CRISPR way for accelerating improvement of food crops. *Nat. Food* 1, 200–205
3. Yang, Y. and Hobbs, J.E. (2020) The power of stories: narratives and information framing effects in science communication. *Am. J. Agr. Econ.* Published online January 3,2020. https://doi.org/10.1002/ajae.12078
4. Vergauwen, D. and De Smet, I. (2019) The strawberry tales: size matters. *Trends Plant Sci.* 24, 1–3
5. Van Woensel, L. (2020) *A Bias Radar for Responsible Policy-Making: Foresight-Based Scientific Advice*, Palgrave MacMillan
6. Lassoued, R. *et al.* (2019) Risk and safety considerations of genome edited crops: expert opinion. *Curr. Res. Biotechnol.* 1, 11–21