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CropBooster-P

Deliverable No. 3.3: Recommendation dossier on mid-term outreach measures to increase public awareness and understanding of novel-technologies

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Authors: Sabine Will (JKI), Nick Vangheluwe (Plant ETP & Euroseeds), Dörthe Krause (JKI), Christian Kohl (JKI), Amrit Nanda (Plant ETP), Petra Jorasch (Euroseeds) and Ralf Wilhelm (JKI)

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1. Introduction

One of the tasks in Work Package 3 is to develop a communication and outreach strategy for being considered in future EU-funded projects dealing with New Plant Breeding Techniques like plant genome editing. This strategy is not meant to influence someone's opinion but to increase the public awareness, understanding of novel technologies in plant breeding (e.g. genome editing) and facilitate an open societal dialogue between science and society. This should facilitate a differentiated and science-based opinion forming process. It should be noted that some elements of the communication strategy are highly dependent on the concrete design of future research projects that will implement the strategy. For example, the duration of the project, funding and the respective research goals are factors influencing, besides others, the choice of dialogue groups and applied communication measures. The support of scientists by communication experts will also be substantially determined by the size of the research project.

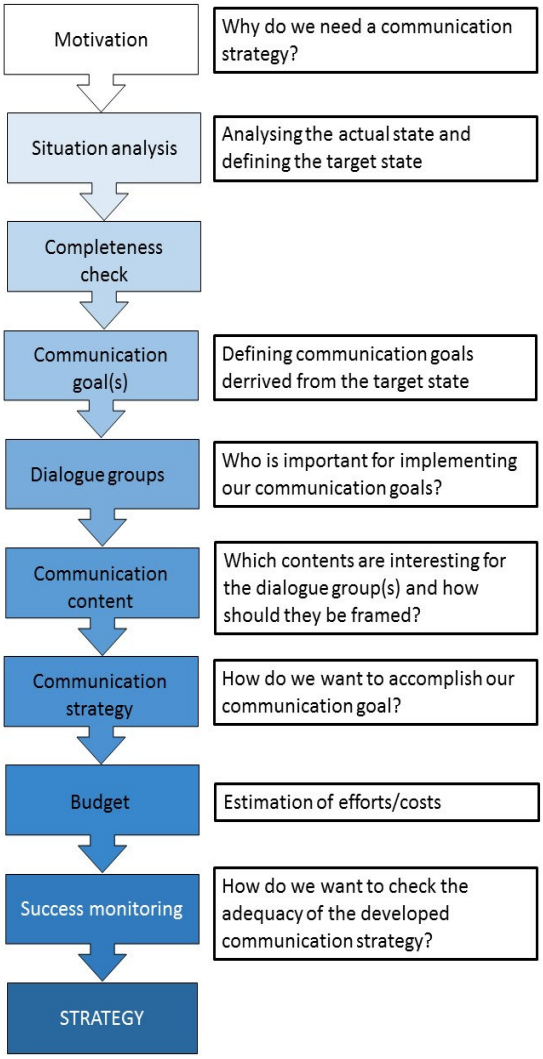

Figure 1: Overall process during the development of a communication strategy

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Based on a specific motivation, the status quo and the target state are being analysed in order to identify challenges that can be solved by communication means but currently hamper an efficient communication.

Derived from the target state, specific goals that should be achieved by the communication strategy need to be specified. In a next step, relevant dialogue groups need to be identified and the communication content has to be developed, channelled, contextualised and targeted considering the specific needs, interests and values of the audience. These considerations are then summed up in order to adapt the comprehensiveness of the strategy to the available resources. Furthermore, success-monitoring measures would be useful to put into place. Based on this structure, recommendations on communication efforts in the frame of plant breeding innovation through genome editing are presented in the upcoming sections.

The recommendations are informed by studies carried out in the course of CropBooster-P aiming at elucidating the communication behaviour of stakeholder groups being involved in the public discourse surrounding plant genome editing. The studies were based on qualitative and quantitative research methods. The Julius Kühn-Institut (JKI), which is the German Federal Research Centre for Cultivated Plants conducted qualitative online interviews and a quantitative online survey, covering four stakeholder groups namely academia, consumer organisations, environmental organisations and journalists. The European Technology Platform 'Plants for the Future' (PlantETP) and the Association of the European seed & plant breeding sector, Euroseeds, conducted a quantitative online survey and focus group discussions considering three stakeholder groups, namely seed & plant breeding companies, farmers and policy makers[1]. The empirical results of these various surveys contributed to the situation analysis on which the communication strategy is based. The developed communication recommendations were discussed with communicators and communication/social scientists by means of feedback interviews to check for completeness.

[1] The description of survey methods, the samples and basic analyses are presented in the supplementary survey reports.

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2. Communication Strategy on plant genome editing

2.1 Motivation and Vision

Increasing the public awareness and understanding of novel technologies in plant breeding and facilitating an open societal dialogue between scientists and society are the main motivations when developing the communication strategy.

The guiding principle of the communication strategy is based on goals relevant to all societal actors - sustainability in agriculture, food quality and food security. These common goals should function as a common basis for communication, as they can form a bridge between actors with contrasting views on the future of agricultural -and food production. All communicative statements should be developed on this basis. The application of new plant breeding techniques should be communicated as one of the innovative approaches to achieve these common goals. However, the communication should always emphasise that the goals can only be achieved through enabling all possible approaches and methods whose individual effects interlock and complement each other.

"Demonstrating synergies between new plant breeding technologies and other approaches that at first glance appear to be contrary to genome editing to future- proof agriculture. New plant breeding technologies and organic agricultural practices and agro ecology approaches should be seen as complementary tools of one toolbox rather than mutually exclusive approaches" (Purnhagen et al. 2021)

In this sense, the guiding principle of the communication strategy is integrating and not polarising. The communicative integration of plant genome editing as one approach within the breeder's toolbox as well as the consideration of further complementary strategies would require an increased interdisciplinary communication. In addition, communication should be two-sided, evidence-based and all major target groups should be considered. Taken together, the strategy should make communication activities more visible, diverse, and defensible.

The report provides background information on how multi-stakeholder communication could be implemented in future projects. Its presentation is not limited to the format of such projects or "users". In this sense, it can also be used by public authorities and the Commission. The report does not make policy statements about how NPBTs should be regulated, but highlights the perspectives (and communication behaviour) of different stakeholder groups. Nevertheless, the Commission's ongoing activities to update the regulation of genome-edited and cisgenic plants and their outcomes need to be taken into account in future communication efforts.

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2.2 Situation Analysis

In this section we analyse the actual state of the communication activities related to plant genome editing to set the scope and facilitate the development of communication goals.

Genome editing allows for targeted modification of the genetic material in plants. This technique has become part of the breeders' toolbox for breeding new plant varieties to address future challenges, e.g. caused by climate change, or contributing to more sustainable agricultural crop production and achieving the political goals as set by the EU Green Deal (EC 2019a).

As a result of the European Court of Justice's (ECJ) ruling from 2018 (case C-528/16), plants produced by genome editing fall under the scope of the rules and regulations for genetically modified organisms (GMO) in the EU (EC 2001, 2003a, 2003b, 2013, 2015, 2018). Plants resulting from genome editing thus have to undergo a stringent risk assessment process (Grand Chamber (The Court), from 25.07.2018). In contrast, plants resulting from classical mutagenesis breeding are exempted from this regulation due to the history of safe use of those breeding processes.

Within the agricultural sector, the success of innovation adoption largely depends on the farmer's human capital, on local (agronomic and climatic) conditions and the acceptance by consumers, regulators, and non-governmental organisations (NGOs). Thus, an innovation cannot be viewed in isolation but needs to be contextualised by considering the socio-cultural settings surrounding the respective debate (Lassoued et al. 2018; Chavas and Nauges 2020). In the case of the plant breeding innovation, genome editing, the initial framing of the GMO debate and the judgement of the ECJ set the stage for a risk-focused discourse (Bechtold 2018). This is also highlighted by the fact that the so-called precautionary principle is frequently used within the public debate to question the safety of genome-edited plants from the outset. The precautionary principle was originally set into place to assist and not to hamper decision-making under scientific uncertainty and has been anchored as a core principle in the European environmental legislation. This precautionary approach states that *"Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation" (European Commission DG Environment 2017).* Based on a content analysis of position papers and press releases of German discourse actors, Siebert et al. (2021) describe two major strategic frames served by proponents and opponents of regulation. The former warns that the use of genome editing in agriculture would pose an inestimable risk, due to "unknown uncertainties", and the latter highlights the view that there is a lack of public trust in scientific results. Further complexity is added as involved stakeholders have conflicting views on the future of agriculture, and contradictory scientific evidence might be used to support one or the other argument. Alongside scientific information, emotions, values and moral aspects play a decisive role within the public debate surrounding plant genome editing as well (Bechtold 2018).

For non-specialists, it is impossible to evaluate the credibility of all available scientific information, and so the level of trust assigned to a respective information source might instead be an important determinant to accept their recommendation (Hunt and Frewer 2001). The question of trust directly links back to shared values within the individual stakeholder group(s). To be considered as trustworthy depends on experiences in three dimensions, i.e. the attribution of 1) skills (e.g. experience, expertise), 2) integrity (e.g. honesty and truthfulness), and 3) good intentions (e.g. focusing on public welfare, protecting the environment) (Jonge et al. 2008). Emotions and values have a critical role in building trust, especially in cases where no first-hand evaluation of scientific statements is possible (Khodyakov 2007). A survey commissioned by the European Food Safety Authority (EFSA) revealed that European citizens are most likely to trust scientists (82%) and consumer organisations (79%) for information on food-related risks, followed by farmers (69%), national authorities (60%), EU institutions (58%), NGOs (56%) and journalists (50%). To a smaller extent, citizens consider supermarkets and restaurants (43%) or food industries

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(36%) as trustful sources, while only 19% trust celebrities, bloggers and influencers (European Food Safety Authority 2019).

Our empirical results provide some indications regarding the level of trust being assigned to different stakeholders involved in the debate on plant genome editing. While surveyed participants from academia, journalists, farmers, policy makers and the seed & breeding sector trust academia and education providers, this is only the case for one third of the surveyed environmental organisations. *Vice versa*, surveyed journalists, participants from academia, farmers and the seed & breeding sector allocate a low level of trust to environmental organisations when it comes to the topic of genome editing in plants. Regarding the assessment of the trustworthiness of offices and authorities, on the other hand, the surveyed stakeholder groups academia, journalists, farmers, policy makers and the seed & breeding sector are relatively unanimous and show comparatively high trust scores.

To facilitate an informed public discourse about plant genome editing and to prevent that false information or exaggeration is provided by the involved actors, a recent report of the European Commission (EC) highlights the need for mechanisms that ensure the validity of the provided information (European Commission DG Research and Innovation 2021). In addition, the European Group on Ethics (EGE) proposed to broaden the risk-focused debate and consider costs and benefits as well. This would include a comparative impact assessment by considering the scenario to continue to use current practices compared with the scenario of any potential future use of crops resulting from genome editing. Considerations may include a potential impact on the environment, the need to combat climate change and to ensure food security. Furthermore, it is suggested that regulations should be proportionate to the potential risks, a view that is highly contested by some non-governmental organisations (NGOs) (Panella et al. 2015) by highlighting the precautionary pronciple and requesting a full risk assessment for genome-edited plants. In contrast, the innovation principle, as promoted by the EC (EC 2019b), argues that “EU policy and legislation should be developed, implemented and assessed in view of encouraging innovations that help realise the EU’s environmental, social and economic objectives, and to anticipate and harness future technological advances”.

To facilitate an open discourse as promoted by the EGE, understanding the underlying communication behaviour of interested and engaged stakeholders is of utmost importance.

The EU-funded H2020 project CropBooster-P includes the development of a communication strategy that aims at achieving an open-minded discussion on plant genome editing, and that could guide communication efforts of future EU-funded research projects about other innovations.

2.2.1 Mapping of ongoing communication activities in the field

In this section a summary of the empirical results regarding the information behaviour and the communication activities of academia, civil society organisations, journalists, farmer (associations), the seed & breeding sector and European policy makers[2] are presented.

Table 1 shows the most frequently used information sources when it comes to the topic of plant genome editing with regard to the seven surveyed stakeholder groups.

Table 1: Information behaviour regarding genome editing of European stakeholders

[2] See supplementary information 1 (report JKI) and 2 (report Euroseeds/Plant ETP)

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	Major sources	Major channels
Academia	Researcher and academic organisations EFSA Journalists/Media	Conferences, workshops, seminars Scientific publications Personal contact with experts SM: Twitter
Seed & plant breeding sector	Seed & plant breeding sector Researcher and academic organisations Agribusinesses	(Technical) magazines Scientific publications Websites Conferences, workshops, seminars SM: LinkedIN, Youtube
Farming community	Seed & plant breeding sector Farmers Researcher and academic organisations Agribusinesses	(Technical) magazines Scientific publications Websites Conferences, workshops, seminars SM: Twitter, LinkedIN, Facebook
Consumer organisations	Researcher and academic organisations EFSA Consumer organisations Environmental organisations	Conferences, workshops, seminars Personal contact with experts Reports, dossiers, fact sheets SM: Facebook, Twitter
Environmental organisations	Researcher and academic organisations EFSA Environmental organisations	Conferences, workshops, seminars Websites Scientific publications SM: Twitter
Policy makers	Researcher and academic organisations Farming community EFSA Journalists/ Media Civil society organisations[3]	Conferences, workshops, seminars Scientific publications Websites SM: Twitter, Youtube
Journalists	Researcher and academic organisations EFSA Seed & plant breeding sector	Personal expert contacts Scientific publications Reports, dossiers, fact sheets SM: Twitter

Researcher and scientific organisations as well as EFSA are the most important sources of information about plant genome editing for the surveyed European stakeholders. The most important channels that are used to seek information about plant genome editing are conferences, workshops and seminars as well as websites. Twitter is the most used social media platform, but in general social media play a subordinate role as information source.

In a next step, the different actors have been asked to report on the content of their communication, their main target groups as well as the considered communication channels (Table 3).

[3] The use of environmental and consumer organisations (considered together as civil society organisations) as information source reveals a polarisation in the response behaviour of policy makers. While about one third indicated to engage often or almost always with these organisations, another third of the surveyed policy makers never used civil society organisations as a source of information.

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Table 2: Communication activities about genome editing of European stakeholders

	Communication content	Target groups	Communication channels
Academia	Safety Examples of applications Sustainability Transparency Use in the breeding process	Public Journalists Researchers	Personal contacts Discussion events Conferences
Seed & plant breeding sector	Examples of applications Sustainability Safety	Policy makers Farmers Plant breeders	Conferences Newspapers/ magazines Technical magazines
Farming community	Safety Sustainability Examples of applications	Farmers Policy makers Public	Conferences Technical magazines Websites
Consumer organisations	Transparency Safety Labelling Regulation	Consumer organisations Journalists Policy makers Authorities	Discussion events Conferences Newspapers/ magazines Facebook
Environmental organisations	Transparency Labelling Regulation Safety	Public Journalists Policy makers	Personal contacts Press releases Member magazines
Policy makers	Transparency Sustainability Nutritional quality of food	Policy makers Farmers Public	Conferences Radio
Journalists	Sustainability Examples of applications Transparency Safety Climate change	./.	./.

Regarding the communication content: safety, sustainability, transparency and examples of applications were rated as most important aspects in the current communication effort. Policy makers and the public are the most frequently indicated target groups. Conferences, seminars, workshops, discussion events as well as newspapers and (technical) magazines were the most frequently mentioned communication channels.

Financial -and especially time constraints were identified as the main challenges for communication. Representatives from academia primarily perceive that the general public is not interested in the topic of plant genome editing.

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2.3 Communication goal(s)

The overarching communication goal is to increase the public awareness and understanding of novel technologies in plant breeding and facilitate an open societal dialogue between science and society. Key is connecting the technology with societal goals. Within CropBooster-P, sustainability of agriculture, nutritional quality and food security have been prioritised as the most relevant societal goals. Plant genome editing should be considered as one of the tools within the breeders' toolbox and it should always be emphasised that the societal goals can only be achieved through providing access to a wide range of different approaches and methods whose individual effects interlock and complement each other.

2.4 Dialogue groups

The selection of dialogue groups to be considered in the frame of future EU-funded projects needs to be established case by case, depending on the research question and available resources. Based on the results displayed in Table 2 and 3, the following dialogue groups have been considered as most important and have been prioritised into main -and sub target groups.

Main dialogue groups:

- Academia
- Civil society organisations (environmental -and consumer organisations)
- Scientists and agricultural journalists
- Farmers

We recommend to address as sub-target groups:

- Policy makers
- Interested public

The seed & breeding sector was not included as a target group based on the following consideration:

The purpose of our study was, besides others, to provide suggestions on how actors can be reached, and which communication content could be used to reach them. Even though the seed & breeding sector was considered as being prominently involved within the public debate on plant genome editing, it has not been mentioned as a major target group by the surveyed stakeholders. Thus, only limited information regarding the channels and the conveyed content used to address the seed & and breeding sector is available.

2.4.1 Academia: scientists from various disciplines

The active inclusion of diverse academic perspectives on the current challenges is necessary in order to be able to implement the integrating character of the communication strategy as described in section 2.1. Thus, communication on plant genome editing as one of the important breeding tools among several promising approaches can only succeed through the active integration of these other breeding approaches. This can be achieved by specifically addressing the relevant experts.

Language and communication channels for this target group have been well established.

What are the sub-goals in the communication regarding this target group?

The aim of communication should be an interdisciplinary exchange that focuses on mutual understanding and the complementary elements of different approaches. By building bridges between different strategic approaches to achieving more sustainable agriculture, trust should be built. Networks across disciplines could be used to jointly implement various communication measures. In addition, scientists are considered to communicate too little about plant genome editing and only few scientists have been involved so an increased diversity should be achieved.

What are the major challenges with this target group?

Within the scientific community, different views regarding the safety and the potential of plant genome editing in contributing to achieve societal goals do exist. Therefore, a balanced set of actors should be addressed. In addition, it would need to be decided if individual scientists are targeted or rather scientific academies/institutes. Finally, it was pointed out that the contributions of scientist communication rarely finds its way into mass media, hence public outreach is limited.

2.4.2 Civil society organisations

Civil society organisations are diverse in their attitude towards different elements of plant genome editing. As there are no genome-edited plants available yet on the European market, feedback from consumers is still limited. Therefore, consumer organisations do not consider it relevant to communicate on the topic as of yet. From the consumer's point of view, however, consumer organisations are important intermediates for food-related questions. Therefore, communication with this target group should be prioritised, also to gain insights in societal aspects and consumer’s expectations. Overall, the consumer organisations surveyed are critical of new plant breeding technologies, however more open-minded compared to environmental organisations.

Environmental organisations are in general critical when it comes to the use of genome editing in the breeding process of new plant varieties. However, they are considered as an important contacts for policy makers and the general public, so dialogue with them should be facilitated.

What are the sub-goals in the communication regarding this target group?

As a basis for dialogue, up-to-date scientific information should always be available in non-specialist understandable language. Particularly for environmental organisations, building mutual trust is a fundamental prerequisite for entering into dialogue. The aim of a constant dialogue should be to include the perspectives of civil society organisations in the research process.

What are the major challenges with this target group?

For consumer organisations, the issue of new plant breeding technologies is not yet relevant, as there are no products on the European market. Thus, the topic of new plant breeding technologies competes with many other topics.

Based on the findings, there seems to be a clear mistrust between environmental organisations and scientific organisations, at least in some European regions. Thus, trust building measure would need to be set up in a first place.

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2.4.3. Science and agricultural journalists

Journalists were identified as an important target group of environmental organisations, while scientific organisations rarely address them directly. Journalists should be more targeted, as they have an important intermediary position in engagement with the general public. Media are by far the public's most important sources of information on scientific topics (Leopoldina 2015). However, balanced reporting is important and can be achieved by actively addressing journalists with sensible and meaningful content.

What are the sub-goals in the communication regarding this target group?

The aim of communication with journalists should be to increase the frequency of reporting on the topic of plant genome editing. The content of journalistic reporting should be more balanced (considering advantages vs. limitations and risks vs. benefits) and less emotionalized.

What are the major challenges with this target group?

The topic is not mainstream and competes with many other scientific topics and may thus get little attention. Application-related examples of plant genome editing are of particular interest.

Journalists need to have sound knowledge on plant genome editing in order to report on this topic.

2.4.4. Farmers

Farmers are the users of newly developed plant varieties and are more likely to seek information about new plant breeding technologies from the seed and plant breeding sector and from their own farmers' associations than from scientists.

As farmers and farmer associations are important stakeholders because they are the end-users of plant breeding activities and are particularly involved in the communication with policy makers and consumers about agricultural production, an intensified dialogue with the farming community is advisable.

What are the sub-goals in the communication regarding this target group?

Farmers are interested in concrete plant applications/traits, thus, information about potential applications of plant genome editing and how farmers would benefit from these new plant varieties are essential.

What are the major challenges with this target group?

Due to the current legal regulations in the EU, no genome-edited plant varieties are available on the market for use and cultivation in Europe. Thus, the practical relevance of genome-edited plants for the farming community in the current situation is limited.

2.4.5. Sub-target group: policy makers

Policy makers are one of the three most important target groups of environmental organisations, but are addressed less frequently by the scientific community. In order to avoid access to one-sided information on this topic by political decision-makers, it would be desirable that specialists from scientific institutes address them more intensively regarding the different elements related to plant genome editing in the context of plant breeding and agricultural applications.

What are the sub-goals in the communication regarding this target group?

Informing policy makers about the empirical, state-of-the-art evidence regarding ongoing research activities on plant genome editing should be one of the goals of communication. To achieve continuous communication, it is important to build a professional relationship and provide access points to policy makers on the topic. The aim is to communicate about scientific results, policy recommendations should not be the primary aim in communication efforts.

What are the major challenges with this target group?

Communication with policy makers is described as difficult: they are hard to reach and only show interest in an issue when it becomes topical. Building relationships and regular communication efforts require a certain time period for a research project. Short research projects would most likely not benefit from addressing policy makers in their communication efforts.

2.4.6. Sub-target group: interested public

The general public is a less important target group for scientists when compared to for instance environmental organisations. Despite their elementary importance for the social acceptance of the use of plant genome editing applications, it is recommended to address the general public only as a sub-target group via multipliers.

What are the sub-goals in the communication regarding this target group?

It is more important to address people's assumptions and uncertainties about plant genome editing with appropriate communication measures than their lack of knowledge about them. For this reason, building trust is a key goal for this target group. The provision of information might be of secondary importance. In this regard it would be particularly important to establish a bidirectional flow of information by addressing societal needs.

What are the major challenges with this target group?

Knowledge about plant breeding in general and about the application of genome editing is rather limited.

As the case for genetic modification (GM), information about risks and benefits may have little impact on the acceptance of genome-edited foods. Consumers seldomly make decisions on the basis of rational considerations, but rather apply heuristics (i.e. opinions derived from previous experiences) (Siegrist und Hartmann 2020).

- 'Affect heuristic': evaluation is based on the affective meaning that is associated with an image or association of GM Foods
- 'Trust heuristic': evaluation is based on the (social) trust in the source of information (two types of trust: confidence – based on past experiences or perceived competencies – and social trust – based on perceived value similarities)
- 'Natural-is-better heuristic': Products developed by conventional breeding methods, including the use of mutagenesis, are considered "natural" and are associated with a low perceived risk.

In general, for four of the six recommended target groups, building (mutual) trust and understanding is an important goal of communication. Thus, trust building measures should be considered according to

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the specific research topic. To be perceived as trustworthy depends on experiences in three dimensions (Khodyakov 2007):

1. Attribution of skills (*e.g.* experience, expertise)
2. Attribution of integrity (*e.g.* honest and truthful/accurate research and results and transparency over research funding)
3. Attribution of good intentions (*e.g.* focusing on public welfare, communicator acts independently of his financial bakers and is well-intentioned)

When having identified relevant target groups to be considered for communicating about plant genome editing, relevant communication topics need to be selected and addressed in a next step. Communication topics that have been identified in the course of our studies are presented and discussed in the next section.

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2.5 Communication content

The selection of specific communication content is based on the specific communication goals in relation to the individual target groups, their interests and needs. Potential communication topics are depicted below.

Safety

Safety was identified as an important communication content for all stakeholder groups surveyed in our empirical studies[4]. Civil society organisations are particularly interested in the assessment of potential environmental as well as health impacts associated with plant genome editing. In general, the benefits and risks of applications should always be considered together.

Examples of application

It is highly recommended to make the communication about genome editing and other new plant breeding technologies as concrete as possible. This means that the technology itself and how it works should be less emphasised compared to its concrete applications.

This is particularly relevant for the target groups of journalists and their lay audiences: technologies must be linked to their impacts which have direct consequences for the consumer.

Sustainability and climate change

Sustainable agriculture and climate change can unite various stakeholders with different opinions and approaches.

Sustainability is particularly relevant for the dialogue groups: journalists, farmers, policy makers and the interested public. Climate change is of particular interest to journalists and the interested public.

Technological developments

Technological developments compared to conventional breeding methods are of particular interest for farmers and policy makers.

Food quality

Improving nutritional quality of food through the use of genome editing is of particular interest to civil society organisations and policy makers.

Use in the breeding process

The potential applications of genome editing within the plant breeding process is especially relevant for the target group of researchers from various disciplines. The aim here is to develop an understanding of the different steps of the plant breeding process and to discuss how synergistic effects can be achieved with other approaches and research disciplines.

Labelling and regulation

Labelling and regulation of genome editing is of particular interest to civil society organisations. This target group rejects the term “New Plant Breeding Technologies”, because from their point of view, genetic engineering methods, including genome editing, must be referred to as such. If a labelling strategy could manage to link the use of plant genome editing with the achievement of societal goals (e.g.

[4] See supplementary information 1 (report JKI) and 2 (report Euroseeds/Plant ETP)

improved environmental protection through less pesticide use), consumers could make a conscious decision for or against derived products by considering both, the technology *per se* and intrinsic values.

Functionality

The communication on the basic principles underlying plant breeding and genome editing in particular, is of fundamental importance, especially for the general public.

In the next section, different communication measures that could be used in the frame of a future research project are outlined in more detail. Measures are divided into online and offline formats.

2.6 Communication measures

The different communication measures should complement each other. The basis of all measures is a regularly updated online presence that thematically embeds the plant research project in the societal goals regarding future food and agriculture relevant to all actors.

A dialogue should start at the early stages of the research processes and interactive formats need to be considered such as stakeholder consultations, regional discussion groups with the public, blogs at homepages and social media platforms.

2.6.1 Online communication

Online communication should be a combination of a well-maintained website and an active social-media account.

The website is intended to serve as an objective source of information for all target groups. The language should be non-specialist but specific. For scientific target groups, additional content is offered through links to the original scientific studies and scientific exposés. The entire website should be preferably available in many of the languages of the consortium members.

The website serves to:

- present own content embedded in the thematic field of food security and sustainable agriculture,
- introduce consortium members
- disclose research funding
- provide interactive elements for the audience

A blog with a comment function and/or a discussion forum as interactive elements could enable a dialogue with the target groups. These elements should be regularly updated with contributions from all consortium members and cooperating partners.

The website should present a holistic view on societal goals and how they can be addressed by plant breeding and complementary approaches like *e.g.* complementing alternative farming approaches, reducing food waste, changing dietary habits, changing global food distribution, adapting cultivation practices etc. The hierarchical structure of the website should be determined by these overarching goals and not by the organisation of the project itself (*cf.* work packages, tasks, deliverables etc.).

The website should be complemented by an active social media account that aims

- to raise awareness on the topic
- to engage in a dialogue about its own content and to network beyond its own research approach
- to increase visibility

It is recommended to focus on one social media platform to ensure sufficient activity on the channel.

As a source of information, Twitter appears to be more important than Facebook for the main target groups mentioned in section 2.4 and is therefore recommended as social media platform when communicating about plant genome editing. The target groups mainly approached via Twitter are specialists, journalists and policy makers.

A social media platform only provides added value if it is actively used on a regular basis. It must be used as a networking and dialogue platform and not just as a platform for presenting own content. In a practical sense, this means that retweets, quotes and comments must be used frequently. In addition, comments from others must be responded to in a timely manner.

The following topics could be served through social media:

- Specific applications of the technology in plant breeding research
- Series: development steps of the research
- Who we are: Researcher profiles in the consortium (motivation of researchers etc.)
- Series: applications of own research in the plant breeding process and how this relates to the topics of sustainability in agriculture and assuring for nutritional quality and food security
- Presentation of offline communication measures (stakeholder consultations, participation on conferences etc.)
- Links to other approaches for better food and sustainable agriculture

The style should be open, personal, approachable and factual.

2.6.2 Offline Communication

To increase effectiveness, the focus should be on communication measures that are accessible for several target groups at the same time.

Stakeholder consultations

Various stakeholders can be involved in the research process through working groups. In these working groups, stakeholders are regularly informed about the objectives, methods and status of the research. They are also given the opportunity to actively participate in the research process. Their feedback should be taken into account in the research process. Therefore, these consultations are to be placed in the course of the project in such a manner that corresponding feedback can be integrated into practical day-to-day research.

In addition to the active dialogue with the target groups, the consultations also open up the possibility of building up a network, *e.g.* with researchers from other disciplines, which can be drawn on when carrying out further communication measures (*e.g.* website, webinar series).

Must-haves:

Consultations at European level

Nice-to-haves:

Consultations at local (regional or national) level

The threshold of participation for more local stakeholders could be lowered through locally-held consultations. Especially for representatives of civil society organisations and the farming community, interests differ in different European regions. Thus, the diversity of interests could be better addressed.

Main target group(s): civils society organisations, Researchers from various disciplines, farmers, policy makers

Scientific Conferences and agricultural events

Active participation in scientific conferences to increase the visibility of the project and to discuss the intermediate steps and results should be used intensively. Not only conferences being in the own field of expertise should be chosen, but also events of other research areas addressing the issue of sustainable agriculture and improving food quality. This is especially to raise awareness of one's own approaches across disciplines and potential identify synergies effects in order to achieve common goals.

In addition to scientific conferences, practice-related events, especially with an audience from agriculture like *e.g.* agricultural fairs, should be actively used for the presentation of the project and for networking.

Target groups: researchers from various disciplines, farmers, science and agricultural journalists, civil society organisations

Scientific publications

Scientific publications are considered by various actors as a source of information. Potential practical implications of the research findings together with associated limitations should be presented. In addition, an executive summary being evidence based but easy to understand might be considered to serve the needs of the different actors.

Main target group(s): researchers from various disciplines, science and agricultural journalists, farmers, civil society organisations

Publication scan

Screening of the published literature on a regular basis in order to identify key publication being that are relevant within the projects´ scope. The findings should be briefly summarized and contextualised in a non-technical format, accompanied by a brief validity assessment. The compiled information should be presented on the projects' webpage and should serve as a communication measure to provide an overview on the ongoing research progress and on its potential impact on the projects' results.

The publication scan should follow a repeatable protocol and, if deemed relevant, include grey literature as well. It should be performed regularly to be prepared for cases that occur suddenly and unexpectedly (crisis communication).

Main target group(s): researchers from various disciplines, science journalists, policy makers

Materials in language suitable for everyday use

Reports, dossiers and fact sheets enable scientific research to be presented in varying degrees of detail and in a language targeted to the different, non-scientific target groups.

- Fact sheets present a single extract from research in a condensed form of no more than two pages. As part of a comprehensive research program, it makes sense to develop a series of fact sheets, each dealing with individual aspects of the research. The fact sheet should include links to studies, research and specialists and other sources on the topic for anyone interested in more detailed information.
- Dossiers compile the various individual topics in the research network and show connections between them and to other research approaches. They are also written in non-specialist language, but have more space to work with visualisations. They are also intended to show how the individual research topics can contribute to achieving the common goals regarding sustainable agriculture and food security.
- Reports are of a more formal nature, reporting specifically on objectives and research steps as well as (interim) results.

All written materials should be published on the website and send to (potential) cooperation partners and policy makers interested in the field of agriculture.

The entire materials should be available in as many languages as possible of the consortium members.

Main target group(s): civil society organisations, science and agricultural journalists, policy makers, interested public

Webinar series

A series of self-organised webinars is to be dedicated to the topics of food security, food quality and sustainable agriculture. The aim of these webinars is a multidisciplinary discussion of different approaches to achieving these societal goals. The focus should be on the practical applications of research results. In addition to presenting project specific research in the field of plant breeding, researchers from other disciplines could be invited to present and discuss their approaches and the potential for synergistic effects.

Must-haves:

Webinar series at European level

Nice-to-haves:

Webinar series at local (regional or national) level

Webinars at local (regional or national) level would make it possible to adapt the focus to local aspects regarding healthy food and sustainability in agriculture as interests can be quite different within different European regions. This diversity of interests could be better addressed through regional webinar series. In addition, any language barriers that may occur would be reduced.

Target groups: civil society organisations, researchers from various disciplines, science and agricultural journalists, policy makers

Contributions in trade/technical magazines

Articles in agricultural trade/technical magazines report on application-related research results that are of relevance to agricultural practices. Such contributions should be provided by researchers themselves. Close cooperation with agricultural journalists is also recommended to promote published scientific articles. Besides specific breeding examples, economic cost-benefit assessments are of particular interest for the farming community.

It should be examined whether the contributions of individual consortium members could also be of interest in other European countries. Through appropriate translations into the respective national languages, contributions can be used several times and thus increase their reach.

Main target group(s): the farming community

Local formats

Project members should be active at the local level as well by engaging by means of already existing formats (e.g. agricultural fairs, the “Green Week”, or open (field) days, as well as collaboration with schools and universities). Closer cooperation with local communicators and press offices is recommended. Local formats make it possible to establish a regional reference and open up points of connection to the everyday life of regional target groups.

Main target group(s): interested public

Based on the aforementioned considerations, an overview on how a potential communication strategy on plant genome editing could be conceptualised, is sketched out in Figure 2.

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Figure 2: Basic concept, guiding the development of a communication strategy when communicating about plant genome editing (and New Plant Breeding Techniques in general)

2.6.3 Crisis communication – preparation is everything

As plant genome editing has been perceived as a contentious topic with society, interviewees raised the need to set, in addition to the regular communication about plant genome editing, a crisis communication strategy into place. Preparing for a potential crisis allows for quick response and communication in order to prevent and/or mitigate potential damage.

In the case of research projects that deal with the topic of plant genome editing, the following issues are, besides others, conceivable:

- Publication of a flawed scientific study providing false claims related to plant genome editing
- Accusations of scientific misconduct or misinformation by internal or external players;
- Publication of a scientific study providing claims related to plant genome editing that are not supported by study data

Constant open and transparent communication helps to be less vulnerable in potential crisis situations. An up-to-date, well-structured and traceable online presence assures that, when people search for information on the crisis incident, information provided by the research project are not overlooked.

The active use of social media may also offer opportunities. For example, a community that was build up in social media can help to mitigate a shitstorm. Having one's own communication channels in the social media also offers the chance to maintain communication sovereignty in the event of a crisis. The context can be explained directly before the start and expansion of media coverage. This increases transparency and ensures credibility.

In an acute crisis, short reaction times are essential in public relations. In addition to active communication throughout the duration of the project, the following questions should be clarified and written down in advance of a crisis:

- Definition of responsibilities and processes to ensure a rapid response in the event of a crisis,
- contact persons and their availability,
- Preparation of sample texts, phrases (*e.g.* for an initial statement in the event of a crisis).

2.7 Organisational structure and budget

Communication about plant genome editing is far too complex for scientists to be dealt with by themselves so professional communicators are essential

To assure for the implementation of recommended measures (especially on a regular basis), the communication strategy should be considered as important as the research agenda itself, that means

- **An additional work package for communication besides the "research packages" is needed,**
- **Communicators should have experience in science communication**

Tasks of communicator(s):

Must-to-have:

- Compilation of topics and preparation of materials adapted to the different channels and target groups (homepage, brochures, reports, possibly material for educators, possibly Twitter)
- Homepage: set up and maintenance,
- Organisations of events (*e.g.* stakeholder consultations etc.),

- Press work: proactive cooperation with media including journalists
- Crisis communication

Nice-to-have:

- Management of Twitter platform,
- Support in the planning and implementation of local activities with local target groups.
- Overview of events in which scientists can participate to increase the visibility of the project and to build networks beyond their own scientific community

- **Inclusion of additional financial resources for researchers to support the communicators, as a very close interaction between the communication team and researchers is required**

Tasks of the researchers:

Must-to-have:

- Provision of information for communicators,
- Active participation during stakeholder consolations

Nice-to-have:

- Communication training
- Conduct of smaller local dialogue formats for local people,
- Media interviews

- **Financial budget**

  Cost categories:

  - Personnel costs:
    Must-to- have:
    - If scientists are responsible for science communication themselves, approximately 20% of their work time should be envisaged. Output should be shared between all consortium members equally in order to decrease the time required.
      or
    - Approximately 10% of a scientists work time should be envisaged if it is combined with an extra 50% employment for a communication expert or communication co-ordinator.

    Nice-to- have:
    - Up to 2 full time science communication employments are suitable for a professional science communication team, as they have expertise in the fields of relevant issues, functionality of the media and getting into contact with journalists or the media in general.

  Must-to-haves:

  - Translations services (for homepage)
  - Costs for printed materials (flyer, brochures etc.): layout, print costs
  - Travel costs

  Nice-to-have:

  - Communication training for scientists

2.8 Success monitoring

Evaluation of the communication strategy should be focused on single communication measures rather than evaluating the entire strategy. Therefore, the evaluation process should take place during the project in order to be able to make timely adjustments. The measures for this process do not necessarily need to be quantifiable, but can be suitable to reflect on the content made or other measures.

Evaluation measures:

Qualitative:

- Survey of the participants of communications formats (stakeholder consultations, local discussion rounds)
- Qualitative evaluation of participants comments on the website
- Qualitative evaluation of interactions on social media

Quantitative:

- Number of participants in webinars and other self organised dialogue formats etc.
- Project website: number of visits
- Social media: number of followers, likes, retweets

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2.9 Identified gaps:

2.9.1 Discrepancies between the perceived and mentioned involvement of actors in the public debate about plant genome editing and considered target groups

Figure 3 shows the comparison of the major actors involved in the public debate on plant genome editing, their perceived presence, as well as the target groups mentioned by the surveyed stakeholders. The results were based on survey responses obtained from representatives from academia, environmental organisations, consumer organisations and journalists. The data obtained from farmers, the seed and breeding sector and policy makers is not present in this analysis, as no comparable datasets are available.

As the diagram shows, “journalists” and “scientists”, among others, are considered as main actors in the debate. At the same time, their presence in the discourse is perceived as very high. Overall, these two groups were most frequently named as target groups by the respondents. A similarly balanced picture emerges regarding the target groups “politicians and political parties”, as well as “European offices and authorities”. “National offices and authorities” are amongst the least perceived to be part in the public discussion, but are nevertheless the fourth most frequently mentioned main target group. “Consumer organisations” as well as “conventional farmers and their associations” and “agricultural and food industries” are perceived with a high presence in the public discourse. However, they remain still under average when it comes to their involvement in the public discussion. The same applies to the frequency that these three actors were mentioned as main target groups by the stakeholder groups surveyed. This holds also true for “organic farmers and their associations”, even though their involvement in the public discussion remains above average. The data are most striking for the target groups “environmental organisations” and “seed and plant breeding companies”. Both target groups seem to be perceived as main actors with a high presence in the public discourse on plant genome editing. Nevertheless, they were least likely to be addressed as a target group by the respondents.

In summary, it can be concluded that there is partly a discrepancy between the perceived presence of actors and the frequency they have been mentioned as main players being involved in the debate. In addition, the results revealed that not all groups are addressed in a balanced way. This gab could be closed by considering especially “environmental organisations” and “seed and plant breeding companies” as additional target groups when communicating about plant genome editing.

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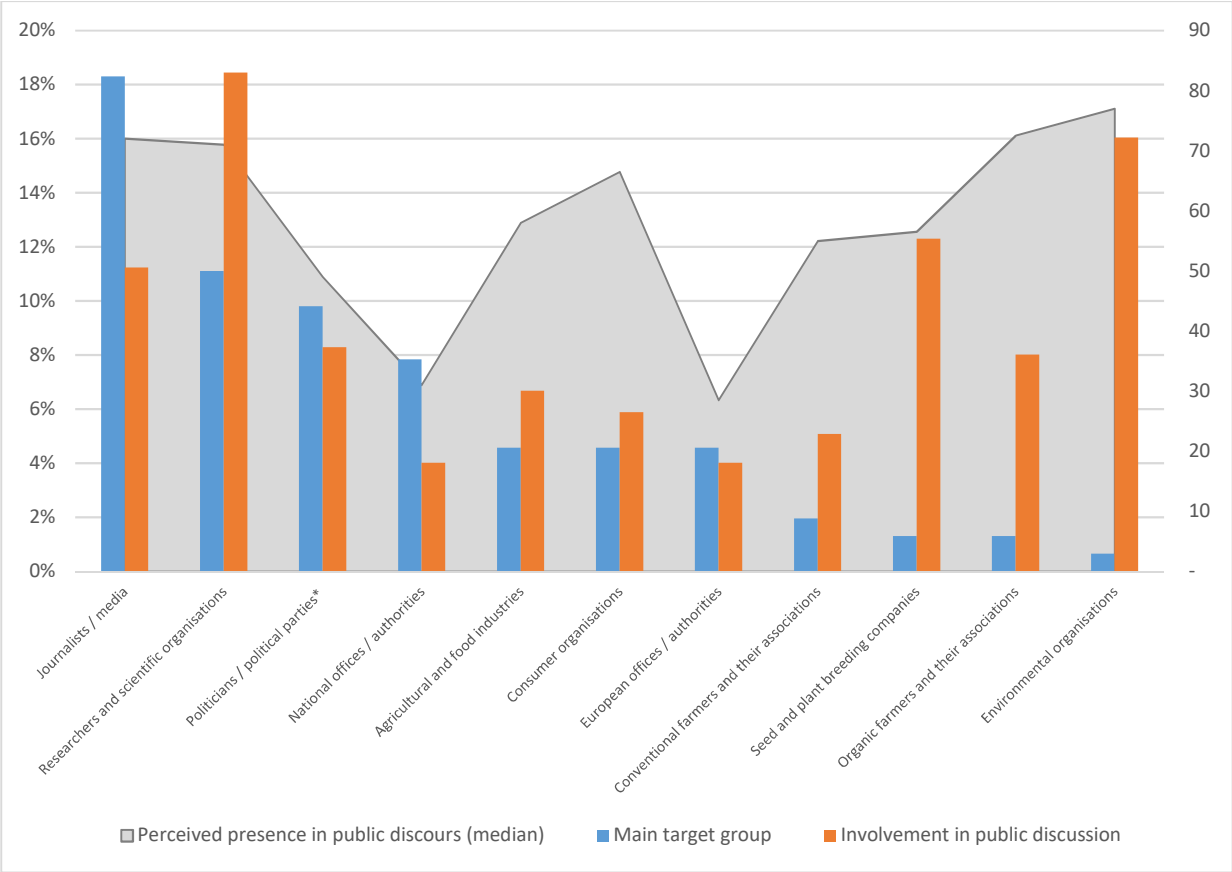

*Policy makers: joint representation of EU and national politicians and political parties

***Figure 3**: Perceived presence and mentioned frequency of involved actors in the public debate about plant genome editing and considered target groups out of the perspective from Academia, EO, CO and Journalists.*

2.9.2 Discrepancies between communication channels and channels used for information sourcing

In order to analyse the usage of communication channels by the stakeholder groups surveyed, two complementary datasets have been compared:

Dataset 1 consists of the selected channels through which the respondents inform themselves about plant genome editing, as well as plant production, plant improvement and plant research.

Dataset 2 consists of the selected channels used when reaching out to respective target groups. These results are based only on the responses of academia, environmental organisations, consumer organisations and journalists as comparable datasets were lacking for farmers, the seed and breeding sector and policy makers.

The following figures provide an insight in possible gaps regarding the communication between the surveyed stakeholder groups.

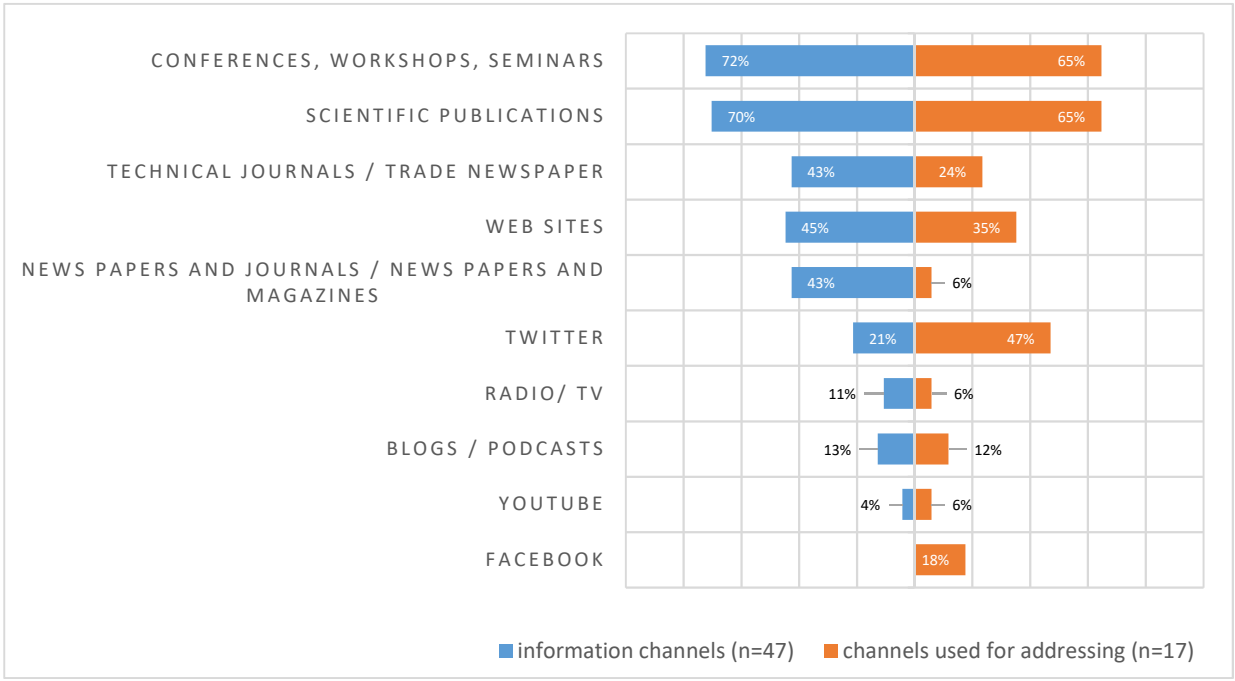

***Figure 4**: Proportion of the usage of different communication channels for information sourcing and communication purposes by the stakeholder group 'academia'.*

In the case of academia, the overall result is balanced. However, this stakeholder group is not frequently addressed via "news papers and journals/ newspaper and magazines" and "technical journals/ trade newspaper", although academia obtain their information from these channels. The opposite is the case for "Twitter". Twitter is used to reach academia, although they hardly source any information from there.

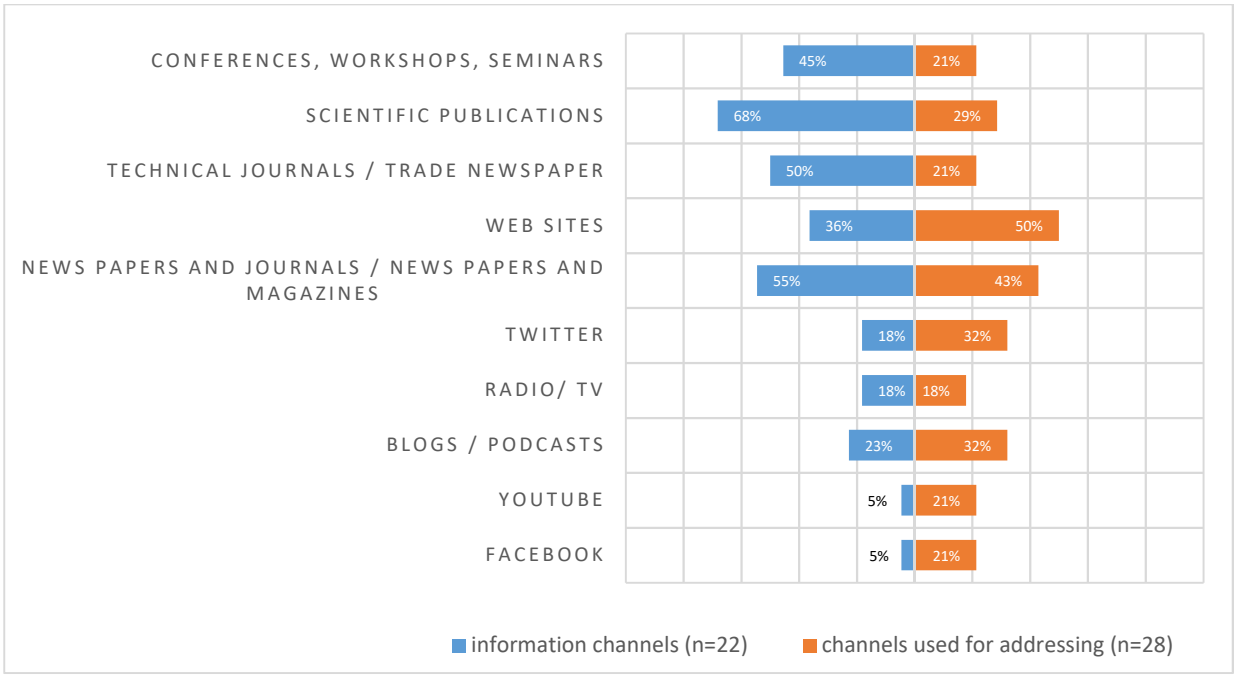

***Figure 5**: Proportion of the usage of different communication channels for information sourcing and communication purposes by the stakeholder group 'journalists'.*

This figure shows that journalists should be addressed more frequently via “conferences, workshops, seminars”, “scientific publications” and “technical journals/ trade newspaper” because these are important information channels for this stakeholder group. At the same time, the results suggest that less effort is needed to address journalists via “YouTube” and “Facebook”.

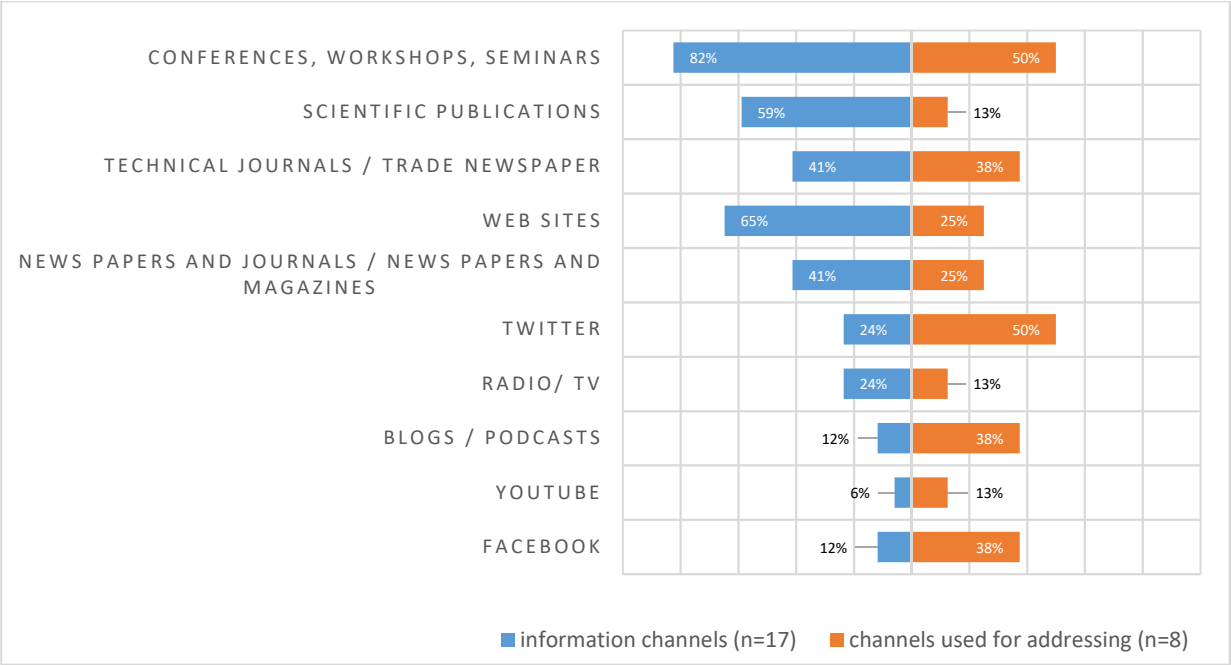

***Figure 6**: Proportion of the usage of different communication channels for information sourcing and communication purposes by the stakeholder group ‘civil society organisations’ including consumer -and environmental organisations.*

The focus for addressing civil society organisations (consumer organisations and environmental organisations) in the most effective way should be via “conferences, workshops, seminars”, “scientific publications” as well as “newspapers and journals/ newspapers and magazines”. Less focus on communication activities should be applied to “Facebook”, “YouTube” and “blogs/ podcasts”.

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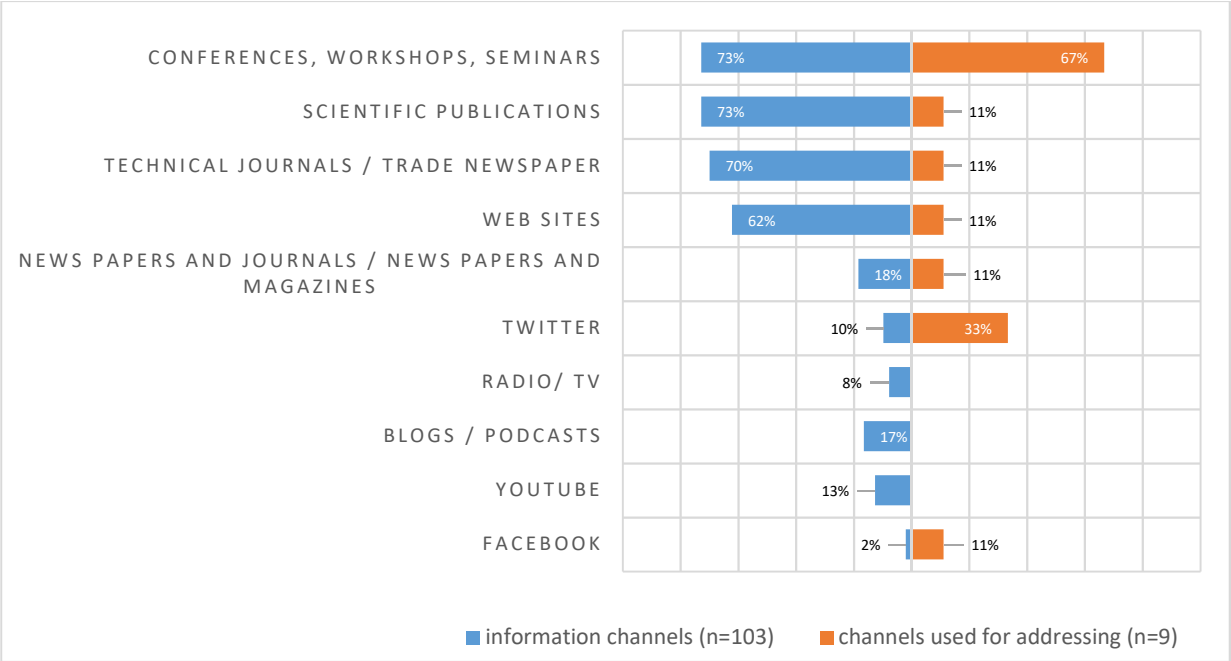

***Figure 7**: Proportion of the usage of different communication channels for information sourcing and communication purposes by the stakeholder group 'seed and plant breeding sector.*

Concerning the seed and plant breeding sector, "scientific publications", "technical journals/ trade newspapers" and "websites" should be used more frequently in order to improve the flow of information towards this stakeholder group. "Facebook", "radio/ TV" and "Twitter" are less relevant.

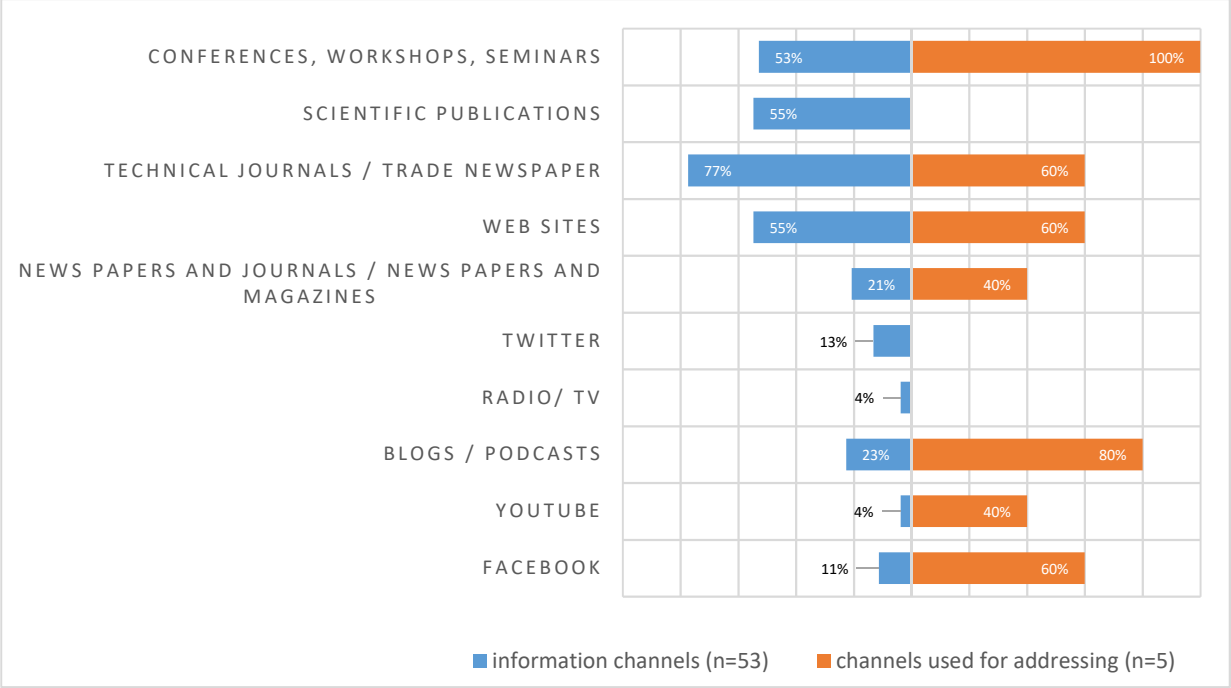

***Figure 8**: Proportion of the usage of different communication channels for information sourcing and communication purposes by the stakeholder group 'farming community'.*

To address the farmer community efficiently, the focus of communication activities should be more on "scientific publications" and at the same time less on "conferences, workshops, seminars", "blogs/podcasts", "YouTube" and "Facebook".

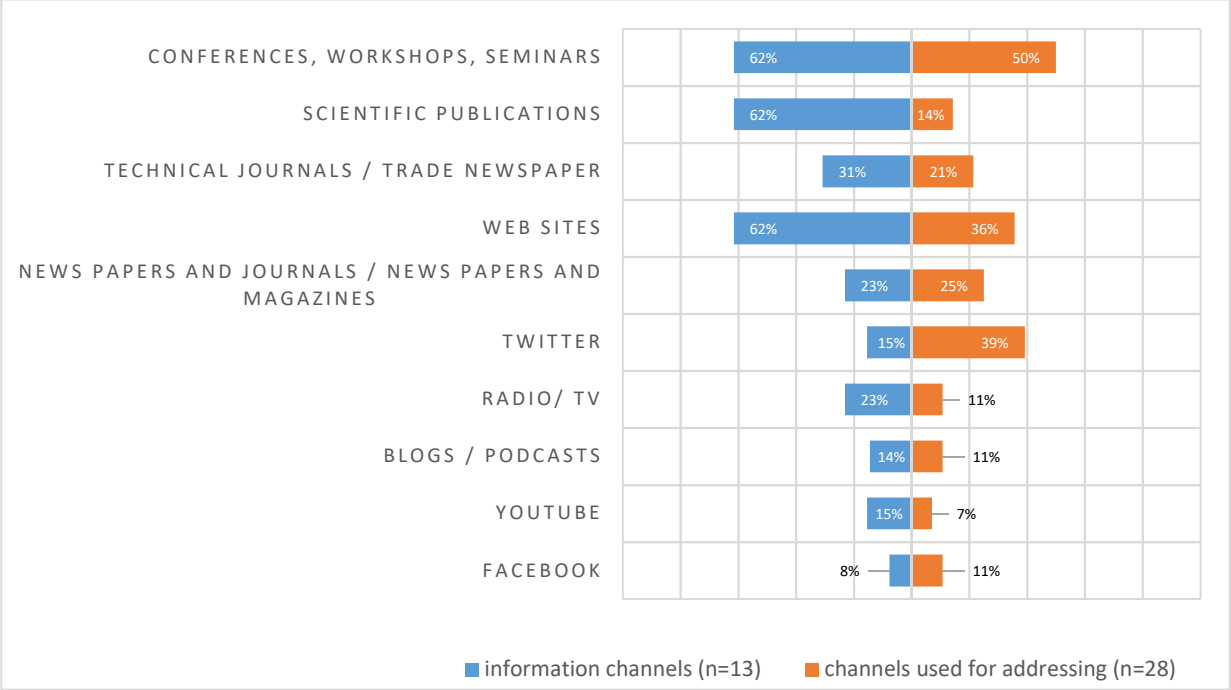

***Figure 9**: Proportion of the usage of different communication channels for information sourcing and communication purposes by the stakeholder group 'policy makers'.*

Similar to the stakeholder group academia, the information seeking behaviour and communication activities of policy makers is mostly balanced. However, the results revealed that policy makers should be more addressed via "scientific publications" as this communication channel appears to be an important source of information and on the other hand less effort should be dedicated to "Twitter".

All in all, the communication activities via certain channels should be improved in order to reach target groups more effectively.

2.10Recommendations:

- The desire to support a two-sided dialog must be part of the wording and should be represented within the communication strategy. In addition, communication in the given context should not be lecturing.
- It is important to define how measures should be implemented in the communicational approach as well as defining how they should not be used.
- Very importantly, the selection of the target groups and their priority depends on the research topics, goals, the duration of the project and associated budget.
- Trust building measures may need to be set/up, especially when reaching out to environmental organisations.

- The use of social media depends on the selected target groups and, depending on the projects' budget, it is recommended to concentrate on one social media platform only.
- Personal contacts are regarded as essential in order to reach most target groups.
- The impact of local formats is usually underestimated. It takes less effort to build on already existing formats, than to implement new local formats.
- It is considered as an advantage to involve science influencers and/ or individual scientists with a broad online/ offline presence to increase the visibility of research topics.
- The manner science communication is conducted within a project, strongly depends on the topic, the goals, vision, and the measures available.
- Communication should be based on specific applications and on how they can help to serve societal goals and less on the technology as such.
    - Surveyed environmental organisations doubt that plant genome editing could contribute to the achievement of various EU goals[5]. Only regarding an increased nutritional quality of food, 33% of the environmental organisations are somewhat convinced that genome editing could make a contribution. The approval rates of the surveyed consumer organisations are slightly higher than those of the environmental organisations.
- Clear statements are considered as essential for a functional dialog, especially, when the topic is perceived as contentious and polarising.
- The biggest challenge for communicators is to motivate project partners to engage with them and to provide materials to communicate about.
- The project communication should include a plan on crisis communication.
- Considerations to guide the development of a communication strategy on plant genome editing are depicted in Figure 2. Even though the focus was based on plant genome editing when generating and collating the data, these considerations can also be applied when communicating on New Plant Breeding Techniques in general.
    - Based on our data, not all stakeholder groups being perceived as prominent actors within the public debate are currently addressed in a balanced way. This gap could be closed by considering especially "environmental organisations" and "seed and plant breeding companies" more prominently as target groups when communicating about plant genome editing.
    - Care should be taken to align the channels used to reach out to a target group with the channels the respective target groups uses for information sourcing.

[5] EU goals: reducing the use of chemicals in agriculture, adaption to climate change, improved sustainability in agriculture, increased nutritional quality of food, adequate food supply in the world. See report about empirical studies in appendix.

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Supplementary information 1:

CropBooster-P

Survey analysis report contributing to the mid-term outreach strategy of Deliverable No. 3.3

Academia's, Environmental Organisations, Consumer Organisations and Journalists communication and information seeking activities linked to genome editing in Europe

Authors: Sabine Will, Dörthe Krause, Christian Kohl and Ralf Wilhelm (all JKI)

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Content

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1 Introduction

The study was conducted in the frame of the EU-funded project CropBooster-P to gain insights into the communication activities, experiences and wishes of the European stakeholder groups Academia, Environmental Organisations (EO), Consumer Organisations (CO) and Journalists regarding New Plant Breeding Techniques, in particular genome editing in plants. Together with studies performed by Eurodeeds/Plant ETP, it sets the basis for the developed mid-term outreach strategy of Task 3.2 that is reported in Deliverable 3.3.

2 Methods

The study was conducted in two stages. Qualitative online interviews with European stakeholders, covering Journalists, Academia, Consumer Organisations (CO) and Environmental Organisations (EO), were conducted to gain in-depth insights into their perceptions and views regarding communication and reporting of plant breeding and New Plant Breeding Techniques in Europe. These interviews served as the basis for a quantitative online survey of the stakeholder groups on the topic of communication and reporting on genome editing.

While the qualitative study addressed the communication about New Plant Breeding Techniques, the quantitative survey was specific on the communication about plant genome editing. This decision was taken because the term “New Plant Breeding Techniques” was perceived as misleading by some stakeholders consulted in the first phase of the study (see also section 2.2.1).

2.1 Qualitative interview study

Since relevant stakeholder groups were expected to have very different, even opposing views on New Plant Breeding Techniques, and came from all European regions with diverse political set-ups and media structures, exploratory interviews were used in the initial phase of our empirical work. These types of interviews allowed a deep insight into individual viewpoints by using explorative questioning techniques. The gathered results were, besides others, used to inform about the development of the questionnaire (see section 2.2).

2.1.1 Protocol development and field work

Based on a draft communication strategy, semi-structured protocols specific to the stakeholder groups were prepared. They included the following key aspects:

- Perception of the public discourse about New Plant Breeding Techniques in interviewee’s home country or in Europe,
- Description of the interviewee’s communication or reporting efforts and experiences,
- Assessment of the communication efforts of plant scientists,
- Collaboration between stakeholders,
- Information seeking behaviour,
- Trust in sources: Slider questions shown via screen sharing were used to capture
    - interviewee’s trust in the actors engaged in the public discourse about New Plant Breeding Techniques,
    - interviewee’s perception on the level of trust the general public assigns to these actors.

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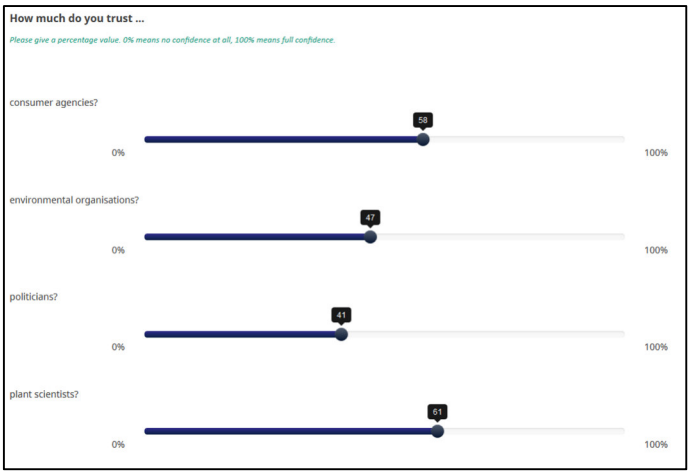

Figure 1: Example of a slider question to capture interviewee's trust in the different actors (random numbers)

Overall, the aim of the interview guidance was to create an atmosphere of trust. Therefore, the interviews were to resemble a normal conversation rather than an artificial question-answer sequence.

The protocol was tested in a pilot interview and slightly adapted based on the results.

The recruitment process was based on a database of contact details of regional representatives and networks in the fields of academia, policy makers, regulators, journalism, environmental and consumer organisations, which were compiled in preparation for the empirical work. The database includes representatives from 16 European countries and from the EU level [1] and contains more than 400 contacts. In addition, a snowballing system was used by asking already confirmed participants for further suggestions for stakeholders who could be consulted. Potential interviewees were contacted by email.

The interviews were conducted online via the BigBlueButton video conferencing system. This software met internal data protection requirements and allowed audio and video recordings of the interviews.

Table 1: Spatial distribution and stakeholder group allocation of interviewees

	EU	Middle Europe	Southern Europe	Eastern Europe	Northern Europe
Journalists		XXX			
Academia	X	XX	X	X	X
Consumer Organisations		X	X	X	X
Environmental Organisations		X		X	

In total, 15 interviews lasting about 0.5-1.5 hours were completed. Two interviewers conducted the interviews. While one interviewer mainly asked the questions, the other interviewer took additional notes and was responsible for the technical implementation. Table 1 shows the spatial distribution and stakeholder group allocation of the participants.

[1] Belgium, Bulgaria, Denmark, Finland, France, Germany, Greece, Italy, the Netherlands, Norway, Poland, Romania, Spain, Sweden, Switzerland, United Kingdom.

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2.1.2 Analysis approach

The audio recordings of the interviews were transcribed by a professional agency. These transcripts were checked for errors and anonymised. The evaluation of these qualitative data was carried out by means of qualitative content analysis with the MAXQDA software (https://www.maxqda.de/).

Two reviewers coded the transcripts of the 15 interviews. To ensure the highest possible coding agreement, the coding process went as follows:

- Based on the interview protocol, a first coding framework with a hierarchical structure was created. On this basis, the two reviewers then coded the same transcript simultaneously and independently of each other. Verbatims, which could not initially be coded within the predefined framework, were collected in a residual category.
- Using the MAXQDA Intercoder Agreement function, the coding of the two reviewers was compared and used as a starting point to further harmonize the coding procedure. These extensive discussions aimed to align the coding between the coders and to improve the coding agreement of the remaining transcripts. During the discussions, new codes were developed for the verbatims originally collected in the residual category.
- In a further step, these transcripts were divided among the coders and coded independently using the refined coding framework.

The interpretation of the codings was guided by the basic research question:

How do you communicate/report about New Plant Breeding Technologies?

Of particular interest was

- the exploration of the perspectives of the different groups of actors on communication/reporting and
- the exploration of the conditions of communication/reporting in the different European regions.

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2.2 Quantitative survey

In order to put the insights gained from the qualitative interviews on a larger data basis, a quantitative online survey was conducted.

2.2.1 Questionnaire development and field work

The development of the questionnaire was based on the qualitative interviews. The inputs from the interviewed representatives of the stakeholder groups were used to determine the answering options for the questions on communication content, target groups and formats. In addition, it was decided to include a section on discourse perception with regard to New Plant Breeding Techniques in the respondent's home country.

As the views of the stakeholder groups are partly contrary, great importance was attached to a neutral formulation of the questions and answering options when developing the questionnaire. For example, instead of the term "New Plant Breeding Techniques", the term "genome editing" was used to increase the willingness of all participants to take part in the survey and to avoid reactance when answering the questionnaire[2].

The questionnaire included the following sections

- The public discourse on genome editing (description, actors and their significance in the national discourse);
- Information behaviour (e.g. information sources);
- *Non-journalists*: description of **own communication** activities regarding genome editing **or** plant breeding (contents, target groups, formats and channels);
  Journalists: description of **own reporting** about genome editing **or** plant breeding (contents, media);
- Recommendations on communication and reporting;
- Opinion on genome editing;
- Trust in actors of the discourse.

If the respondents did not communicate about genome editing, they were asked about communication activities in the field of plant breeding in general.

Closed questions were used for the most part.

The original version of the questionnaire was developed in German, as the responsible team members come from Germany. A professional translation agency translated the questionnaire into eight European languages (English (see appendix), French, Spanish, Italian, Greek, Polish, Romanian, and Bulgarian). Native-speakers for the respective languages from the CropBooster-P consortium double-checked the translated versions.

An anonymized survey link and a short explanatory text were distributed by email and via contact forms on the target groups' websites. Network representatives were asked to circulate the invitation to the survey within their network. Additionally, a snowballing procedure was applied: The contact persons were asked to forward the link to interested colleagues and partners. Finally, the CropBooster-P website and the Julius Kuehn- Institute's Twitter account were used to advertise the survey via social media channels.

[2] In the qualitative interviews, representatives of civil society organisations pointed out that the term New Plant Breeding Techniques is used in a way that unilaterally promotes a positive evaluation of the technology. Genome editing should be referred to as a genetic engineering method and not as a plant breeding method.

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Due to the different distribution channels, some responses were received from stakeholders outside the target groups, e.g. from industry representatives and regulators. They are included in the figures of the overall analysis, but not in the stakeholder-specific assessments.

The survey was open for 2.5 months from June 15 until the beginning of September 2021. Two reminders were sent out within this period.

109 organisations and individuals responded to the questionnaire, and 86 people completed the survey. The responses of people who dropped out during the survey were taken into account with regard to the evaluation of the individual questions they answered.

Answering the complete questionnaire took an average (median) of 14 minutes.

Table 2: Response time of completed questionnaires

	N	%
under 15 min	47	55
15 min – 60 min	37	43
above 60 min	2	2.3
Total	86	100

2.2.2 Analysis approach

The survey cannot be quantified in relation to the representation of the stakeholder groups surveyed. The results presented in the following sections must thus be interpreted against this background.

The quantitative data were analysed with the statistical programme SPSS. The data analysis compared the results by stakeholder group at four different levels (Academia, Consumer Organisation (CO), Environmental Organisation (EO), Journalists) and European regions at four different levels (Middle European Countries (MEC), Eastern European Countries (EEC), Northern European Countries (NEC), Southern European Countries (SEC)). Subgroup level results will only be reported if at least five data points are available. Descriptive and inductive statistical methods are used. Due to the non-random survey methodology, the small and also unequal sizes of the sub-samples, the assumptions for parametric test procedures (ANOVA) are not met. The non-parametric Kruskal-Wallis-Test, which does not compare the mean differences but the differences in the rank sums between the subgroups, was therefore applied to detect significant differences. Due to the lower statistical power, small differences are less likely to be indicated as significant.

Only four respondents answered the questions on communication about plant breeding. Due to the small number of cases, these results are only presented in tabular form in the appendix.

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2.2.3 Description of the sample

Most of the respondents place themselves in the field of Academia and work within a middle European country.

Table 3: Description of the sample

	N	%
Stakeholdergroup (SHG)	**109**	**100**
Academia	50	46
Consumer Organisations (CO)	10	9
Environmental Organisations (EO)	12	11
Journalists	27	25
Industry [a]	4	4
Regulator / politician [a]	2	2
Others	4	4
Region [b]	**109**	**100**
Middle European Countries (MEC)	61	56
Northern European Countries (NEC)	10	9
Eastern European Countries (EEC)	14	13
Southern European Countries (SEC)	13	12
EU	6	6
No named	5	5
Sex	**86**	**100**
Female	35	41
Male	49	57
No indication	2	2
Age	**86**	**100**
25-34	10	12
35-44	17	20
45-54	21	24
55-64	26	30
≥ 65	12	14

[a] These stakeholder groups were post-coded based on verbatim mentions in the Others-category. [b] MEC (Austria, Belgium, France, Germany, the Netherlands, Switzerland); NEC (Denmark, Finland, Latvia, Norway, Sweden, United Kingdom); EEC (Bulgaria, Poland, Romania); SEC (Greece, Italy, Spain).

About 70 % of the non-journalists surveyed (Academia, CO, EO) stated that communication was part of their professional duties.

Furthermore, the respondents' position on genome editing based on their assessment of the potential of genome editing in plants in relation to various EU goals was assessed as well. Figure 2 shows the percentage of respondents by stakeholder group who are somewhat or strongly convinced that genome editing could contribute to achieve these goals.

The EO surveyed doubt that genome editing could contribute to achieving 4 out of the 5 goals. Only with regard to increasing the nutritional quality of food, three out of nine EO are somewhat convinced that genome editing could make a contribution.

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The approval rates of the surveyed CO are slightly higher than those of the EO, but they are still relatively critical compared to the group of Academia and the surveyed Journalists.

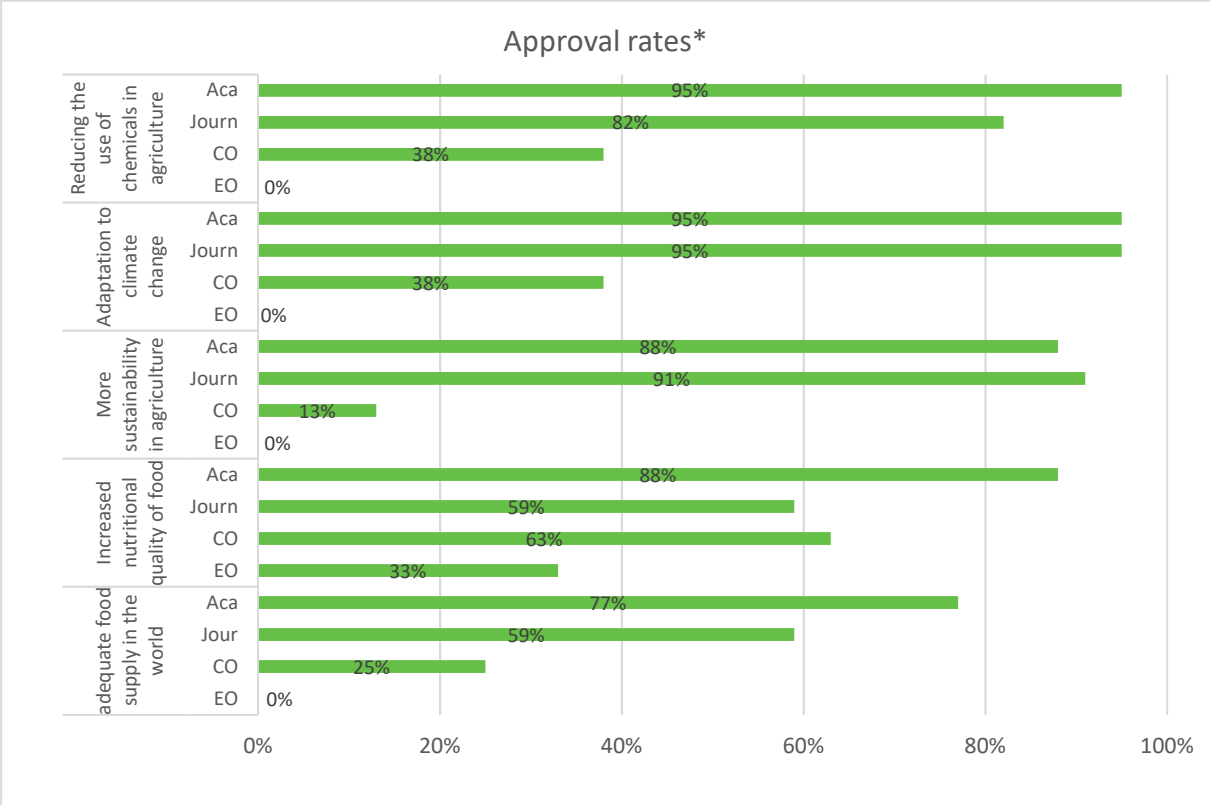

Figure 2: How convinced are you that genome editing in plants could help to achieve the following EU goals as quickly as possible?
*Sizes of subsamples: Academia=43; CO=8; EO=9; Journalists=22. * Percentage of respondents who are somewhat or strongly convinced that genome editing could help to achieve the goals.*

Due to the significantly different sizes of the stakeholder subsamples (Academia=43; CO=8; EO=9; Journalists=22), the survey questions must be evaluated predominantly on a stakeholder-specific basis. Evaluations that relate to the overall sample (i.e. considers the overall amount of responses across the different stakeholder groups) are only carried out in exceptional cases and are marked accordingly in the report.

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3 Results

The qualitative and quantitative results are presented together. In particular, quotes from the interviews are used to complement and, if adequate, support the quantitative results.

3.1 Perceived discourse about genome editing in plants in European countries

According to the interviewees, the perception of the public discourse on genome editing varies considerably across the different home countries/regions. The debate in Northern European Countries (NEC) seems to be more liberal and tech-friendly, while in some Eastern (EEC) and Southern European Countries (SEC) no public discussion are perceived at all.

These impressions are confirmed by the quantitative results. 19 % of respondents did not perceive any public discourse about genome editing in their home country. With 50%, the proportion is particularly high among respondents who come from an EEC (see Appendix).

Overall, respondents perceive the public discussions in their home countries as polarised, emotional and deadlocked. It does not seem to succeed in getting all actors to participate in the discourse. With the exception of respondents from EEC, the discourse is perceived as socially relevant.

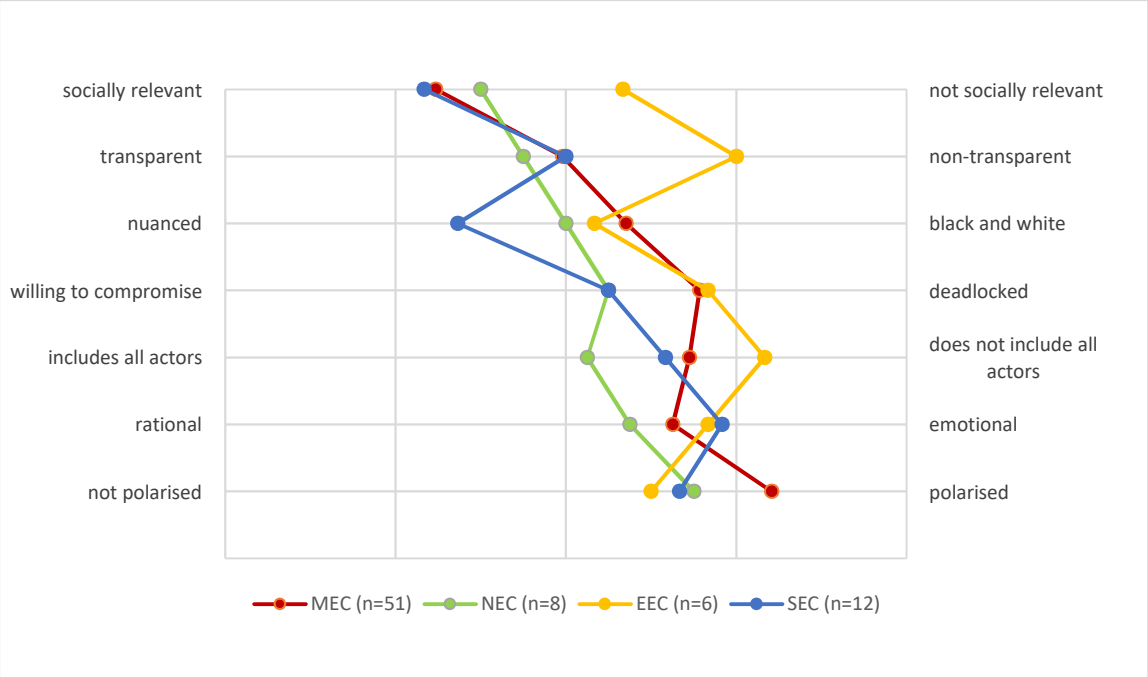

Figure 3: How do you perceive the public discussion about genome editing in plants in your country? (means)

The perception of a polarised discourse is particularly pronounced among respondents from MEC (see Figure 3). This is supported by the interview results, raising the issue that NGOs in MEC appear very emotional and aggressive from the point of view of the interview partners. Due to this emotionalisation, they are said to have a substantial influence on public opinion. In addition, it was mentioned that NGOs have a far-reaching network, that might facilitate an outreach to the general public. On the other hand, the opinion was also expressed that the influence of loud actors on public opinion is often overestimated.

" (...) in social media, where the opponents of such technologies are often very loud. That means very visible, very active in communicating. And that sometimes leads experts to the misperception that the whole population thinks that way. And there is, for example, this theory that only one per cent of people actually participate in such discussions in social media and on daily newspapers, for example, and the rest simply listen silently. And

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I think that the experts sometimes forget this silent rest because they concentrate so much on these loud opponents with whom they also interact. And therefore sometimes overestimate a bit how strongly people have an opinion about a certain technology." (Transl.) Aca_MEC_interview, Pos. 37

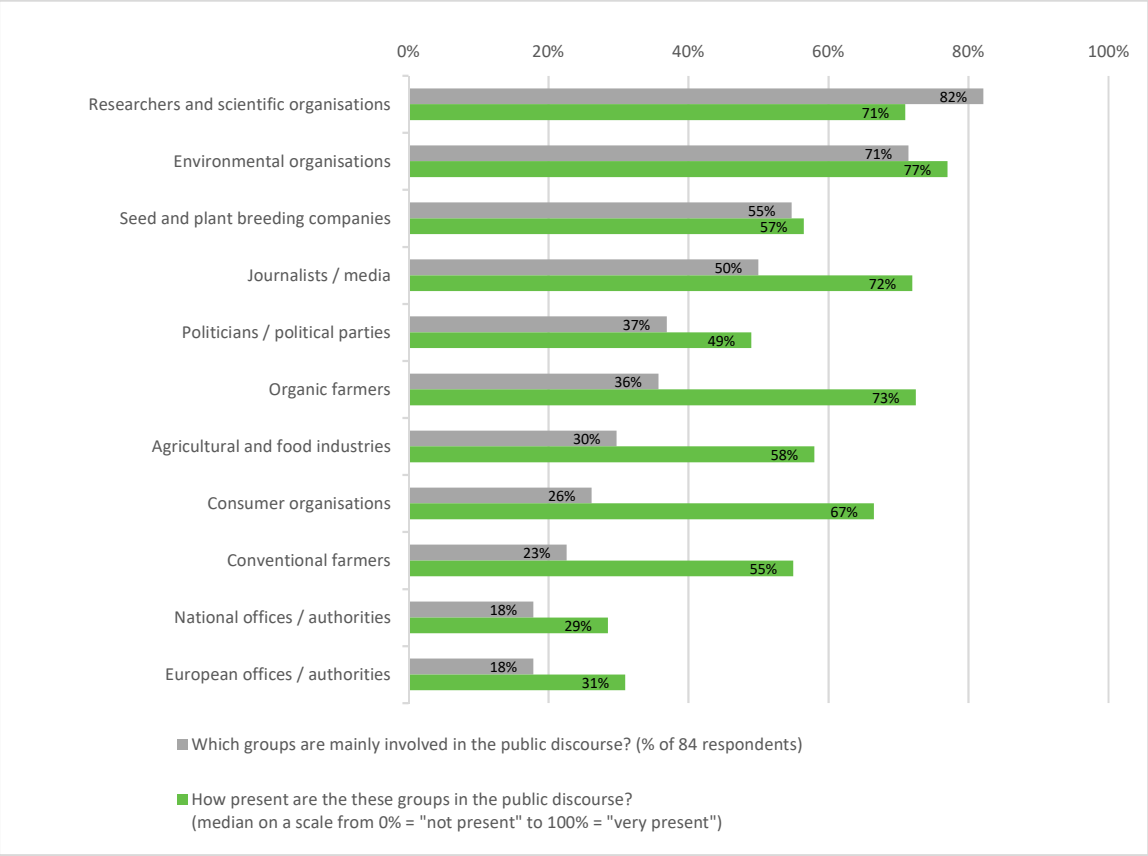

Figure 4: Perceived involvement and presence of different groups in the public discussion on genome editing in plants

Which stakeholders are involved in and how present are they within the public discourse, and how present are their discourses. When contributing to the discourse about genome editing, several actors are being considered important by interview partners. NGO's were most commonly mentioned by the interviewees. Political representatives and authorities were also often mentioned. Journalists and media were least frequently mentioned. This was partly confirmed by the quantitative results. The grey bars in Figure 4 illustrate that researchers and environmental organisations were considered as the main actors by the majority of respondents.

The plant breeding sector as well as journalists were also perceived as important actors in the discourse by a slight majority of respondents. The green bars indicate how strong the presence of the different actors was perceived. On a scale from 0 = "not present" to 100 = "very present", environmental organisations were perceived as having the strongest presence, with a median of 77%. Although researchers have been considered as the main actors, they have a comparatively low presence (71%) according to the respondents. Actors who are less frequently mentioned as participants in the discourse, such as journalists and organic farmers, are considered to have a comparable presence to researchers (72% and 73% respectively).

Significant regional differences are not detectable in the quantitative data. However, the analysis of quantitative data confirms that in NEC researchers and scientific organisations are more present in the public debate than in the other European regions.

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3.2 The issue of trust

Trust, as the basis for an open-minded communication, was addressed in both the qualitative interviews and the survey. During the interviews, the interviewees were asked to assess both, their own trust and the perceived trust of the population of their home country in the various actors. In the survey, only their own trust was assessed. In the latter, respondents were asked how much they trust the groups they consider as actors in the public discourse on genome editing. The results are shown in Figure 5 to Figure 8. Since the respondents only evaluate those actors that they themselves consider to be actors, the number of cases per actor group varies considerably. Only those values are listed where a minimum number of four cases could be achieved.

Interview partners from Academia and Journalists trust in science representatives the most and in NGO's the least. This was also confirmed by the quantitative survey: researchers and environmental organisations, which were considered main actors in the public debate, were assessed very differently in terms of their trustworthiness with regard to information on genome editing. While the majority of respondents trusted researchers fully or a little, only 8-15% of the surveyed Academia representatives and Journalists trusted environmental organisations respectively.

The confidence the surveyed EO put in researchers was relatively low. Furthermore, no trust was assigned to seed and plant breeding companies at all (see Figure 7), while about half of the surveyed Journalists and Academia trusted them at least a little (Figure 5 and 6).

Besides, scientific organisations, offices and authorities also experience a comparatively high level of trust among all stakeholder groups, even if they are not very present in the public debate on genome editing.

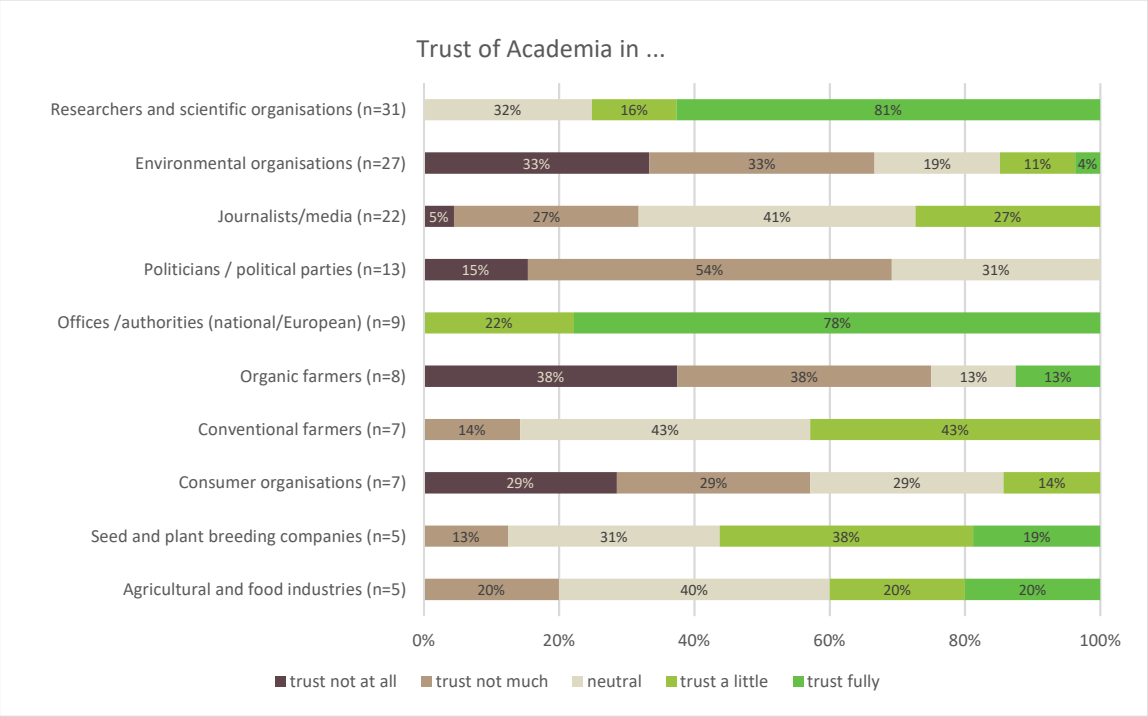

Figure 5: Trust of Academia in different actors of the public debate about genome editing - % of survey respondents

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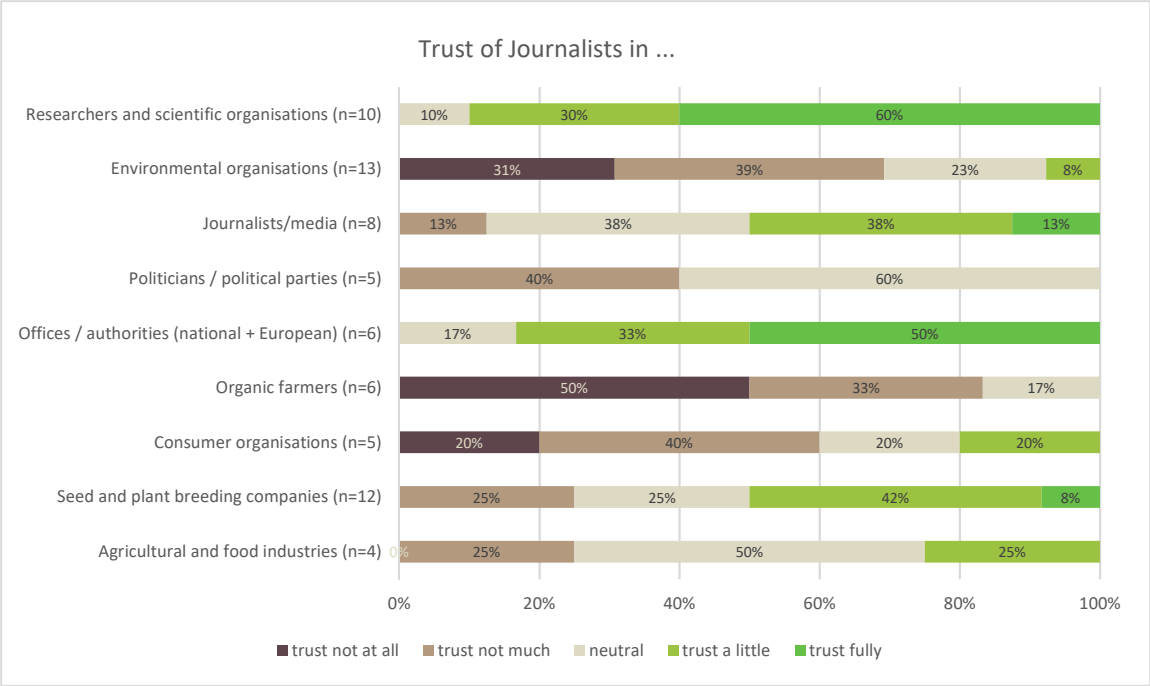

Figure 6: Trust of journalists in different actors of the public debate about genome editing - % of survey respondents

Trust in politics varied substantially within the interviews and depended on the political party and associated political agendas as well as on the European region. It was mentioned that society in certain NEC is characterized by the assignment of trust in authorities, while people in EEC tend to distrust authorities. In the survey, representatives from Academia, EO and Journalists allocate little or no trust in politicians.

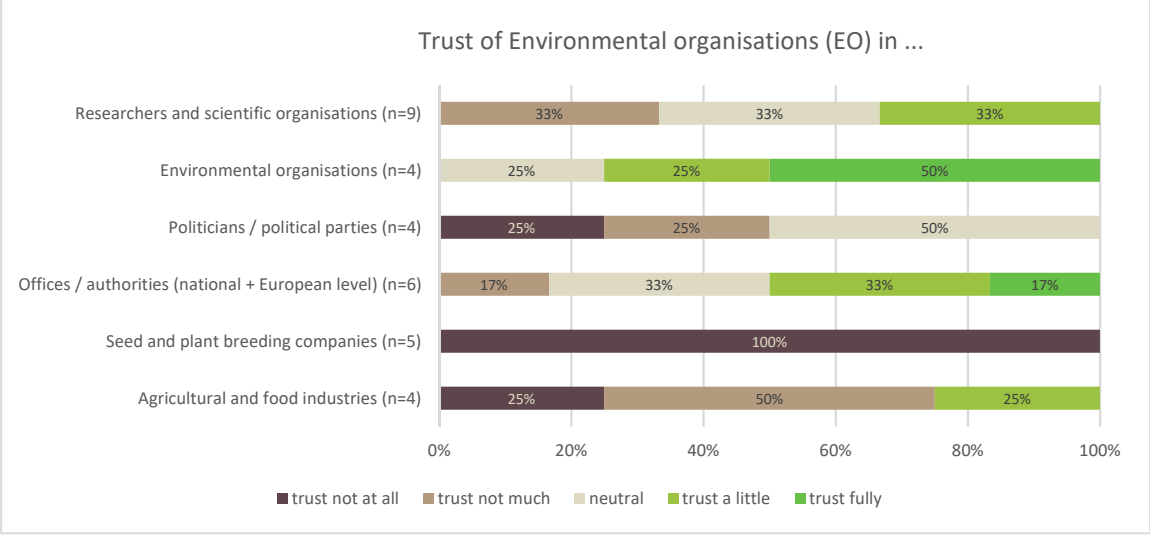

Figure 7: Trust of Environmental Organisations (EO) in different actors of the public debate about genome editing - % of survey respondents

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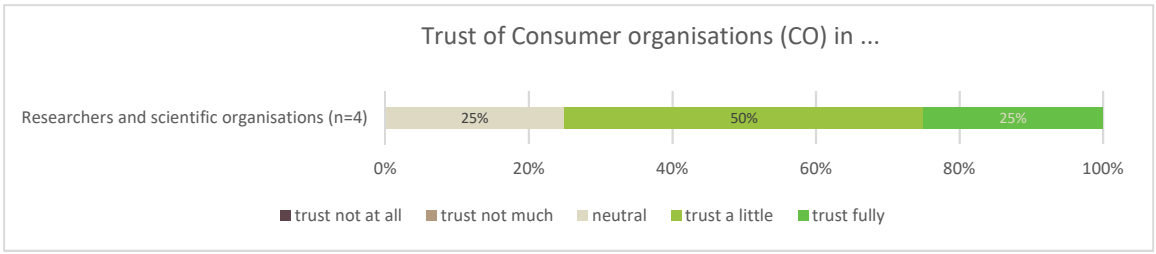

Figure 8: Trust of Consumer Organisations (CO) in researchers in the public debate about genome editing - % of survey respondents

In the qualitative interviews, respondents were asked to report on their own trust and on their perception of the level of trust that the population in their home country assigns to discourse actors. A comparison of the answers showed the following results: Of all actors considered important in the debate, interviewees' and the public's perceived trust in NGOs differed most. The public was considered to put a higher level of trust in NGOs compared to the interview partners. Interviewees' trust in NGOs depended on what the organisations represent, how polarised they are and how scientifically founded they are.

Trust in companies was considered to be higher within trust societies i.e. societies characterized by the assignment of trust in authorities. The confidence of the interviewees and the expected confidence the public put in industry was assessed as similarly as moderate. In addition, the public is considered to have more confidence in organic farmers than in conventional farmers. This contrasts with the assessment of the surveyed Academia representatives, who had more confidence in conventional than in organic farmers (see Figure 5).

Interviewees perceive people's trust in scientists as relatively high, but being accompanied by a certain degree of scepticism. Therefore, the importance of a science transparency register was also evident from the responses of some interview partners.

In order to get an insight into the information seeking behaviour of surveyed stakeholder, the considered channels are presented in the next chapter.

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3.3 Information behaviour of the stakeholders regarding genome editing in plants

To assess which sources the stakeholder groups use when searching for information on genome editing in plants, various information sources (selected on the basis of the recommendations from the qualitative interviews) were presented during the survey for evaluation).

Overall, the respondents most frequently mentioned conferences, scientific publications and personal contacts with experts as sources of information. However, a look at the evaluation by stakeholder group shows that the importance of individual sources varies considerably across the different actors (see *Figure 9*).

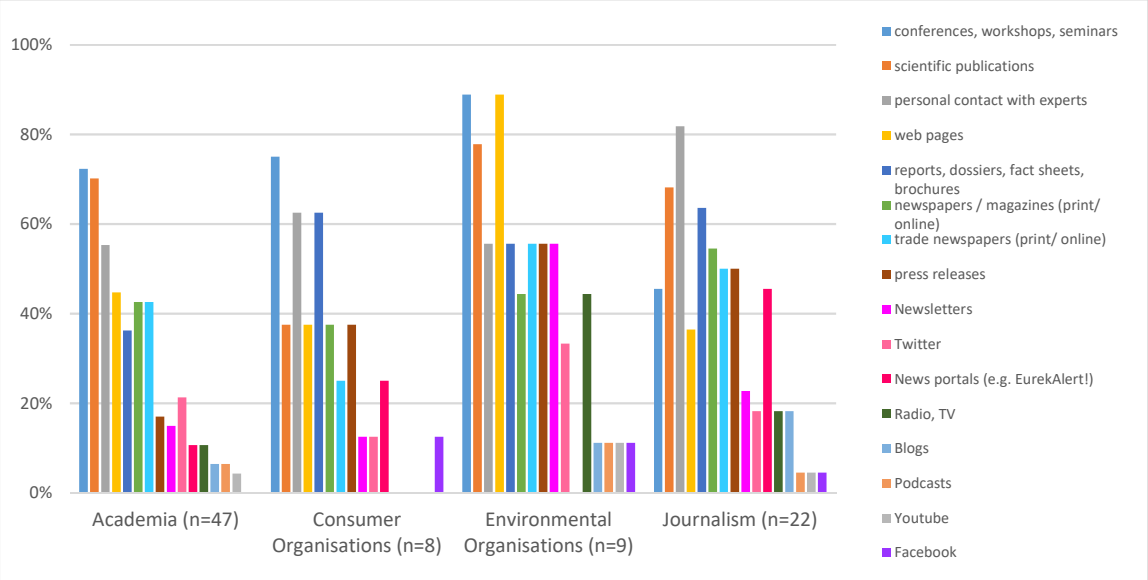

Figure 9: Where do you inform yourself about genome editing in plants? (% of survey respondents)

The CO surveyed most frequently used conferences, personal contacts with experts and written information materials such as reports, dossiers and brochures to inform themselves about genome editing. Scientific publications were significantly less important to them as information source.

EO used the widest variety of information channels. They most frequently used web pages, conferences and scientific publications. Furthermore, newsletters and press releases, trade journals, mass media such as radio and television and social media channels such as Twitter have been mentioned as important information sources as well.

The most frequently mentioned sources for Journalists were personal contacts with experts, scientific publications and written materials like reports and dossiers. Journalists also used newspapers, news portals and blogs more often than average to inform themselves about genome editing.

Next, the different bodies used for information retrieval about plant genome editing have been analyzed (Figure 10). Researchers and scientific organisations as well as EFSA were most frequently mentioned.

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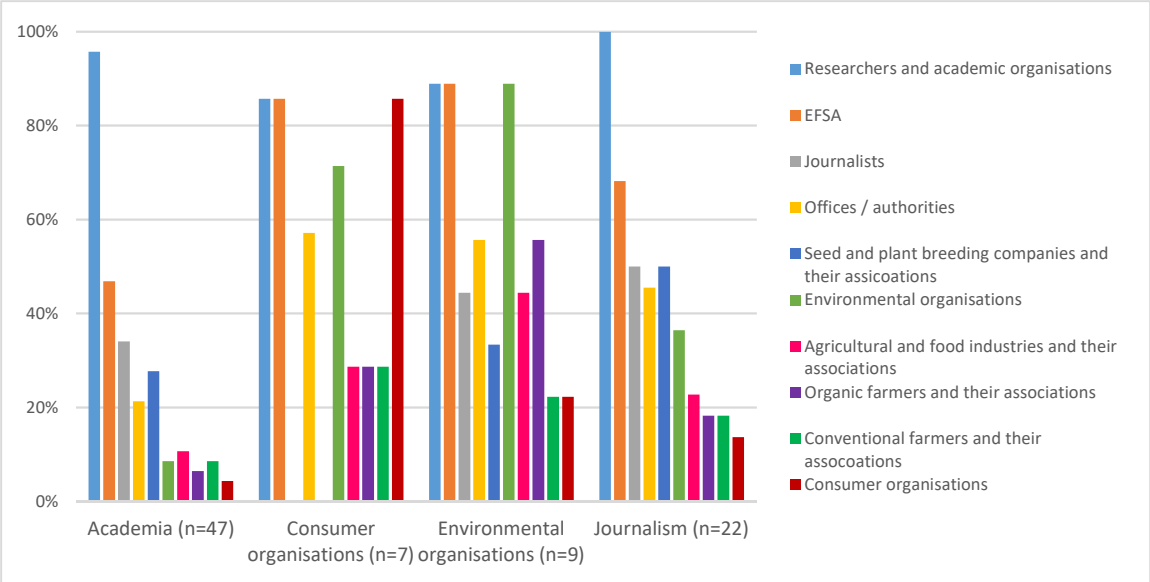

Figure 10: From which groups do you use information on genome editing in plants? (% of survey respondents)

It was striking that each of the stakeholder groups named their own group as an important source of information. In this context, it was emphasised in the interviews that the author of a contribution must be trustworthy. This is assessed either on the basis of personal relationships (group membership) or on the basis of whether or not vested interests might have been pursued.

In addition, EO and CO particularly frequently cited environmental organisations as a source of information. The same applied to offices and authorities. EO also used information from organic farmers and their associations.

For Journalists, researchers and academic institutions, followed by EFSA and seed and plant breeding companies were the most important information source.

The quality of a source was assessed by the interview partners using various criteria. Some Journalists assessed quality of publications, reports and other written contributions based on whether:

- the arguments were clear and not too far-reaching, i.e. limited to the area studied and/or
- the methods and their uncertainties were discussed in the article.

In addition, it was considered important to cross-check the provided information. Based on a second or third opinion from other experts in the field, based on the review of multiple national and international sources. Other factors are the reputation as well as the impact factor of a scientific journal where the information is published.

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3.4 Communication and reporting activities of the stakeholders regarding genome editing in plants

This chapter summarises the communication activities and efforts, interviewees' and survey participants undertake when communicating about plant genome editing. 81 survey respondents communicated or reported on genome editing in plants. The survey examined the respondents' communication activities by asking them about the content of their communication, their most important target groups and their preferred communication channels.

3.4.1 Content of communication

Across all stakeholder groups interviewed, attempts were made to link genome editing to other agriculturally relevant topics in terms of communication. The results showed that issues such as the biodiversity crisis, the use of pesticides in agriculture and sustainability were frequently communicated in the context of genome editing.

"(…) When we have a project related to the sustainable development and the climate changes we talk a lot about new ways of getting crops (...)" *EO_EEC_interview, Pos. 46*

Academia representatives emphasised the scientific consensus on these techniques. Furthermore, it was communicated about the function and importance of plant breeding in today's food system.

"(…) We are eating innovation. We don't eat tradition. Because the very big problem is the idea that we should stick to our old tradition of our grandfather. (…)" *Aca_SEC_interview, Pos. 119*

The interviewed EO representatives addressed basic biological processes and explained the technique itself. They also highlighted alternative strategies that could be applied to achieve a more sustainable and climate adopted agriculture.

In the quantitative survey, 77 respondents answered the question on which types of content would be particularly important for them in the communication/reporting about plant genome editing. The word clouds in Figure 11 give an overview on the coded verbatims for this question by stakeholder group (see appendix). The original (transl.) answers (verbatims) are presented in the appendix.

The most frequently cited topic of Academia representatives was *scientific evidence*. This was in line with their communication goals of correcting misunderstandings and clarifying misconceptions or misinformation.

Journalists stated that reporting about genome editing needs to be evidence-based. In addition, it was addressed that discussions about genome editing might be overlaid by value judgements. Another important issue is to separate these different lines when reporting on genome editing. The goal should be to allow people to form their own opinion about the pros and cons of plant genome editing.

"(…) I would actually like to sort out what is now criticism of the system, and what is criticism of science. Because often, in my opinion, it is a criticism of the agricultural system. Or also criticism of these big corporations that want to sell their pesticides and so on. And that's all justified criticism. But it has nothing to do with the technology itself. And I would like to try to break that down a little bit, for example. (…)" *J_MEC_interview, Pos. 44 (transl.)*

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In addition to *scientific evidence* and in line with their communication goals, addressing the *functionality* of the technology was an important issue from the perspective of Academia and Journalists.

The topic of *labelling* was particularly important for the CO surveyed. From the perspective of CO in NEC, there was a main interest in the *labelling* of animal foods produced by genome edited feed crops. This would secure the consumers' freedom of choice.

The topic of *patenting* was only mentioned by EO representatives as important content with regard to the communication on genome editing in plants.

„Associated patents and their problems as well as the concentration of market power in the seed market that this entails" EO_MEC_survey

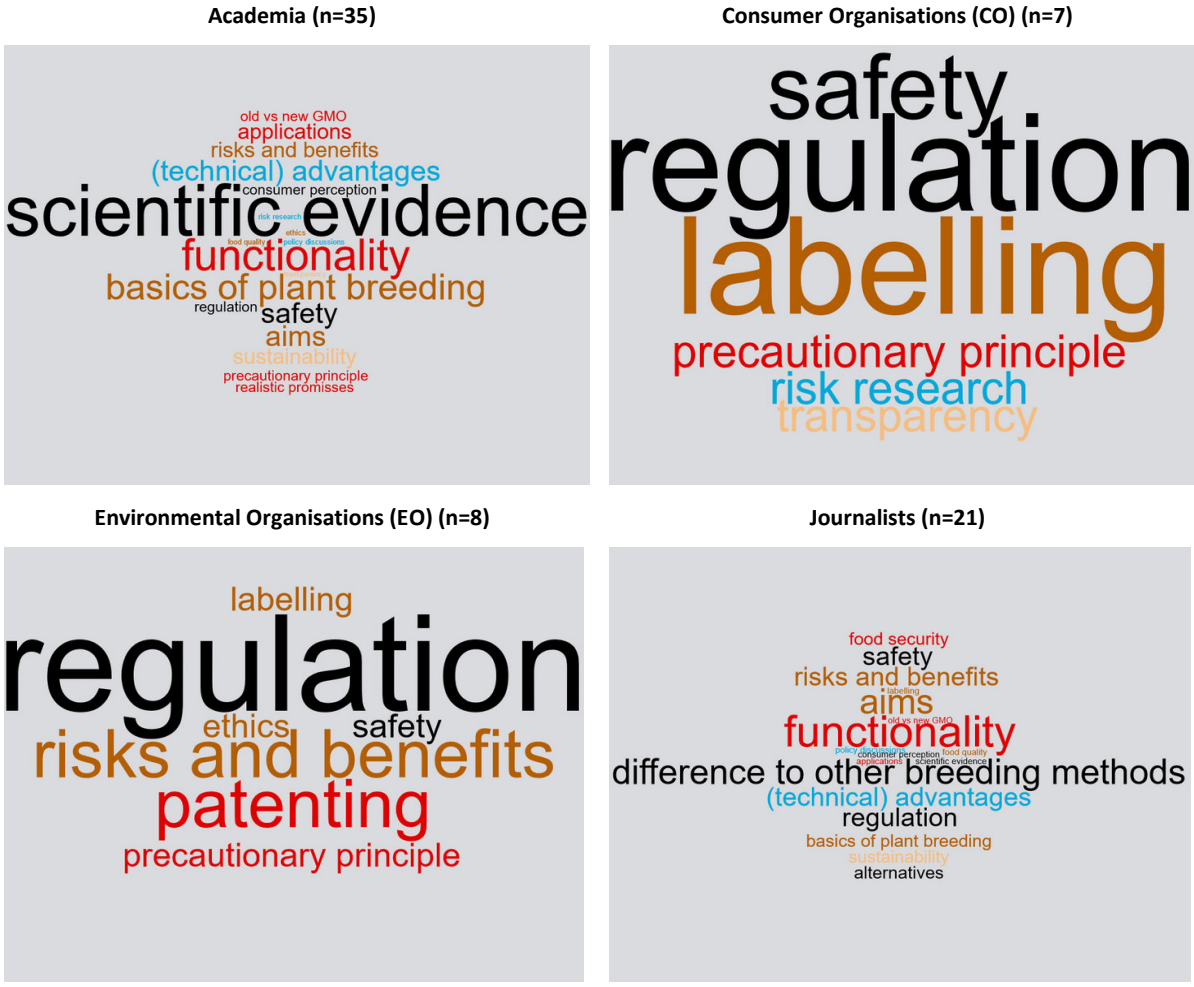

Figure 11[3]: What content is particularly important to you in your communication about/reporting on genome editing in plants? - word clouds of stakeholder groups

Regulation and *safety* were the topics that each stakeholder group mentioned as important communication content. These topics were mentioned with particular frequency by EO and CO representatives. With regard to aspects of *regulation*, interviewed EO representatives were concerned to not maintain the existing legal regulations. Academia representatives, on the other hand, would like to address the fact that regulation should be fair and less restrictive.

[3] Created with wordclouds.co.uk

„Impending deregulation of genetic engineering in agriculture“ EO_MEC_survey

„fair legislation“ Aca_MEC_survey

Survey respondents were presented with pre-defined options for potential topics to be addressed during the communication about plant genome editing. These individual topics were explained in more detail by means of pop-up texts in the online survey (see the questionnaire in the appendix). Respondents, who communicated or reported on genome editing, were asked to provide a judgement on how important these topics are with regard to their communication or reporting activities. Respondents who did not communicate or report at all about plant genome editing were asked to provide a judgement on the expected importance of the pre-defined topics. Figure 12 shows the combined results of both groups, and significant differences between the stakeholder groups are highlighted as well.

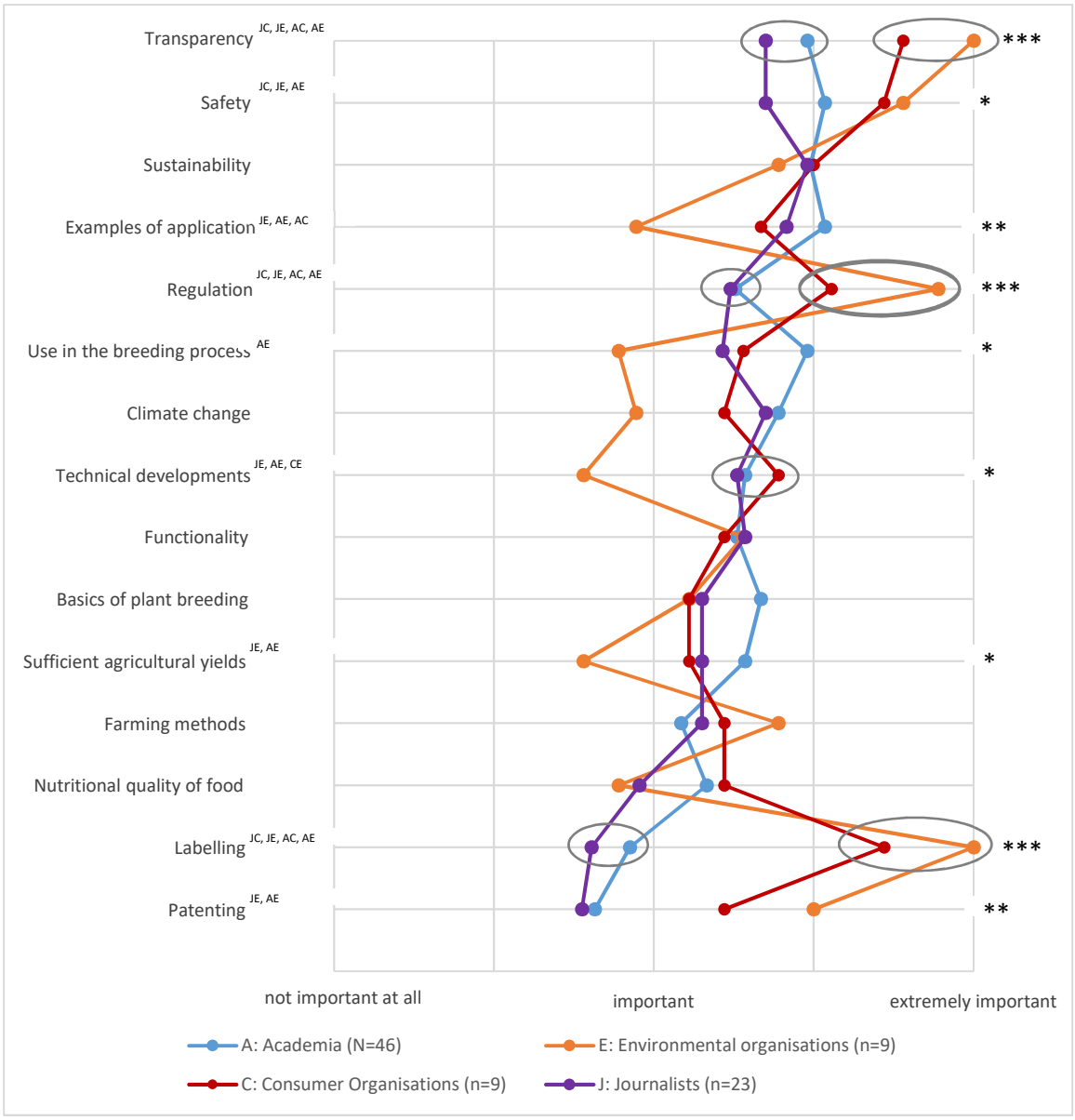

Figure 12: How important are the following types of content in communication/reporting about genome editing in plants now and in the future? (n= 93) (means)
*The superscript letter combinations indicate significant differences at least at the 5% level between the corresponding stakeholder pairs according to the Kruskal-Wallis H-test. *, **, *** indicate significant differences at least at p≤0.05, 0.01, 0.001 according to Kruskal-Wallis H-test.*

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For Academia representatives, s*afety, examples of application, sustainability, transparency, use in the breeding process* and *climate change* were rated as very important for communication. The topics of *patenting* and *labelling* were rated as least important.

For CO representatives, *transparency, labelling* and *safety* were rated as very and extremely important for communication.

For Journalists, *sustainability, climate change, examples of application, transparency* and *safety* were rated as very important for reporting. The topics of *patenting* and *labelling* were rated as least important.

For EO representatives, t*ransparency, labelling, regulation* and *safety* were rated as extremely important for communication. *Patenting* was a special area of interest for this stakeholder group.

Transparency, safety and *sustainability* were the topics rated most important as communication topics by interviewees. However*, transparency* was rated significantly more important by civil society organisations than by the representatives from Academia and Journalists in the data set. The same applied to the topics of *labelling* and *regulation,* which are very to extremely important for CO and EO, in particular.

The topic *technical developments* was significantly less important for the EO surveyed than for the other three stakeholder groups. The topics *application examples*, *use in breeding*, *climate change* and *sufficient agricultural yield* also tend to be rated as less important by the EO when compared to the other three stakeholder groups. However, significance could not be demonstrated for all cases (i.e. for all stakeholder pairs).

Regional differences were evident in the assessment with regard to the importance of the topics *sufficient agricultural yield* and *nutritional quality of food*. Respondents from SEC and EEC rated *sufficient agricultural yield* as significantly more important than stakeholders from MEC. Furthermore, *nutritional quality of food* is significantly more important for Eastern Europeans than for Middle Europeans (see appendix).

Sustainability

Participants were asked to briefly describe how they address the issue of *sustainability* in their communication about genome editing in plants, if they rated this topic as very or extremely important. Those answers (n=49) were analysed in order to find out whether participants addressed genome editing in a supportive, rejective or neutral way and which more specific topics are associated with the term *sustainability*. This resulted in 91 topic-related statements, which were summed up in 9 categories. Especially the “use of chemicals (e.g. pesticides)” (n=21) and the “use of natural resources (e.g. water, land)” (n=15) were mentioned, followed by “plant adaption to biotic and abiotic stresses” (n=11), “food security” (n=10), genome editing in relation to a “sustainable agriculture and food system” (n=8), “long term effects on the whole system” (n=7), “political aspects (e.g. Sustainable development goals, regulation)” (n=4) and the “reference to organic agriculture” (n=4). Single statements were summarised under “others” (n=11). A total of 30 participants addressed genome editing in plants in a supportive manner, 3 participants used rejective arguments and 16 participants addressed the issue in a neutral way. Mainly respondents from Academia and Journalism addressed genome editing in plants in a supportive manner (n(A)=15; n(J)=10), whereas respondents from EO used rejective (n(EO)=2) or neutral argumentation (n(EO)=2) in equal parts, but no supportive one. Respondents from CO addressed the topic in a neutral manner (n=5) only.

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Nutritional Quality

Participants were asked to briefly describe how they address the issue of *nutritional quality* in their communication about genome editing in plants, if they rated this topic as very or extremely important. Those answers (n=21) were analysed in order to find out whether participants address genome editing in a supportive, rejective or neutral way and what they associate with *nutritional quality*. This resulted in 31 topic-related statements, which were summed up in 6 categories. Especially the “Food quality: Increase of beneficial ingredients” (n=12)) was mentioned followed by “Food quality: decrease of harmful ingredients” (n=6), “altered composition” (n=3), the “reference to organic agriculture” (n=3) and “economic aspects” (n=2). Single statements were summarised under “others” (n=5). A total of 15 participants addressed genome editing in plants in a supportive manner, 2 participants used rejective arguments and 4 participants addressed the issue in a neutral way. Respondents from Academia (n=10) and CO (n=2) addressed the topic only in a supportive manner, whereby respondents from EO only used rejective arguments (n=2). Journalists mainly used a neutral way of addressing *nutritional quality*.

Yield

Participants were asked to briefly describe how they address the issue of yield in their communication about genome editing in plants, if they rated this topic as very or extremely important. Those answers (n=29) were analysed in order to find out whether participants address genome editing in a supportive, rejective or neutral way and what they associate with yield. This resulted in 39 topic-related statements, which were summed up in 8 categories. Especially “more stable yield” (n=9) and “land use” (n=8) were mentioned followed by “contribution to a sustainable system” (n=4), “environmental impact of agriculture” (n=4), “economic aspects” (n=4), “time use of cultivating adapted plants” (n=2) and “food security” (n=2). Single statements were summed up under others (n=6). A total of 23 participants addressed genome editing in plants in a supportive manner and 6 participants addressed the issue in a neutral way. No rejective arguments were recorded. Respondents from Academia mainly used supportive arguments (n=14), whereby respondents from CO only used supportive arguments (n=2) and Journalists used supportive (n=5) and neutral (n=3) arguments. No answers from respondents from EO were recorded.

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3.4.2 Target groups

When communicating about genome editing, the most important dialogue group of representatives from Academia and EO was the general public, most pronounced in the case of EO. All EO surveyed tried to reach this target group with their communication activities (see Figure 13). In contrast, only two out of seven CO stated that they consider the general public to be an important target group when communicating about plant genome editing. CO in NEC and SEC do not seem to communicate about plant genome editing because there are no concrete products on the markets yet. As long as New Plant Breeding Techniques are only relevant in research and have no practical applications on the European market, there seem to be no interest and no need to communicate and inform consumers about them. However, this was not the case in all European regions. CO in MEC seemed to be more interested and communicative despite the lack of specific products. Altogether, CO communicated mainly with other CO. Further important target groups are represented by authorities both on national and European level, national politicians and journalists.

In addition to the general public, the EO surveyed also mentioned journalists and national politicians as important target groups when communicating about genome editing.

Besides to the general public, Academia representatives tried to reach out to researchers and journalists as well.

Environmental organisations as a target group were only mentioned by one respondent.

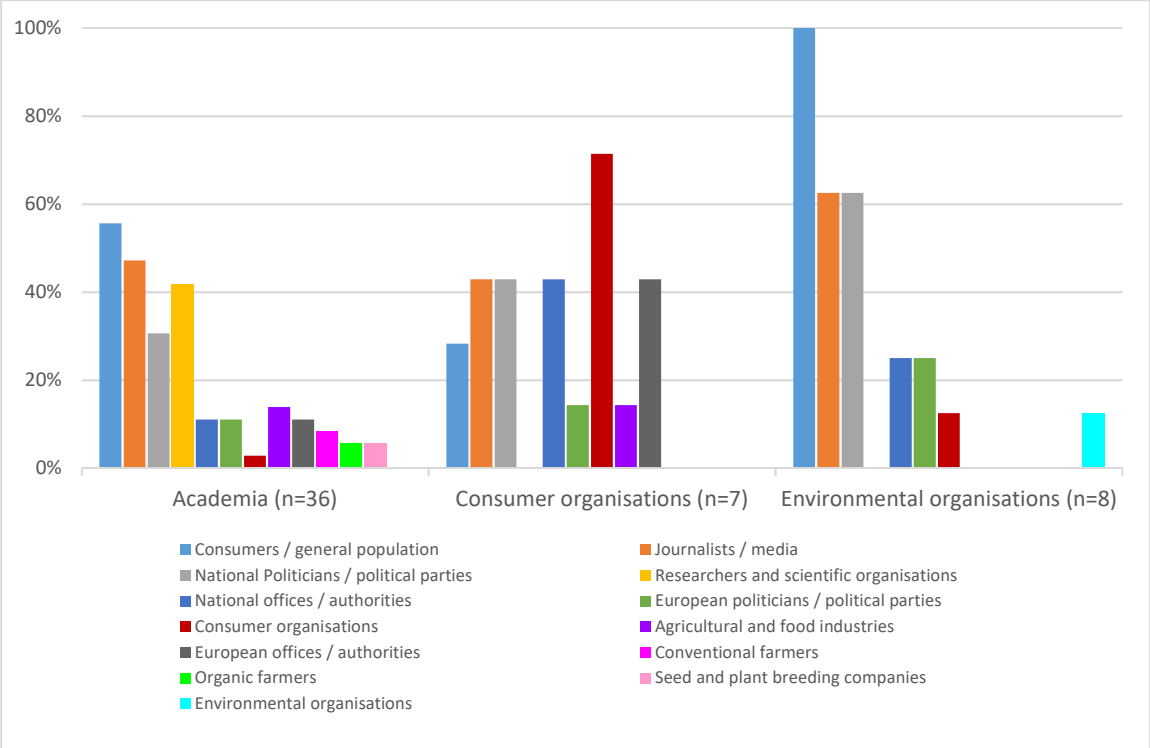

Figure 13: Who are your main target groups when communicating about genome editing in plants? (% of survey respondents)

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3.4.3 Channels and media of communication / reporting

What channels were used to communicate about genome editing? Figure 14 presents the percentage of respondents who considered the listed communication channels. Almost three quarters of the respondents used *discussion events* and *personal contacts* to communicate about genome editing. Conferences and workshops were also perceived as important. It thus became apparent that channels of direct communication with the recipients were particularly important when it comes to the topic of genome editing. With regard to the design of these formats, it was emphasised in the interviews that smaller formats were preferred in order to allow for a real dialogue i.e. to realise a two-sided flow of information.

„(…) The bigger you make the event, the more you build up the fronts beforehand, right? And then you're in exactly the same discussion as always. You simply don't make any progress. That's why we deliberately went back to small formats." *Aca_MEC_interview, Pos. 62 (transl.)*

In addition, over 50% of respondents used *press releases, newspapers, reports and dossiers*, and *web pages* for their communication. In MEC, Twitter seemed to be used more frequently than Facebook. In the other European regions, Facebook is at least as important (Northern Europe) or is even used more frequently than Twitter (Eastern Europe).

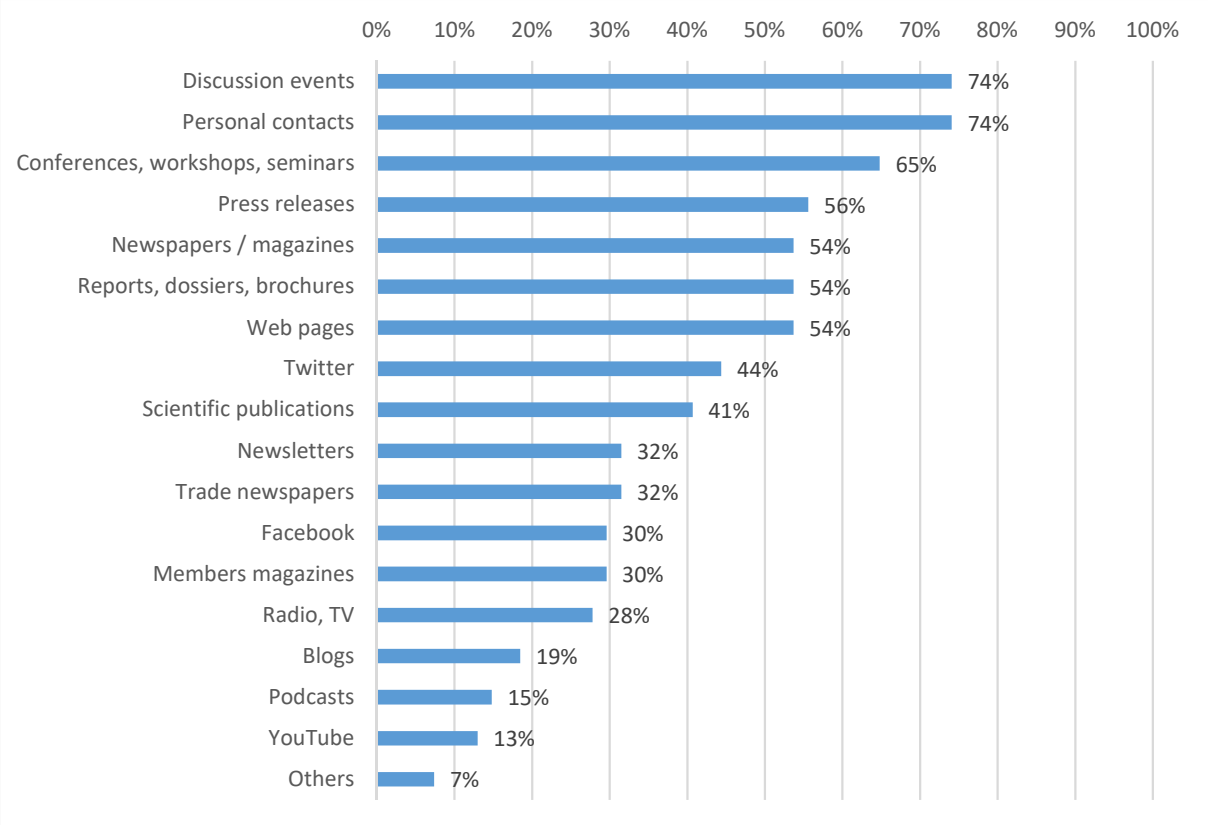

Figure 14: Channels of communication about genome editing (n=54) – percentage of respondents

The channels chosen for communication about genome editing differed, in some cases quite significantly, according to the considered target groups. Table 4 provides an overview of the most important channels per target groups[4]. The most common formats used to reach out to the **general population** are *discussion events*, *web pages* and articles in *newspapers or magazines*. Surprisingly,

[4] The numbers are presented in the appendix to this report.

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more respondents use rather *Twitter (48%)* than *Facebook (24%)* to communicate with lay people (see Appendix). Under the section "Others", *Instagram* was mentioned twice.

By far, most respondents use *press releases* to reach **journalists**. *Discussion events* and *web pages* are also important channels to reach this target group. Among the different social media platforms, *Twitter* is the most important, but is only used by 33% of respondents.

The respondents communicate about genome editing with **researchers and scientific organisations** by means of *scientific publications* and *conferences*. *Personal contacts* also seem to play an important role.

Table 4: Most important channels to reach different target groups [a]

	People (n=29)	Journalists (n=27)	Researcher (n=16)	National politicians (n=18)	European politicians (n=7)	National offices (n=10)	European Offices (n=5)	Consumer organisations (n=6)	Agribusiness companies (n=7)	Farmer (n=5)
Discussion events	■	■		■	■	■		■	■	
Personal contacts			■	■						■
Conferences			■		■	■	■	■	■	■
Press releases		■						■		
Newspapers, magazines	■									
Reports, dossiers, brochures				■	■	■	■		■	■
Web pages	■	■								■
Twitter					■		■	■		
Scientific publication			■							
Newsletters										
Trade newspapers										■
Facebook								■		■
Members magazines								■		
Radio, TV										
Blogs, Podcasts, Youtube										

The grey shaded areas indicate the three most frequently mentioned channels per target group. Channels mentioned with equal frequency are all taken into account, which can result in more than three grey cells per target group. [a] Only those target groups are evaluated that have at least 5 data points.

More than 70% percent of the respondents communicate with **National politicians and political parties** through *discussion events* and *personal contacts*. *Reports and brochures* are also important to reach this dialogue group. The same applies to **European politicians**. In addition, *Twitter also* seems to be an important channel for communicating with them. The majority of interviewees described politicians as a difficult target group. It was mentioned that impersonal communication activities receive less feedback. Therefore, continuous, long-lasting communication efforts seem to be more promising with this group.

The communication channels used to reach out to politicians at national level are more numerous than those at European level. This also applies to **offices and authorities**. *Conferences, reports* and *discussion events* are the most important channels to communicate to national authorities. Again, Twitter seems to be more important for communication with European authorities than with those at national level.

The most frequently used channels to communicate with **consumer organisations** are *discussion events* and *Twitter*. Facebook is also frequently used as a social media platform.

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Direct channels such as *conferences and seminars, personal contacts* and *discussion events* are frequently used to communicate with **agribusiness companies** and **farmers**. Written materials such as *reports and brochures* also seem to be important. Interestingly, unlike Facebook, respondents do not use Twitter to communicate with farmers about genome editing.

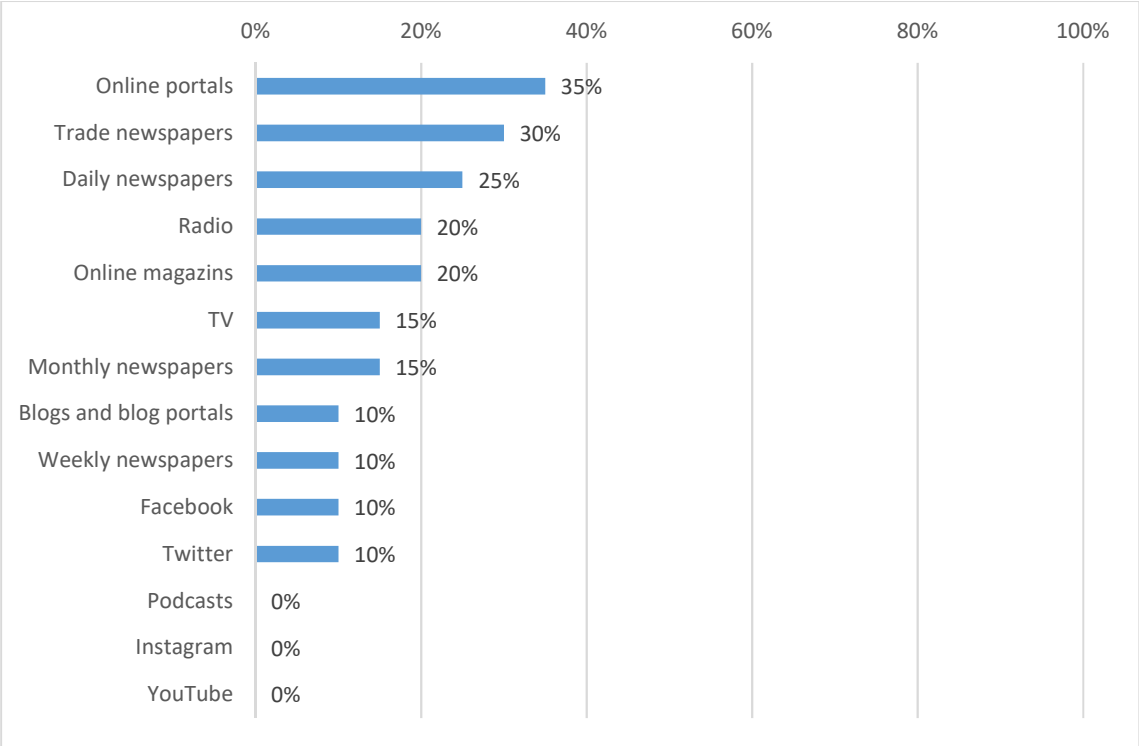

Figure 15: In which media do you report at least occasionally about genome editing in plants? (n=20) (% of respondents)

The Journalists surveyed reported on genome editing in *online portals* and *trade journals* (see Figure 15). *Twitter* and *Facebook* play a subordinate role. Social media seem to be more often used directly by communicators than by intermediaries such as journalists.

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3.4.4 Limiting factors of communication and reporting about genome editing

Basically, interviewees report that communication is time-consuming and cost-intensive.

"(…) And also it took really a lot on my time. (…) 25% of my working time was spent on communicating this on the expense of other things. (…)" *Aca_EU_interview, Pos. 40*

"(…) we don't have the resources (…) for every communication format I have to do fundraising, right? Then I get a little money, but I can just hire one person at forty percent (…). So my hands are tied, aren't they? That's why we have to work in an extremely targeted way with few resources. Perhaps the challenge is to find formats that nevertheless achieve a great impact, because we have few resources. (…)" *Aca_MEC_interview, Pos. 66 (transl.)*

In the quantitative survey, about 80 % of the respondents cited factors that limit their communication or reporting on genome editing. *Figure 16* shows the mentioned factors for each stakeholder group.

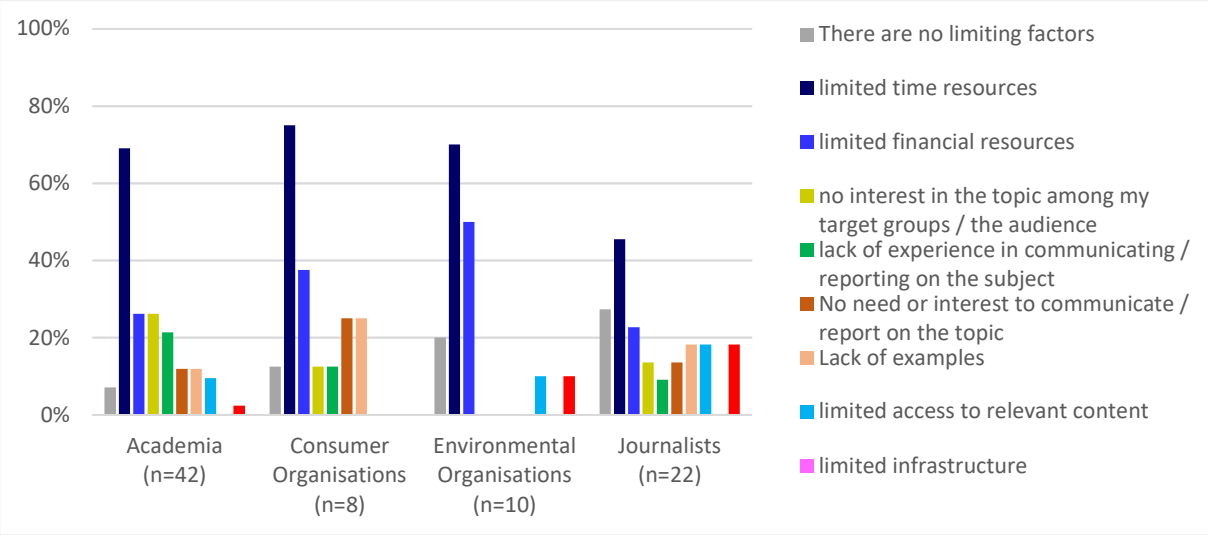

Figure 16: What are the factors that limit your communication or reporting on genome editing in plant breeding? (% of respondents)

Time resources were most often cited as an obstacle and limit communication activities. This applies to all stakeholder groups. 5 out of 10 EO also report on limited financial resources.

More than one quarter of the surveyed Academia representatives reported that their target groups have no interest in the topic. As a limiting factor, lack of experience in communicating on this topic was also mentioned more often than average.

CO stated more often than average that there is no need or no interest in communicating about genome editing. As a limiting communication factor, they also cited a lack of examples more often than average.

Journalists stated more often than average that they have limited access to relevant content.

Table 5 shows additional limiting factors that the respondents formulated in a free text field.

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Table 5: What are the factors that limit your communication or reporting on genome editing in plant breeding? – Verbatims on others

SHG	Region	Verbatim
Journalists	MEC	The topic is polarised. That makes it more difficult to report on. (transl.)
Journalists	MEC	Focus is mainly on regulatory deadlock on EU-level; this moves very slowly. So not much to report on.
Journalists	MEC	secrecy within businesses
Journalists	MEC	editorial fatigue with the subject and lack of practical implications
EO	MEC	internal competition with other topics (transl.)
Academia	MEC	no agreement on the subject within the organisation

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3.5 Recommendations on communication expressed by participants

This section summarises the findings with a focus on how to improve communication based on respondents' and interviewees' assessments of current communication strategies. Within the conducted interview, the focus was on evaluating the communication efforts of plant scientists. In the course of the survey, participants placed suggestions for improving communication of scientists in a comment field at the end of the questionnaire[5]. In addition, they were presented with a battery of statements to rate various recommendations for a better communication using a Likert scale.

In the qualitative interviews, the notion was expressed that scientific organisations and researchers do not sufficiently contribute to the public debate. Thus, an intensification of communication activities is welcomed by most of the interview partners.

"(…) I think scientists need to speak out more. I have the feeling that they don't do that enough. There are some who do. But if it's always the same ones, it's also stupid for the public. (...) I think that if you receive public funding for your research, then you simply have to speak out publicly about it. I think scientists still do far too little of that. So that's something I would really emphasise." *J_MEC_interview, Pos. 79 (transl.)*

While journalists and academia seem to be well reached (e.g. via Twitter and the science section of newspapers), this is less true for politicians and the group of less interested laypeople. In addition, Scientists' contributions are often not picked up by the traditional media. An intensified and more diversified expertise from the academic sector is needed in the public discussion and a way must be found to communicate this in a consumer-friendly and credible way in non-scientific language. It was further mentioned that communication is also seen as a social responsibility of science.

3.5.1 Recommendations: qualitative results

This section presents recommendations on future communication efforts freely expressed by the participants of the interviews and the survey.

3.5.1.1 Communication - how and with whom?

The majority of interviewees in the qualitative interviews recommended that all communication activities with the public as well as with civil society organisations should be focused on a two-sited dialogue. More interaction in communication is necessary. To achieve this, interactive formats that trigger thought processes were considered more effective than simply conveying information (via mass media) to the public. In addition, bi-directional communication would also provide insights into the perception and wishes of the target group, and would support a mutual understanding. This in turn could be helpful for targeted communication, but also for a potential adaptation of the research process.

"Involving civil society and consumers to find out about their expectations and social acceptance of specific research topics is not in the habit of many scientists, who sometimes work in a kind of bubble. However, dialogue is essential in this area. (…)" *CO_MEC_interview, Pos. 1*

Basic requirements on the communication topics to lay audiences would be:

- Key messages needs to be relevant to the audience and should include recent developments.
- Communication should be open-ended.

[5] See appendix to this report

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- Not acting as an individual researcher but if possible as a spokesperson for a whole community (depending on how concrete the communication topic is). In this context, it should be considered that the emphasis on scientific consensus on a topic can lead to reactance among target groups that are already hostile to the communication topic from the outset (Chinn et al., 2021).
- There should not be a teacher-pupil relationship but communication should occur on the same level by understanding the needs and expectations on both sides.

It was mentioned that a prerequisite for the social acceptance of genome edited products would be that breeding objectives meet social and ecological requirements. It would be important to communicate that the technology is not a panacea and can only contribute to e.g. the mitigation of climate change in combination with other approaches.

"(…) And it is even more important not to place breeding goals and marketing of the technology completely in the hands of the big seed companies. Breeding goals should follow social and ecological requirements, only then will the products be accepted." *J_MEC_survey (transl.)*

It was further stressed that the communication to professional stakeholders (regulators, policy makers, civil society organisations) should be bi-directional as well. Furthermore, it was recommended to establish a stable relationship with these dialogue groups.

"(…) But it's always good to maintain this relationship, having them on your side, also getting their feedback, why not? So, for example there must be, there might be something that you in your project have not thought about, right. And if you get the feedback, let's say at the first year instead at the end of the project, it gives you more leeway to improve on the projects. Okay so it's, that's why I say it's bidirectional communication and it's always, in my opinion, very useful. (…)" *Aca_EU_interview, Pos. 25*

Representatives of consumer and environmental organisations should be involved at different stages of research processes. They should not only be informed about research activities but should also have the possibility to contribute to research questions and processes. Additionally, committees like advisory boards should be balanced regarding considered stakeholder groups and should allow for a differentiated view on the current discussions surrounding plant genome editing. Communication about the progress in research should occur on a regular basis to maintain the relationship to and the commitment by professional stakeholders such as civil society organisations as well as policy makers and regulators.

Communication with politicians was described as difficult. The reason for this, according to the interviewees, is that they are hard to reach and only interested in a topic when it becomes topical. It was therefore suggested that regulators who advice policy makers should be addressed with higher priority as a dialogue group.

"(…) But then there is also, let's say, bureaucracy, right. So, there is one level beneath that is actually most of the time always the same people, or they change a bit, okay, independently on who's sitting in the governing body. Okay. So all the, for example regulatory, in your case regulatory agencies would be an important target, right. Because they are, the people who will eventually advise the policy maker. (…)" *Aca_EU_interviews, Pos. 21*

3.5.1.2 Communication - about what?

Beyond these basic requirements, several specific topics are recommended to communicate about in the context of genome editing.

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The technique of genome editing is too abstract for lay persons as a target group. Communication strategies are needed which make the technique more tangible for the lay audiences. One way would be to focus on concrete applications rather than the technique in general. These examples can be placed in the context of societal issues rather than purely technical discussions. In this way, the public's access to the topic could be facilitated and at the same time, their interest in the topic could be promoted.

Another way to make the technique less abstract and more tangible for lay people is to link it to familiar topics. These topics should be of high interest for the respective target group or evoke certain needs in them. This could also allow for an easier access to the topic of genome editing. The broader context thus acts as a bridge to the more abstract technique. Possible topics could be climate change, sustainability or healthy nutrition.

"(…) So there is no plan of removing really the gas we have already produced. So we will have greenhouse gases in the future and we are producing a huge amount now. So we are not really planning to stop the story. So plant have to adapt to this climate changes. (…) And if human produced the change, human should produce the improvement of plant, should help them to adapt to climate changes. (…)" *Aca_SEC_interview, Pos. 165*

In addition, the connection to the home region could facilitate access to the technical applications of genome editing. For example, people from arid regions might have an increased interest in heat tolerance, or people from wine-growing regions might have an increased interest in improving local wine varieties.

"(…) People think and feel regionally. Sustainability is a huge topic, isn't it? They want to contribute to sustainability and climate change. It's an issue, isn't it? (…) But it has to be regional, right? That is, as I said earlier, they want the farmer in their village to be allowed to grow it, don't they? So then they would also buy it, because they trust the farmers, don't they?" *Aca_MEC_interview, Pos.50 (transl.)*

It was also recommended that the potential benefits and risks of the techniques should be weighed against each other during the communication, maybe in comparison to other, well-accepted techniques. The dialogue could focus on the question of whether a potential risk could be accepted in order to gain a potential benefit from the application of a technique.

It was also frequently mentioned during the qualitative interviews that basic knowledge about plants and plant breeding should be conveyed as well. This would be fundamentally important to ensure that the dialogue and potential discussions about the applications of breeding techniques are based on a common knowledge basis. It should be an overarching goal to make people aware of the fact that mutations are something natural, occur regularly and everywhere, and that they are the basis of every breeding process. Ideally, the conveyed knowledge should focus on knowledge gaps present within the respective target group.

Regarding the communication of uncertainty being associated with research results, different opinions were expressed. On the one hand, awareness among the lay audience should be raised that a certain degree of uncertainty is intrinsic to research processes. On the other hand, interviewees gave for consideration that, even if only a low level of uncertainty is communicated, lay people will tend to completely reject a technique without any weighting of pros and cons. Unlike scientists, laypersons

are not trained to have an understanding that there is always a certain degree of associated uncertainty.

Speaking about recommendable communication channels, it is recommended to use consumer and environmental organisations as already established ways to reach public audiences.

> *"Second, use the already existing channels. (…) consumer organisations, environmental organisation, it's your channels to reach out society, consumers. So do the scientific work, simplify it, and give it to organisations to promote it to the public. (…)" CO_SEC_interview, Pos. 132*

3.5.2 Recommendations: quantitative results

In the qualitative interviews, interviewees suggested some overarching communication topics to be considered in the course of future communication activities. These different topics were presented in the form of five statements to the respondents of the survey for evaluation. Figure 17 shows how much the stakeholder groups agree with those statements.

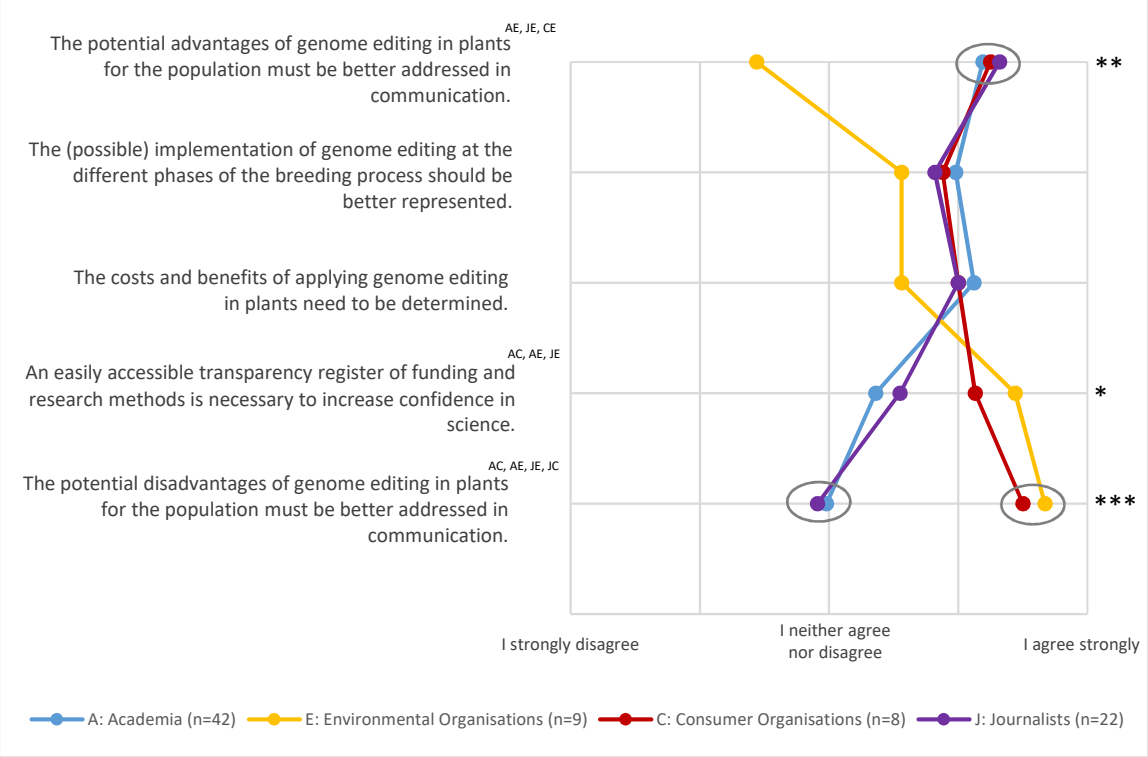

Figure 17: Degree of agreement to several statements on communication approaches (means)
*The superscript letter combinations indicate significant differences at least at the 5% level between the corresponding stakeholder pairs according to the Kruskal-Wallis H-test. *, **, *** indicate significant differences at least at p≤0.05, 0.01, 0.001 according to Kruskal-Wallis H-test.*

The potential advantages of genome editing in plants for the population must be better addressed in communication.

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So far, the discussions have emphasised the technical benefits resulting from the application of genome editing to breed new varieties, which, at first glance, would provide benefits for the agribusiness. It is recommended to focus the communication more on the potential benefits for consumers and society. While CO, representatives of Academia and Journalists agree with this recommendation, EO do not.

The (possible) implementation of genome editing at the different phases of the breeding process should be better represented.

In order to increase the (public) understanding of the technological possibilities and limitations for plant breeding, the use of genome editing within the different phases of the breeding process should be the subject of communication. All stakeholder groups agree with this recommendation.

The costs and benefits of applying genome editing in plants need to be determined.

It is recommended to assess the economic impact of the (non-) application of New Plant Breeding Techniques on the individual farm level. Such concrete economic arguments are needed to address target groups, like farmers, agricultural schools and agricultural consultants.

"(…) That this is calculated, what good does that do us? These economic arguments are absolutely essential in this discussion, aren't they? Because the farmers' lobby only asks, what it brings, right? And they don't want to and can't accept any more deficits, that's just the way it is. They are at the limit in their production schemes. So we are at the limit in terms of productivity increase, that's quite clear, but they are also at the limit, at the financial feasibility, right? That is simply the case. (…)" *Aca_MEC_interview, Pos. 18 (transl.)*

Beyond the impact on farm level, it is recommended to consider socio-economic as well as ecological effects of the techniques at societal level. Therefore, the costs and benefits of applying or not applying the techniques for the agricultural sector and for society as a whole should be assessed in order to be able to communicate their potential economical, ecological and societal effects more concretely. All stakeholder groups surveyed agree with this recommendation.

An easily accessible transparency register of funding and research methods is necessary to increase confidence in science.

Information with regard to funding, research partners, methods and objectives of research projects are not always easy to find. As a trust building measure, this information should be available to the public in the form of an easily accessible register.

" (...) and we asked what (…) what the research projects were. And it was incredibly difficult to find out where we had to ask. (...) and in the end we really did get a table, but it really should be much, much easier to find, and also accessible to everyone. (…)" *EO_CEC_interview, Pos. 59*

Academia and Journalists slightly agree with this recommendation, civil society organisations strongly agree. Significant differences could be observed between EO on the one hand and Journalists and Academia representatives on the other hand.

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The potential disadvantages of genome editing in plants for the population must be better addressed in communication.

Potential risks of the techniques should be better taken into account in research and communication about genome editing in plants. While civil society organisations strongly agree with this recommendation, Journalists and Academia representatives are rather neutral in this assessment. The differences between the two stakeholder clusters are highly significant.

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4 Summary and discussions

The aim of the empirical studies was to describe the communication environment, including the state of the current debate and the information behaviour of actors, as well as the current communication activities of major stakeholder groups on the topic of genome editing in plants. The studies examine the experiences and views of four stakeholder groups: Academia, Environmental Organisations (EO), Consumer Organisations (CO) and Journalists. The qualitative interviews informed the development of the online questionnaire presented to participants during the quantitative survey.

The course of the current **debate on genome editing** determines the nature of the communication activities. Based on our results, the public discussion differs across European regions. In the Middle European Countries (MEC), for example, not all actors seem to be equally represented in the public debate. The debate is also described as low nuanced, as well as, polarised. In the Eastern European Countries (EEC), on the other hand, there seems to be hardly any relevant public debate.

Four stakeholder groups are considered the main actors in the public debate: Researchers/scientific organisations and environmental organisations, and with a slightly lower importance, the plant breeding sector and journalists/media. Authorities are hardly perceived as players in the public debate. This seems to be true for all European regions.

While the majority of Academia and Journalists **trust** researchers and scientific organisations, only one third of the EO surveyed assign trust to the aforementioned stakeholder groups. Vice versa, no more than 15% of the surveyed Journalists and Academia representatives trust environmental organisations when it comes to genome editing in plants. This lack of trust must be addressed with appropriate communication measures in case an open-minded dialogue between these stakeholders is intended to be established. However, the three stakeholder groups (Academia, EO and Journalists) are relatively unanimous in their assessment of the trustworthiness of offices and authorities and show comparatively high trust values (50-100%). This would be a good basis for an intermediary role of authorities between academia and environmental organisations. So far, however, offices and authorities are hardly perceived as an actor in the discourse about genome editing.

With regard to the stakeholders' **information behaviour**, it was investigated which sources of information they use and from which groups they seek information about genome editing in plants.

The three most important sources of information for ***Academia*** are conferences, scientific publications and personal contacts with experts. With regard to social media, Twitter is most frequently used; however, social media generally play a subordinate role as a source of information. Researchers/ scientific organisations and EFSA are the most frequently mentioned groups from which information about genome editing in plants is obtained.

The three most important sources of information for ***Consumer Organisations (CO)*** are conferences, personal contacts with experts and reports/dossiers. With regard to social media, Facebook and Twitter are equally often used. However, social media also play a rather subordinate role as a source of information for CO. Researchers/scientific organisations, EFSA, and consumer organisations are the most frequently mentioned groups from which information about genome editing in plants is obtained.

The three most important sources of information for ***Environmental Organisations (EO)*** are conferences, web pages and scientific publications. Social media also play a rather marginal role as a source of information for EO. However, Twitter plays quite a large role compared to the other stakeholder groups. Researchers/scientific organisations, EFSA, and environmental organisations are the most frequently mentioned groups from which information about genome editing in plants is obtained.

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The three most important sources of information for the surveyed ***Journalists*** are personal contacts with experts, scientific publications and reports/dossiers. With regard to social media, Twitter is most frequently used; however, social media generally play a subordinate role as a source of information. Researchers/scientific organisations and EFSA are the most frequently mentioned groups from which information about genome editing in plants is obtained.

Concerning stakeholders' **communication activities**, it was investigated which target groups they do focus on, which channels they use and which types of content they focus on.

For the surveyed representatives of ***Academia***, the communication about plant genome editing has to be evidence-based. In this context, empirical results show that the emphasis on scientific consensus on a topic can lead to reactance among target groups that are already hostile to the communication topic from the outset (Chinn et al., 2021). Thus, consensus messaging strategies may be ineffective or backfire among audiences that science communicators are most keen to target. Based on our survey, the communication of specific examples of application, safety-relevant aspects and a transparent approach are very important to Academia. Communication on how genome editing can contribute to more sustainable agriculture and adaptation to climate change is considered very important. Compared to the other stakeholder groups, communication about the use of genome editing in the breeding process and the associated basic principles of plant breeding are highly relevant from the perspective of the surveyed Academia representatives. The three most frequently mentioned target groups for Academia are the general public, journalists and researchers. Only about 30 % say they try to reach politicians when communicating about genome editing.

For the ***Consumer Organisations (CO)*** surveyed, transparency, labelling and associated regulatory issues are particularly important when communicating about genome editing in plants. They are also interested in communicating about technological developments in this field. The main dialogue group of CO is represented by other consumer organisations. CO hardly name consumers as a target group of their communication which might be explained by that fact that no products derived from genome edited plants are currently on the European market. This would be in line with the fact that CO frequently state that there is no need or interest to communicate about the issue. Other important target groups are journalists, politicians and national and European authorities respectively.

For ***Environmental Organisations (EO)***, transparency, labelling and regulation are also the most important issues when communicating about genome editing in plants. The response behaviour indicates that they strongly focus on these topics and give significantly less space to other topics than the other stakeholder groups do. EO seem to be more focused in their choice of topics, which could be an advantage in terms of the impact of communication with lay people, who also seem to be their main target group. In addition, journalists and politicians are also important target groups for the majority of the EO surveyed.

Journalists place particular emphasis on sustainability, climate change and examples of application of the technology as important topics for their reporting.

Of all stakeholder groups, channels that can be used for face-to-face communication are most frequently used when it comes to the topic of genome editing in plants. This includes discussion events, conferences and workshops, as well as personal contacts. Depending on the target group, however, there are also specific communication channels that are served.

Written materials like reports, dossiers and brochures are used to reach politicians and offices/ authorities at national and European level as well as actors from the production side such as agribusinesses and farmers.

With regard to online media, websites in particular are important communication channels, especially when targeting the general population, journalists and farmers.

Social media were also listed as important communication channels for some target groups. For example, Twitter is important when reaching out to politicians and authorities at European level and with consumer organisations. Facebook is also very often used to reach consumer organisations and farmers.

Comparing the stakeholders' sources of information identified in the survey with the communication channels used by the respondents, the following findings and recommendations can be derived:

While Twitter plays a rather subordinate role as a source of information for researchers, websites are more frequently used as a source of information about genome editing. However, respondents mentioned Twitter more frequently than websites as a communication channel to reach researchers. Thus, up-to-date and informative websites should not be underestimated as a communication channel for this target group.

While CO cite personal expert contacts as well as reports/dossiers as important sources of information on genome editing, these formats are less frequently used to target them. It is therefore advisable to seek personal contact with these organisations in order to facilitate the establishment of a dialogue about genome editing in plants. The same applies to Journalists. While respondents mainly use press releases to communicate with journalists, Journalists most often use direct contact with expert to inform themselves about plant genome editing.

With the exception of CO, the majority of the stakeholder groups surveyed use scientific publications as a source of information on genome editing. However, the respondents see scientific publications primarily as a communication channel to reach the target group of researchers. From this, it can be concluded as a recommendation that other target groups should be considered as well when producing scientific publications and that their needs regarding language, choice of topic, cross-connections and applicability and limitations of the research results should be taken into account.

Limited time and funding are the two main **factors limiting** communication about genome editing in plants for Academia. Additionally, there is the perception that target groups are not interested in the topic. Academia representatives also report that they have little experience in communication.

The respondents formulated **recommendations** for successful science communication on the topic of genome editing in plants. A strengthening, professionalization and diversification of communication is generally called for.

Thematically, it should be noted that the acceptance of techniques is largely determined by the goals of their application. If the goals fulfil social and ecological requirements, acceptability increases. It is therefore advisable to base communication on these overarching objectives.

Communication with lay target groups should be as specific as possible and offer points of connection between genome editing and the everyday life of the target group. This could be based on specific technology applications or also on already familiar topics (climate change, sustainability, home region).

The four stakeholder groups surveyed are relatively unanimous that the use of genome editing within the plant breeding process should be better communicated. A basic knowledge about genome editing is indispensable to establish a dialogue about the potential advantages and limitations of the techniques. In addition, the costs and benefits of technology applications for society, the environment and the economy as a whole should be determined.

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In addition to the stakeholder groups studied, other actors such as the seed and plant breeding sector, agriculture and politics are present in the public debate on genome editing in Europe. Their communication activities additionally influence the communication of research projects and must be taken into account when developing communication recommendations. Thus, the present results are combined with survey results from our project partners, who interviewed those stakeholder groups (see supplemtary information 2).

References

Chinn, S. and P. Sol Hart (2021), . Environmental Communication. https://doi.org/10.1080/17524032.2021.1910530.

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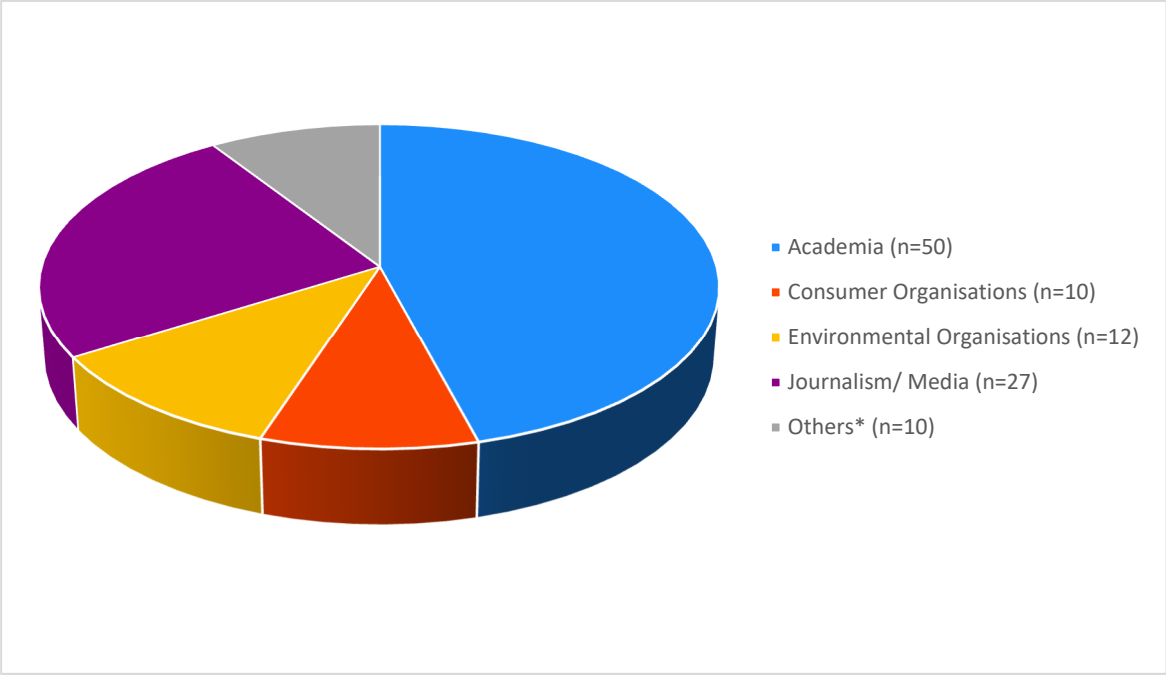
Annex 1: Raw data survey

1 Demographics

1.1

In which area are you mainly active?



***Others**: industry, regulator/politician

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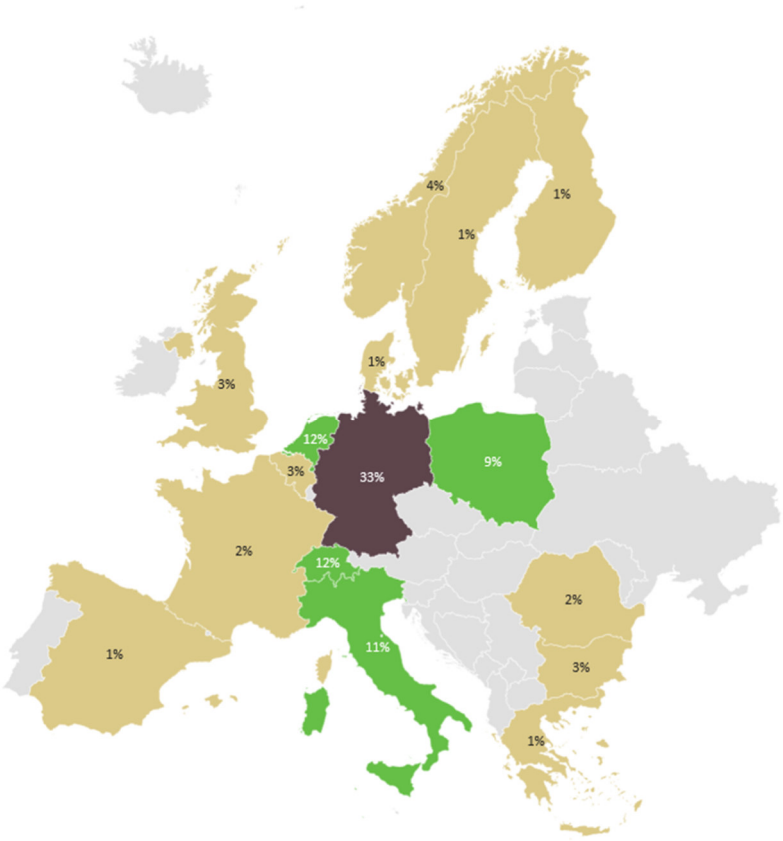
1.2
Generally, where are you or the organisation you work for mainly active?



Above 15% is indicated in dark brown, between 5% and 15% is indicated in green and below 5% is indicated in light brown

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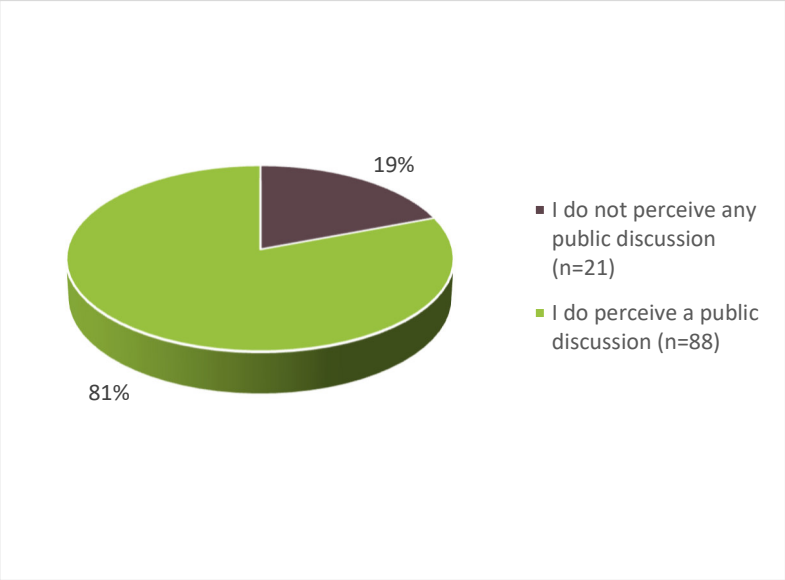
2 The public discussion about genome editing in plants

2.1 How do you perceive the public discussion about genome editing in plants in [country]? - 1

Genome editing (e.g. CRISPR) includes techniques that are able to change genetic information in a targeted manner at a predefined point



	Total		EU		Middle European Countries		Non Middle European Countries*	
	frequency	percent	frequency	percent	frequency	percent	frequency	percent
Perception	88	80,73%	6	100,00%	52	85,25%	27	72,97%
No perception	21	19,27%	0	0,00%	9	14,75%	10	27,03%
Total	109	100,00%	6	100,00%	61	100,00%	37	100,00%

***Non Middle European Countries** is composed of the values of Northern, Eastern and Southern European Countries

	Northern European Countries		Eastern European Countries		Southern European Countries		Others	
	frequency	percent	frequency	percent	frequency	percent	frequency	percent
Perception	8	80,00%	7	50,00%	12	92,31%	3	60,00%
No perception	2	20,00%	7	50,00%	1	7,69%	2	40,00%
Total	10	100,00%	14	100,00%	13	100,00%	5	100,00%

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2.1 How do you perceive the public discussion about genome editing in plants in [country]?

I do perceive the discussion as follows:

	++	+	0	+	++	
includes all actors						does not include all actors
not polarised						polarised
willing to compromise						deadlocked
rational						emotional
transparent						non-transparent
nuanced						black and white
socially relevant						not socially relevant

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	Total			**EU**			**Middle European Countries**			**Non Middle European Countries***		
	frequency	mean	median	frequency	mean	median	frequency	mean	median	frequency	mean	median
Socially relevant : not socially relevant	85	2,32	2,00	5	1,80	1,00	51	2,24	2,00	26	2,54	2,00
Transparent : non-transparent	85	3,05	3,00	5	2,80	3,00	51	2,98	3,00	26	3,15	3,50
Nuanced : black and white	84	3,15	3,00	5	3,40	3,00	51	3,35	4,00	25	2,76	3,00
Willing to compromise : deadlocked	85	3,59	4,00	5	3,60	3,00	51	3,78	4,00	26	3,38	3,50
Includes all actors : does not include all actors	86	3,63	4,00	6	3,17	3,00	51	3,73	4,00	26	3,58	4,00
Rational : emotional	85	3,64	4,00	5	3,80	4,00	51	3,63	4,00	26	3,73	4,00
Not polarised : polarised	87	4,00	4,00	5	4,00	4,00	53	4,21	4,00	26	3,65	4,00

*__Non Middle European Countries__ is composed of the values of Northern, Eastern and Southern European Countries

	Northern European Countries			**Eastern European Countries**			**Southern European Countries**			**Others**		
	frequency	mean	median	frequency	mean	median	frequency	mean	median	frequency	mean	median
Socially relevant : not socially relevant	8	2,50	2,00	6	3,33	3,50	12	2,17	1,50	3	2,67	3,00
Transparent : non-transparent	8	2,75	2,50	6	4,00	4,00	12	3,00	3,00	3	3,67	3,00
Nuanced : black and white	8	3,00	3,00	6	3,17	3,00	11	2,36	3,00	3	2,67	3,00
Willing to compromise : deadlocked	8	3,25	3,50	6	3,83	4,00	12	3,25	3,00	3	2,00	2,00
Includes all actors : does not include all actors	8	3,13	4,00	6	4,17	4,50	12	3,58	4,00	3	3,33	4,00
Rational : emotional	8	3,38	3,50	6	3,83	3,50	12	3,92	4,00	3	2,67	3,00
Not polarised : polarised	8	3,75	4,00	6	3,50	3,50	12	3,67	4,00	3	3,33	3,00

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2.2 Which groups are mainly involved in the public discussion on genome editing in plants in [country]? (maximum 5)

	Total (n=84)			EU (n=6)			Middle European Countries (n=50)			Non Middle European Countries* (n=27)		
	Responses		Cases	Responses		Cases	Responses		Cases	Responses		Cases
	frequency	percent	percent	frequency	percent	percent	frequency	percent	percent	frequency	percent	percent
Researchers and scientific organisations	69	18,45%	82,14%	1	3,85%	16,67%	42	18,75%	84,00%	25	21,01%	92,59%
Environmental organisations	60	16,04%	71,43%	5	19,23%	83,33%	35	15,63%	70,00%	20	16,81%	74,07%
Seed and plant breeding companies	46	12,30%	54,76%	5	19,23%	83,33%	30	13,39%	60,00%	11	9,24%	40,74%
Journalists / media	42	11,23%	50,00%	4	15,38%	66,67%	24	10,71%	48,00%	13	10,92%	48,15%
Politicians / political parties	31	8,29%	36,90%	3	11,54%	50,00%	20	8,93%	40,00%	8	6,72%	29,63%
Organic farmers and their associations	30	8,02%	35,71%	2	7,69%	33,33%	18	8,04%	36,00%	10	8,40%	37,04%
Agricultural and food industries	25	6,68%	29,76%	1	3,85%	16,67%	16	7,14%	32,00%	8	6,72%	29,63%
Consumer organisations	22	5,88%	26,19%	3	11,54%	50,00%	12	5,36%	24,00%	6	5,04%	22,22%
Conventional farmers and their associations	19	5,08%	22,62%	2	7,69%	33,33%	10	4,46%	20,00%	7	5,88%	25,93%
National offices / authorities	15	4,01%	17,86%	0	0,00%	0,00%	10	4,46%	20,00%	4	3,36%	14,81%
European offices / authorities	15	4,01%	17,86%	0	0,00%	0,00%	7	3,13%	14,00%	7	5,88%	25,93%
Others	0	0,00%	0,00%	0	0,00%	0,00%	0	0,00%	0,00%	0	0,00%	0,00%
Total	374	100,00%	445,24%	26	100,00%	433,33%	224	100,00%	448,00%	119	100,00%	440,74%

***Non Middle European Countries** is composed of the values of Northern, Eastern and Southern European CountrieS

	Northern European Countries (n=8)			Eastern European Countries (n=7)			Southern European Countries (n=12)			Others (n=1)		
	Responses		Cases	Responses		Cases	Responses		Cases	Responses		Cases
	frequency	percent	percent	frequency	percent	percent	frequency	percent	percent	frequency	percent	percent
Researchers and scientific organisations	8	22,22%	100,00%	5	17,86%	71,43%	12	21,82%	100,00%	1	20,00%	100,00%
Environmental organisations	6	16,67%	75,00%	6	21,43%	85,71%	8	14,55%	66,67%	0	0,00%	0,00%
Seed and plant breeding companies	3	8,33%	37,50%	2	7,14%	28,57%	6	10,91%	50,00%	0	0,00%	0,00%
Journalists / media	3	8,33%	37,50%	4	14,29%	57,14%	6	10,91%	50,00%	1	20,00%	100,00%
Politicians / political parties	2	5,56%	25,00%	4	14,29%	57,14%	2	3,64%	16,67%	0	0,00%	0,00%
Organic farmers and their associations	2	5,56%	25,00%	4	14,29%	57,14%	4	7,27%	33,33%	0	0,00%	0,00%
Agricultural and food industries	3	8,33%	37,50%	1	3,57%	14,29%	4	7,27%	33,33%	0	0,00%	0,00%
Consumer organisations	3	8,33%	37,50%	0	0,00%	0,00%	3	5,45%	25,00%	1	20,00%	100,00%
Conventional farmers and their associations	2	5,56%	25,00%	1	3,57%	14,29%	4	7,27%	33,33%	0	0,00%	0,00%
National offices / authorities	3	8,33%	37,50%	0	0,00%	0,00%	1	1,82%	8,33%	1	20,00%	100,00%
European offices / authorities	1	2,78%	12,50%	1	3,57%	14,29%	5	9,09%	41,67%	1	20,00%	100,00%
Others	0	0,00%	0,00%	0	0,00%	0,00%	0	0,00%	0,00%	0	0,00%	0,00%
Total	36	100,00%	450,00%	28	100,00%	400,00%	55	100,00%	458,33%	5	100,00%	500,00%

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2.3 In your opinion, how present are these groups in the public discussion about genome editing in plants in [country]?

	not present / very present / Don't know 0 25 50 75 100
Group 1 selected in 2.2	
Group 2 selected in 2.2	
Group 3 selected in 2.2	
Group 4 selected in 2.2	
Group 5 selected in 2.2	

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	Total		**EU**		**Middle European Countries**		**Non Middle European Countries***	
	frequency	median	frequency	median	frequency	median	frequency	median
Researchers and scientific organisations	65	71,00	1	77,00	38	66,50	25	75,00
Environmental organisations	57	77,00	5	77,00	33	77,00	19	71,00
Seed and plant breeding companies	44	56,50	5	79,00	29	58,00	10	45,00
Journalists / media	42	72,00	4	62,00	24	74,00	13	71,00
Politicians / political parties	28	49,00	2	36,00	18	50,00	8	36,50
Organic farmers and their associations	24	72,50	2	87,00	13	71,00	9	67,00
Agricultural and food industries	21	58,00	1	26,00	13	48,00	7	67,00
Consumer organisations	20	66,50	2	81,50	11	78,00	6	29,50
Conventional farmers and their associations	17	55,00	2	88,50	9	50,00	6	47,00
European offices / authorities	15	31,00	0	0,00	7	26,00	7	31,00
National offices / authorities	14	28,50	0	0,00	9	25,00	4	61,50
Others	0	0,00	0	0,00	0	0,00	0	0,00

*__Non Middle European Countries__ is composed of the values of Northern, Eastern and Southern European Countries

	Northern European Countries		**Eastern European Countries**		**Southern European Countries**		**Others**	
	frequency	median	frequency	median	frequency	median	frequency	median
Researchers and scientific organisations	8	80,00	5	49,00	12	66,00	1	87,00
Environmental organisations	6	68,50	5	52,00	8	77,50	0	0,00
Seed and plant breeding companies	3	93,00	1	25,00	6	39,50	0	0,00
Journalists / media	3	35,00	4	63,50	6	73,50	1	28,00
Politicians / political parties	2	32,50	4	37,00	2	62,00	0	0,00
Organic farmers and their associations	2	63,00	3	49,00	4	71,50	0	0,00
Agricultural and food industries	3	75,00	0	0,00	4	64,00	0	0,00
Consumer organisations	3	35,00	0	0,00	3	16,00	1	69,00
Conventional farmers and their associations	2	64,50	0	0,00	4	35,00	0	0,00
European offices / authorities	1	16,00	1	24,00	5	41,00	1	53,00
National offices / authorities	3	79,00	0	0,00	1	25,00	1	30,00
Others	0	0,00	0	0,00	0	0,00	0	0,00

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3 Information seeking behaviour

3.1

a) Do you inform yourself about genome editing in plants? (Please answer yes even if this happens only occasionally)

	Total		Academia		Consumer Organisations		Environmental Organisations		Journalists		Others*	
	frequency	percent	frequency	percent	frequency	percent	frequency	percent	frequency	percent	frequency	percent
Yes	94	96%	47	100%	8	80%	9	90%	22	96%	8	100%
No	4	4%	0	0%	2	20%	1	10%	1	4%	0	0%
I don't know	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Total	98	100%	47	100%	10	100%	10	100%	23	100%	8	100%

***Others**: industry, regulators/politicians

b) Do you inform yourself about plant breeding? (Please answer yes even if this happens only occasionally)

	Total		Academia		Consumer Organisations		Environmental Organisations		Journalists		Others	
	frequency	percent	frequency	percent	frequency	percent	frequency	percent	frequency	percent	frequency	percent
Yes	0	0,00%	-	-	0	0,00%	0	0,00%	0	0,00%	-	-
No	4	100,00%	-	-	2	100,00%	1	100,00%	1	100,00%	-	-
I don't know	0	0,00%	-	-	0	0,00%	0	0,00%	0	0,00%	-	-
Total	4	100,00%	0	0,00%	2	100,00%	1	100,00%	1	100,00%	0	0,00%

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3.2 Where do you inform yourself about *genome editing in plants*? (multiple answers possible)

	Total (n=94)			Academia (n=47)			Consumer Organisations (n=8)			Environmental Organisations (n=9)			Journalism (n=22)			Others* (n=8)		
	Responses		Cases	Responses		Cases	Responses		Cases	Responses		Cases	Responses		Cases	Responses		Cases
	freq.	percent	percent	freq.	percent	percent	freq.	percent	percent	freq.	percent	percent	freq.	percent	percent	freq.	percent	percent
Conferences, workshops, seminars	65	13,18%	69,15%	34	15,89%	72,34%	6	16,67%	75,00%	8	12,70%	88,89%	10	7,75%	45,45%	7	13,73%	87,50%
Scientific databases / journals and publications	63	12,78%	67,02%	33	15,42%	70,21%	3	8,33%	37,50%	7	11,11%	77,78%	15	11,63%	68,18%	5	9,80%	62,50%
Personal contact with experts	59	11,97%	62,77%	26	12,15%	55,32%	5	13,89%	62,50%	5	7,94%	55,56%	18	13,95%	81,82%	5	9,80%	62,50%
Web pages	47	9,53%	50,00%	21	9,81%	44,68%	3	8,33%	37,50%	8	12,70%	88,89%	8	6,20%	36,36%	7	13,73%	87,50%
Reports, dossiers, fact sheets, brochures	44	8,92%	46,81%	17	7,94%	36,17%	5	13,89%	62,50%	5	7,94%	55,56%	14	10,85%	63,64%	3	5,88%	37,50%
Newspapers / magazines (print/ online)	44	8,92%	46,81%	20	9,35%	42,55%	3	8,33%	37,50%	4	6,35%	44,44%	12	9,30%	54,55%	5	9,80%	62,50%
Trade newspapers (print/ online)	40	8,11%	42,55%	20	9,35%	42,55%	2	5,56%	25,00%	5	7,94%	55,56%	11	8,53%	50,00%	2	3,92%	25,00%
Press releases	29	5,88%	30,85%	8	3,74%	17,02%	3	8,33%	37,50%	5	7,94%	55,56%	11	8,53%	50,00%	2	3,92%	25,00%
Newsletters	23	4,67%	24,47%	7	3,27%	14,89%	1	2,78%	12,50%	5	7,94%	55,56%	5	3,88%	22,73%	5	9,80%	62,50%
Twitter	21	4,26%	22,34%	10	4,67%	21,28%	1	2,78%	12,50%	3	4,76%	33,33%	4	3,10%	18,18%	3	5,88%	37,50%
News portals (e.g. EurekAlert!)	18	3,65%	19,15%	5	2,34%	10,64%	2	5,56%	25,00%	0	0,00%	0,00%	10	7,75%	45,45%	1	1,96%	12,50%
Radio, TV	15	3,04%	15,96%	5	2,34%	10,64%	0	0,00%	0,00%	4	6,35%	44,44%	4	3,10%	18,18%	2	3,92%	25,00%
Blogs	8	1,62%	8,51%	3	1,40%	6,38%	0	0,00%	0,00%	1	1,59%	11,11%	4	3,10%	18,18%	0	0,00%	0,00%
Podcasts	7	1,42%	7,45%	3	1,40%	6,38%	0	0,00%	0,00%	1	1,59%	11,11%	1	0,78%	4,55%	2	3,92%	25,00%
YouTube	5	1,01%	5,32%	2	0,93%	4,26%	0	0,00%	0,00%	1	1,59%	11,11%	1	0,78%	4,55%	1	1,96%	12,50%
Facebook	4	0,81%	4,26%	0	0,00%	0,00%	1	2,78%	12,50%	1	1,59%	11,11%	1	0,78%	4,55%	1	1,96%	12,50%
Others**	1	0,20%	1,06%	0	0,00%	0,00%	1	2,78%	12,50%	0	0,00%	0,00%	0	0,00%	0,00%	0	0,00%	0,00%
Total	493	100,00 %	524,47 %	214	100,00 %	455,32 %	36	100,00 %	450,00 %	63	100,00 %	700,00 %	129	100,00 %	586,36 %	51	100,00 %	637,50 %

***Others**: industry, regulators/politicians; ****Others**: Google, Wikipedia

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3.3 From which groups do you use information on *genome editing in plants*?

	Total (n=93)			Academia (n=47)			Consumer Organisations (n=7)			Environmental Organisations (n=9)			Journalism (n=22)			Others* (n=8)		
	Responses		Cases	Responses		Cases	Responses		Cases	Responses		Cases	Responses		Cases	Responses		Cases
	freq.	percent	percent	freq.	percent	percent	freq.	percent	percent	freq.	percent	percent	freq.	percent	percent	freq.	percent	percent
Researchers and academic organisations	86	24,71%	24,71%	45	35,71%	95,74%	6	18,18%	85,71%	8	16,33%	88,89%	22	23,66%	100,00 %	5	10,64%	62,50%
EFSA	58	16,67%	62,37%	22	17,46%	46,81%	6	18,18%	85,71%	8	16,33%	88,89%	15	16,13%	68,18%	7	14,89%	87,50%
Journalists	36	10,34%	38,71%	16	12,70%	34,04%	0	0,00%	0,00%	4	8,16%	44,44%	11	11,83%	50,00%	5	10,64%	62,50%
Offices/authorities	35	10,06%	37,63%	10	7,94%	21,28%	4	12,12%	57,14%	5	10,20%	55,56%	10	10,75%	45,45%	6	12,77%	75,00%
Seed and plant breeding companies and their associations	33	9,48%	35,48%	13	10,32%	27,66%	0	0,00%	0,00%	3	6,12%	33,33%	11	11,83%	50,00%	6	12,77%	75,00%
Environmental organisations	28	8,05%	30,11%	4	3,17%	8,51%	5	15,15%	71,43%	8	16,33%	88,89%	8	8,60%	36,36%	3	6,38%	37,50%
Agricultural and food industries and their associations	21	6,03%	22,58%	5	3,97%	10,64%	2	6,06%	28,57%	4	8,16%	44,44%	5	5,38%	22,73%	5	10,64%	62,50%
Organic farmers and their associations	17	4,89%	18,28%	3	2,38%	6,38%	2	6,06%	28,57%	5	10,20%	55,56%	4	4,30%	18,18%	3	6,38%	37,50%
Conventional farmers and their associations	16	4,60%	17,20%	4	3,17%	8,51%	2	6,06%	28,57%	2	4,08%	22,22%	4	4,30%	18,18%	4	8,51%	50,00%
Consumer organisations	15	4,31%	16,13%	2	1,59%	4,26%	6	18,18%	85,71%	2	4,08%	22,22%	3	3,23%	13,64%	2	4,26%	25,00%
Others**	3	0,86%	3,23%	2	1,59%	4,26%	0	0,00%	0,00%	0	0,00%	0,00%	0	0,00%	0,00%	1	2,13%	12,50%
Total	348	100,00 %	306,43 %	126	100,00 %	268,09 %	33	100,00 %	471,43 %	49	100,00 %	544,44 %	93	100,00 %	422,73 %	47	100,00 %	587,50 %

***Others**: industry, regulators/politicians**; ****Others**: Master and diploma students, Ethics Council and churches

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4 Communication measures

4.1

a) Do you or your organisation communicate/report at least occasionally about genome editing in plants?

	Total		Academia		Consumer Organisations		Environmental Organisations		Journalists		Others*	
	frequency	percent	frequency	percent	frequency	percent	frequency	percent	frequency	percent	frequency	percent
Yes	81	83,51%	39	82,98%	7	77,78%	8	80,00%	21	91,30%	6	75,00%
No	14	14,43%	7	14,89%	2	22,22%	1	10,00%	2	8,70%	2	25,00%
I don't know	2	2,06%	1	2,13%	0	0,00%	1	10,00%	0	0,00%	0	0,00%
Total	97	100,00%	47	100,00%	9	100,00%	10	100,00%	23	100,00%	8	100,00%

***Others**: industry, regulator/politicians

b) Do you or your organisation communicate/report at least occasionally about plant breeding?

	Total		Academia		Consumer Organisations		Environmental Organisations		Journalists		Others*	
	frequency	percent	frequency	percent	frequency	percent	frequency	percent	frequency	percent	frequency	percent
Yes	4	25,00%	2	25,00%	0	0,00%	1	50,00%	0	0,00%	1	50,00%
No	11	68,75%	6	75,00%	2	100,00%	1	50,00%	1	50,00%	1	50,00%
I don't know	1	6,25%	0	0,00%	0	0,00%	0	0,00%	1	50,00%	0	0,00%
Total	16	100,00%	8	100,00%	2	100,00%	2	100,00%	2	100,00%	2	100,00%

***Others**: industry, regulator/politicians

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4_GE.2 What content is particularly important to you in your communication about/ reporting on genome editing?

	Total (n=77)			Academia (n=35)			Consumer Organisation (n=7)			Environmental Organisation (n=8)			Journalism (n=21)			Others* (n=6)		
	Responses		Cases	Responses		Cases	Responses		Cases	Responses		Cases	Responses		Cases	Responses		Cases
	freq.	percent	percent	freq.	percent	percent	freq.	percent	percent	freq.	percent	percent	freq.	percent	percent	freq.	percent	percent
Scientific evidence	13	9,29%	16,88%	10	16,67%	28,57%	0	0,00%	0,00%	0	0,00%	0,00%	1	2,38%	4,76%	2	22,22%	33,33%
Regulation	13	9,29%	16,88%	2	3,33%	5,71%	3	21,43%	42,86%	4	26,67%	50,00%	3	7,14%	14,29%	1	11,11%	16,67%
Safety	11	7,86%	14,29%	4	6,67%	11,43%	2	14,29%	28,57%	1	6,67%	12,50%	3	7,14%	14,29%	1	11,11%	16,67%
Functionality	11	7,86%	14,29%	6	10,00%	17,14%	0	0,00%	0,00%	0	0,00%	0,00%	5	11,90%	23,81%	0	0,00%	0,00%
Aims of Genome Editing	10	7,14%	12,99%	4	6,67%	11,43%	0	0,00%	0,00%	0	0,00%	0,00%	4	9,52%	19,05%	2	22,22%	33,33%
Joint risks and benefits	8	5,71%	10,39%	3	5,00%	8,57%	0	0,00%	0,00%	2	13,33%	25,00%	3	7,14%	14,29%	0	0,00%	0,00%
Basics of plant breeding	8	5,71%	10,39%	5	8,33%	14,29%	0	0,00%	0,00%	0	0,00%	0,00%	2	4,76%	9,52%	1	11,11%	16,67%
(Technical) advantages	7	5,00%	9,09%	4	6,67%	11,43%	0	0,00%	0,00%	0	0,00%	0,00%	3	7,14%	14,29%	0	0,00%	0,00%
Sustainability	5	3,57%	6,49%	3	5,00%	8,57%	0	0,00%	0,00%	0	0,00%	0,00%	2	4,76%	9,52%	0	0,00%	0,00%
Labelling	5	3,57%	6,49%	0	0,00%	0,00%	3	21,43%	42,86%	1	6,67%	12,50%	1	2,38%	4,76%	0	0,00%	0,00%
Difference to other methods	4	2,86%	5,19%	0	0,00%	0,00%	0	0,00%	0,00%	0	0,00%	0,00%	4	9,52%	19,05%	0	0,00%	0,00%
Old vs new GMO	4	2,86%	5,19%	2	3,33%	5,71%	0	0,00%	0,00%	0	0,00%	0,00%	1	2,38%	4,76%	1	11,11%	16,67%
Applications	4	2,86%	5,19%	3	5,00%	8,57%	0	0,00%	0,00%	0	0,00%	0,00%	1	2,38%	4,76%	0	0,00%	0,00%
Consumer perception	3	2,14%	3,90%	2	3,33%	5,71%	0	0,00%	0,00%	0	0,00%	0,00%	1	2,38%	4,76%	0	0,00%	0,00%
Precautionary principle	2	1,43%	2,60%	0	0,00%	0,00%	1	7,14%	14,29%	1	6,67%	12,50%	0	0,00%	0,00%	0	0,00%	0,00%
Realistic promises	2	1,43%	2,60%	2	3,33%	5,71%	0	0,00%	0,00%	0	0,00%	0,00%	0	0,00%	0,00%	0	0,00%	0,00%
Ethics	2	1,43%	2,60%	1	1,67%	2,86%	0	0,00%	0,00%	1	6,67%	12,50%	0	0,00%	0,00%	0	0,00%	0,00%
Food security	2	1,43%	2,60%	0	0,00%	0,00%	0	0,00%	0,00%	0	0,00%	0,00%	2	4,76%	9,52%	0	0,00%	0,00%
Food quality	2	1,43%	2,60%	1	1,67%	2,86%	0	0,00%	0,00%	0	0,00%	0,00%	1	2,38%	4,76%	0	0,00%	0,00%
Alternatives	2	1,43%	2,60%	0	0,00%	0,00%	0	0,00%	0,00%	0	0,00%	0,00%	2	4,76%	9,52%	0	0,00%	0,00%
Transparency	2	1,43%	2,60%	1	1,67%	2,86%	1	7,14%	14,29%	0	0,00%	0,00%	0	0,00%	0,00%	0	0,00%	0,00%
Patenting	2	1,43%	2,60%	0	0,00%	0,00%	0	0,00%	0,00%	2	13,33%	25,00%	0	0,00%	0,00%	0	0,00%	0,00%
Risk research	2	1,43%	2,60%	1	1,67%	2,86%	1	7,14%	14,29%	0	0,00%	0,00%	0	0,00%	0,00%	0	0,00%	0,00%
Policy discussions	2	1,43%	2,60%	1	1,67%	2,86%	0	0,00%	0,00%	0	0,00%	0,00%	1	2,38%	4,76%	0	0,00%	0,00%
Others**	14	10,00%	18,18%	5	8,33%	14,29%	3	21,43%	42,86%	3	20,00%	37,50%	2	4,76%	9,52%	1	11,11%	16,67%
Total	140	100,00 %	181,82 %	60	100,00 %	171,43 %	14	100,00 %	200,00 %	15	100,00 %	187,50 %	42	100,00 %	200,00 %	9	100,00 %	150,00 %

***Others**: industry, regulators/politicians; ****Others**: see Table 2

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Table 6: What content is particularly important to you in your communication about/reporting on genome editing in plants? (n=77) – verbatims

codes	Verbatims
Scientific evidence	Scientific evidence (transl.) Balance of evidence on potential risks and benefits Numerically proven information (transl.) Scientifically based statements (transl.) Scientific correctness (transl.) Factually correct information (transl.) Scientific (content) (transl.) Scientific content (transl.) Scientific facts Fact-based information (transl.) Scientific evidence Scientifically based statements (transl.) Scientific articles and facts contained therein (transl.)
Regulation	Approval procedure, labelling (transl.) Plant breeding and regulatory Future legislation Example on how European legislation is not helping the European crop breeding sector Regulation of the release of genome-edited plants (transl.) Legislation Threat of deregulation of genetic engineering in agriculture (transl.) Retention of EU legal regulations also in the area of genome editing (transl.) Legal (contents) Difference vs classical transgenic organisms and the current globally deviating GMO def. in EU fair legislation changing legislative environment
Safety	Safety (transl.) Food- and environmental safety Consumer safety (transl.) Safety (transl.) Safety for people, animals and the environment Risk prevention (transl.) Safety (transl.) Safety (transl.) Safety aspects (transl.) Risk assessment How safe is this method? (transl.)
Functionality	Functionality (transl.) Understanding of mechanisms (transl.) Method Education about techniques (transl.) Methods (transl.) Explanation of what it is (transl.) Explanation of how this method works (transl.) Technical (content) (transl.) Molecular aspects and effects on the genome (transl.) Optimal procedure (transl.) The basic science behind genome editing (incl. designer nucleases and CRISPR)

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Aims of GE	Opportunities arising from this for domestic breeding (transl.) Goals to be achieved by genome editing (transl.) Breeding objectives Goal Potentials of genome editing (transl.) The potential of this technology (transl.) The importance of innovation in agriculture (transl.) Research purposes (transl.) Benefit potential of GE crops
Joint risks and benefits	Neutral presentation of advantages and risks of new breeding methods (transl.) Balanced presentation of opportunities and risks (transl.) Opportunities and risks (transl.) Clearly communicating the balance of evidence on potential risks and benefits Description of the risks and opportunities of the technology (transl.) Considering opportunities vs benefits, explaining risks (transl.) Opportunities and risks (transl.) Realistic assessment of the opportunities and limitations of genome editing (transl.)
Basics of plant breeding	Emphasising the need for mutations in the development of cultivated plants (starting with domestication) (transl.) The similarity with natural processes (mutations) Molecular aspects and effects on the genome (transl.) Scientific basics (transl.) Natural evolution, genomic plasticity, molecular mechanisms of mutagenesis (transl.) That humans have adapted crops for thousands of years already History (transl.)
(Technical) advantages	Benefits (transl.) Advantages (transl.) Numerically proven information on the benefits of plants obtained through genome editing (transl.) Benefits (transl.) The broad and fast applicability compared to previous techniques (transl.) Genome editing is an efficient and very precise breeding technology Which is much less drastic than the natural transition (transl.)
Sustainability	Climate protection (transl.) genome editing with the goal of improving the environment (e.a. crops that need less water) relevance for crop breeding in a context of climate change Added value for sustainable agriculture, food quality, adaptation to climate change (transl.) Genome editing is an efficient and very precise breeding technology that allows for the development of an eco-friendly, climate resilient agriculture
Labelling	Labelling (transl.) Labelling Mandatory labelling (transl.) Labelling (transl.) Traceability, labelling
Difference to other methods	Precise differentiation from other cultivated forms (transl.) Comparison with conventional breeding methods (transl.) Difference to conventional breeding methods the broad and fast applicability compared to previous techniques (transl.)
Old vs new GMO	Distinction between „old“ and „new“ genetic engineering (transl.) Genome editing is very different from the 'classical GMOs' Difference between GMO and NBTs (transl.) Difference vs classical transgenic organisms
Applications	Possible applications (transl.) Application, possible uses (transl.) Useful application for plants (transl.) Applicability (transl.)

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Consumer perception	The bias of much of the public regarding the safety of genome editing (transl.) Public perception and acceptance Acceptance of techniques and risk
Precautionary principle	Preservation of the precautionary principle (transl.) Freedom of choice and precautionary principle as high goods that we must preserve at all costs (transl.)
Realistic promises	Realistic assessment of the opportunities and limitations of genome editing (transl.) Do not raise excessive expectations (transl.)
Ethics	Ethical use of genome editing Social and ethical impacts
Food security	Food security (transl.) showing the advantages of gene editing for agriculture and food security
Food quality	showing the advantages of gene editing for agriculture and food security and quality added value for sustainable agriculture, food quality (transl.)
Alternatives	Question whether these goals are achieved and whether genome editing is the right tool (transl.) Possible alternatives
Transparency	Transparency (transl.) Necessity of transparency (transl.)
Patenting	Patenting The associated patents and their problems as well as the resulting concentration of market power in the seed market (transl.)
Risk research	Long-term safety studies (transl.) Risk research (transl.)
Policy discussions	Policy discussions Policy options
Others	Associated risks and side effects in plants and animals (transl.) Competitiveness of the Dutch seed sector Effects of genetic modification of plants (transl.) What is natural- what is unnatural? (transl.) New genetic engineering also manifests wrong agricultural system (transl.) Information to consumers about it Preservation of GMO-free food production (transl.) The entire world is embracing genome editing, making it hard to understand why Europe regulates GE as GMOs Multidisciplinarity (transl.) Global applications (transl.) The research part, which genes are used, which traits are targeted, how is gene expression regulated (transl.) New techniques are just extra tools, with which you can do 'good' and 'bad' things. We need to make the 'good' things possible Genome editing in context History gene modification effects (transl.)

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4_GE.3 Sometimes you don't always think of everything straight away. In the following, we show you different types of communication content: How important is it for you to address these types of content in your communication about/reporting on genome editing in plants?

	Total			Academia			Consumer Organisations			Environmental Organisations			Journalism			Others*		
	freq.	mean	median	freq.	mean	median	freq.	mean	median	freq.	mean	median	freq.	mean	median	freq.	mean	median
Safety	80	4,01	4,00	38	4,00	4,00	7	4,43	5,00	8	4,75	5,00	21	3,57	3,00	6	4,17	4,00
Transparency	80	3,98	4,00	38	3,79	4,00	7	4,57	5,00	8	5,00	5,00	21	3,57	4,00	6	4,50	4,50
Sustainability	80	3,96	4,00	38	4,00	4,00	7	4,00	4,00	8	3,63	3,50	21	3,95	4,00	6	4,17	4,00
Examples of application	79	3,82	4,00	37	4,05	4,00	7	3,43	3,00	8	2,75	2,50	21	3,81	4,00	6	4,33	4,50
Regulation	79	3,76	4,00	37	3,54	3,00	7	4,43	4,00	8	4,88	5,00	21	3,38	3,00	6	4,17	4,00
Use in the breeding process	80	3,69	4,00	38	3,92	4,00	7	3,57	3,00	8	2,88	3,00	21	3,48	4,00	6	4,17	4,00
Climate change	80	3,58	4,00	38	3,66	4,00	7	3,29	3,00	8	2,63	2,50	21	3,67	3,00	6	4,33	4,50
Technological developments	80	3,56	4,00	38	3,61	4,00	7	3,71	4,00	8	2,50	2,00	21	3,62	4,00	6	4,33	4,50
Functionality	80	3,46	3,50	38	3,47	4,00	7	3,43	3,00	8	3,38	3,00	21	3,52	4,00	6	3,33	3,00
Basics of plant breeding	80	3,45	3,00	38	3,53	3,50	7	3,29	3,00	8	3,13	3,00	21	3,33	3,00	6	4,00	4,00
Sufficient agricultural yield	80	3,39	3,00	38	3,53	4,00	7	3,29	3,00	8	2,50	2,50	21	3,29	3,00	6	4,17	4,00
Farming methods	80	3,26	3,00	38	3,03	3,00	7	3,29	3,00	8	3,88	4,00	21	3,24	3,00	6	4,00	4,00
Nutritional quality of food	80	3,09	3,00	38	3,18	3,00	7	3,29	3,00	8	2,63	2,50	21	2,81	3,00	6	3,83	3,50
Labelling	80	2,98	3,00	38	2,63	2,00	7	4,43	5,00	8	5,00	5,00	21	2,38	2,00	6	2,83	3,00
Patenting	80	2,86	3,00	38	2,63	3,00	7	3,57	4,00	8	4,25	4,50	21	2,52	3,00	6	2,83	2,50

***Others**: industry, regulators/politicians

Likert scale: 1= not important at all, 2=less important, 3=important, 4= very important, 5= extremely important

Transparency:	Public access to information on the application and funding of genome editing in plants
Safety:	Environmental and / or food safety assessment when using genome editing in plants
Regulation:	Regulation of plants bred through the use of genome editing
Use in the breeding process:	Potential application of genome editing in the different phases of the breeding process and its limitation
Technological developments:	Innovations related to the application of genome editing in plants
Functionality:	Illustration of the mechanisms of genome editing in plants
Basics of plant breeding:	Explanation of the biological processes and procedures on which plant breeding is based
Farming methods:	Farming methods for a future-orientated European agriculture
Labelling:	Labelling of genome-edited plants and the products processed from them
Patenting:	Protection of intellectual property in the application of genome editing in plants

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	Total			EU			Middle European Countries			Non Middle European Countries*		
	frequency	mean	median	frequency	mean	median	frequency	mean	median	frequency	mean	median
Safety	80	4,01	4,00	4	4,25	4,50	46	3,85	4,00	27	4,26	4,00
Transparency	80	3,98	4,00	4	3,75	3,50	46	3,96	4,00	27	3,93	4,00
Sustainability	80	3,96	4,00	4	4,25	4,50	46	3,83	4,00	27	4,11	4,00
Examples of application	79	3,82	4,00	4	4,00	4,00	46	3,85	4,00	26	3,81	4,00
Regulation	79	3,76	4,00	4	2,75	3,00	46	3,72	4,00	26	3,96	4,00
Use in the breeding process	80	3,69	4,00	4	4,25	4,00	46	3,48	4,00	27	3,96	4,00
Climate change	80	3,58	4,00	4	4,50	4,50	46	3,33	3,00	27	3,78	4,00
Technological developments	80	3,56	4,00	4	4,00	4,50	46	3,43	4,00	27	3,74	4,00
Functionality	80	3,46	3,50	4	3,00	3,00	46	3,41	3,00	27	3,59	4,00
Basics of plant breeding	80	3,45	3,00	4	3,75	4,00	46	3,43	3,00	27	3,41	3,00
Sufficient agricultural yield	80	3,39	3,00	4	4,25	4,00	46	3,13	3,00	27	3,78	4,00
Farming methods	80	3,26	3,00	4	3,50	3,50	46	3,37	3,00	27	3,11	3,00
Nutritional quality of food	80	3,09	3,00	4	3,75	4,00	46	2,89	3,00	27	3,30	3,00
Labelling	80	2,98	3,00	4	2,00	2,00	46	3,04	2,50	27	2,85	3,00
Patenting	80	2,86	3,00	4	2,25	2,00	46	2,85	3,00	27	2,93	3,00

***Non Middle European Countries** is composed of the values of Northern, Eastern and Southern European Countries

	Northern European Countries			Eastern European Countries			Southern European Countries			Others		
	frequency	mean	median	frequency	mean	median	frequency	mean	median	frequency	mean	median
Safety	8	4,25	4,00	8	4,25	4,00	11	4,27	5,00	3	4,00	4,00
Transparency	8	4,50	4,50	8	3,38	3,00	11	3,91	4,00	3	5,00	5,00
Sustainability	8	4,38	4,00	8	3,88	4,00	11	4,09	4,00	3	4,33	4,00
Examples of application	7	3,86	4,00	8	3,75	4,00	11	3,82	4,00	3	3,33	3,00
Regulation	8	4,25	4,50	7	3,57	4,00	11	4,00	4,00	3	4,00	5,00
Use in the breeding process	8	3,50	3,00	8	3,75	4,00	11	4,45	5,00	3	3,67	3,00
Climate change	8	3,63	3,50	8	3,63	4,00	11	4,00	4,00	3	4,33	4,00
Technological developments	8	3,50	3,50	8	3,88	4,00	11	3,82	4,00	3	3,33	3,00
Functionality	8	3,13	3,00	8	4,00	4,00	11	3,64	4,00	3	3,67	4,00
Basics of plant breeding	8	3,13	3,00	8	3,25	3,00	11	3,73	4,00	3	3,67	3,00
Sufficient agricultural yield	8	3,38	3,50	8	4,00	4,00	11	3,91	4,00	3	2,67	3,00
Farming methods	8	3,25	3,00	8	3,13	3,00	11	3,00	3,00	3	2,67	3,00
Nutritional quality of food	8	3,13	3,00	8	3,63	4,00	11	3,18	3,00	3	3,33	3,00
Labelling	8	3,38	3,50	8	2,50	3,00	11	2,73	2,00	3	4,33	5,00
Patenting	8	2,75	2,50	8	2,88	3,00	11	3,09	3,00	3	3,33	3,00

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Likert scale: 1= not important at all, 2=less important, 3=important, 4= very important, 5= extremely important

Transparency:	Public access to information on the application and funding of genome editing in plants
Safety:	Environmental and / or food safety assessment when using genome editing in plants
Regulation:	Regulation of plants bred through the use of genome editing
Use in the breeding process:	Potential application of genome editing in the different phases of the breeding process and its limitation
Technological developments:	Innovations related to the application of genome editing in plants
Functionality:	Illustration of the mechanisms of genome editing in plants
Basics of plant breeding:	Explanation of the biological processes and procedures on which plant breeding is based
Farming methods:	Farming methods for a future-orientated European agriculture
Labelling:	Labelling of genome-edited plants and the products processed from them
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4_GE.4 Please briefly describe how you address the issue of sustainability in your communication about/reporting on genome editing in plants:

	Total	
	frequency	percent
Answered	49	61,25%
Not answered	31	38,75%
Total	80	100,00%

	Total		Academia		Consumer Organisations		Environmental Organisations		Journalists		Others*	
	frequency	percent	frequency	percent	frequency	percent	frequency	percent	frequency	percent	frequency	percent
Supporting argumentation	30	61,22%	15	75,00%	0	0,00%	0	0,00%	10	71,43%	5	83,33%
Rejecting argumentation	3	6,12%	1	5,00%	0	0,00%	2	50,00%	0	0,00%	0	0,00%
Neutral argumentation	16	32,65%	4	20,00%	5	100,00%	2	50,00%	4	28,57%	1	16,67%
Total	49	100,00%	20	100,00%	5	100,00%	4	100,00%	14	100,00%	6	100,00%

***Others**: industry, regulators/politicians

Overcode	Undercode	Frequency	Percent
Supportive addressing of Genome Editing in the context of Sustainability (n=30)	Use of chemicals (e.g. pesticides)	18	29,5%
	Use of natural resources (e.g. water, land)	12	19,7%
	Plant adaption to biotic and abiotic stresses	9	14,8%
	Food security	6	9,8%
	Sustainable agriculture and food system	7	11,5%
	Long term effects on the whole system	2	3,3%
	Political aspects (e.g. Sustainable Development Goals, regulation)	1	1,6%
	Reference to organic agriculture	2	3,3%
	Others	4	6,6%
	Total	**61**	**100%**
Rejective addressing of Genome Editing in the context of Sustainability (n=3)	Use of chemicals (e.g. pesticides)	0	0,0%
	Use of natural resources (e.g. water, land)	0	0,0%
	Plant adaption to biotic and abiotic stresses	0	0,0%
	Food security	0	0,0%
	Sustainable agriculture and food system	0	0,0%
	Long term effects on the whole system	0	0,0%
	Political aspects (e.g. Sustainable Development Goals, regulation)	0	0,0%
	Reference to organic agriculture	2	50,0%
	Others	2	50,0%
	Total	**4**	**100%**
Neutral addressing of Genome Editing in the context of Sustainability (n=16)	Use of chemicals (e.g. pesticides)	3	11,5%
	Use of natural resources (e.g. water, land)	3	11,5%
	Plant adaption to biotic and abiotic stresses	2	7,7%
	Food security	4	15,4%
	Sustainable agriculture and food system	1	3,8%
	Long term effects on the whole system	5	19,2%
	Political aspects (e.g. Sustainable Development Goals, regulation)	3	11,5%
	Reference to organic agriculture	0	0,0%
	Others	5	19,2%
	Total	**26**	**100%**

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4_GE.5 Please briefly describe how you address the issue of nutritional quality of food in your communication about/reporting on genome editing in plants:

	Total	
	frequency	percent
Answered	23	28,75%
Not answered	57	71,25%
Total	80	100,00%

	Total*		Academia		Consumer Organisations		Environmental Organisations		Journalists		Others**	
	frequency	percent	frequency	percent	frequency	percent	frequency	percent	frequency	percent	frequency	percent
Supporting argumentation	15	71,43%	10	100,00%	2	100,00%	0	0,00%	1	20,00%	2	100,00%
Rejecting argumentation	2	9,52%	0	0,00%	0	0,00%	2	100,00%	0	0,00%	0	0,00%
Neutral argumentation	4	19,05%	0	0,00%	0	0,00%	0	0,00%	4	80,00%	0	0,00%
Total	21	100,00%	10	100,00%	2	100,00%	2	100,00%	5	100,00%	2	100,00%

***Total**: 2 answers (Academia, Consumer Organisations) were considered invalid as they stated not to address the issue of nutritional quality in food at all; ****Others**: industry, regulators/politicians

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Overcode	Undercode	Frequency	Percent
Supportive addressing of Genome Editing in the context of nutritional quality (n=15)	Increase of beneficial ingredients (e.g. essential amino acids, antioxigens, vitamins)	10	43,5%
	Decrease of harmful ingredients (e.g. less allergens)	6	26,1%
	Altered composition	0	0,0%
	Reference to organic agriculture	2	8,7%
	Economic aspects	2	8,7%
	Others	3	13,0%
	Total	**23**	**100%**
Rejective addressing of Genome Editing in the context of nutritional quality (n=2)	Increase of beneficial ingredients (e.g. essential amino acids, antioxigens, vitamins)	0	0,0%
	Decrease of harmful ingredients (e.g. less allergens)	0	0,0%
	Altered composition	1	50,0%
	Reference to organic agriculture	1	50,0%
	Economic aspects	0	0,0%
	Others	0	0,0%
	Total	**2**	**100%**
Neutral addressing of Genome Editing in the context of nutritional quality (n=4)	Increase of beneficial ingredients (e.g. essential amino acids, antioxigens, vitamins)	2	33,3%
	Decrease of harmful ingredients (e.g. less allergens)	0	0,0%
	Altered composition	2	33,3%
	Reference to organic agriculture	0	0,0%
	Economic aspects	0	0,0%
	Others	2	33,3%
	Total	**6**	**100%**

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4_GE.6 Please briefly describe how you address the issue of agricultural yields in your communication about/reporting on genome editing in plants:

	Total	
	frequency	percent
Answered	32	40,00%
Not answered	48	60,00%
Total	80	100,00%

	Total*		Academia		Consumer Organisations		Environmental Organisations		Journalists		Others**	
	frequency	percent	frequency	percent	frequency	percent	frequency	percent	frequency	percent	frequency	percent
Supporting argumentation	23	79,31%	14	93,33%	2	100,00%	-	-	5	62,50%	2	50,00%
Rejecting argumentation	0	0,00%	0	0,00%	0	0,00%	-	-	0	0,00%	0	0,00%
Neutral argumentation	6	20,69%	1	6,67%	0	0,00%	-	-	3	37,50%	2	50,00%
Total	29	100,00%	15	100,00%	2	100,00%	0	0,00%	8	100,00%	4	100,00%

***Total**: 3 answers (2 Academia, Consumer Organisations) were considered invalid as they stated not to address the issue of agricultural yield at all; ****Others**: industry, regulators/politicians

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Overcode	Undercode	Frequency	Percent
Supportive addressing of Genome Editing in the context of agricultural yield (n=23)	More stable and optimized yield	7	22,6%
	Land use	7	22,6%
	Contribution to a sustainable system	3	9,7%
	Environmental impact of agriculture	3	9,7%
	Economic aspects	3	9,7%
	Time use of cultivating adopted plants	1	3,2%
	Food security	2	6,5%
	Others	5	16,1%
	Total	**31**	**100%**
Rejective addressing of Genome Editing in the context of agricultural yield (n=0)	More stable and optimized yield		
	Land use	-	-
	Contribution to a sustainable system	-	-
	Environmental impact of agriculture	-	-
	Economic aspects	-	-
	Time use of cultivating adopted plants	-	-
	Food security	-	-
	Others	-	-
	Total	**-**	**-**
Neutral addressing of Genome Editing in the context of agricultural yield (n=6)	More stable and optimized yield	2	25,0%
	Land use	1	12,5%
	Contribution to a sustainable system	1	12,5%
	Environmental impact of agriculture	1	12,5%
	Economic aspects	1	12,5%
	Time use of cultivating adopted plants	1	12,5%
	Food security	0	0,0%
	Others	1	12,5%
	Total	**8**	**100%**

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4_GE.7 Who are your main target groups when communicating about genome editing in plants? (maximum 3)

Question only presented Academia, Environmental organisations, consumer organisations

	Total (n=56)			Academia (n=36)			Consumer Organisations (n=7)			Environmental Organisations (n=8)			Others* (n=5)		
	Responses		Cases	Responses		Cases	Responses		Cases	Responses		Cases	Responses		Cases
	freq.	percent	percent	freq.	percent	percent	freq.	percent	percent	freq.	percent	percent	freq.	percent	percent
Consumers/ general population	33	21,57%	58,93%	20	21,74%	55,56%	2	9,52%	28,57%	8	33,33%	100,00%	3	18,75%	60,00%
Journalists/ media	28	18,30%	50,00%	17	18,48%	47,22%	3	14,29%	42,86%	5	20,83%	62,50%	3	18,75%	60,00%
National politicians/ political parties	22	14,38%	39,29%	11	11,96%	30,56%	3	14,29%	42,86%	5	20,83%	62,50%	3	18,75%	60,00%
Researchers and scientific organisations	17	11,11%	30,36%	15	16,30%	41,67%	0	0,00%	0,00%	0	0,00%	0,00%	2	12,50%	40,00%
National offices/ authorities	12	7,84%	21,43%	4	4,35%	11,11%	3	14,29%	42,86%	2	8,33%	25,00%	3	18,75%	60,00%
European politicians/ political parties	8	5,23%	14,29%	4	4,35%	11,11%	1	4,76%	14,29%	2	8,33%	25,00%	1	6,25%	20,00%
Consumer Organisations	7	4,58%	12,50%	1	1,09%	2,78%	5	23,81%	71,43%	1	4,17%	12,50%	0	0,00%	0,00%
European offices/ authorities	7	4,58%	12,50%	4	4,35%	11,11%	3	14,29%	42,86%	0	0,00%	0,00%	0	0,00%	0,00%
Agricultural and food companies/ associations	7	4,58%	12,50%	5	5,43%	13,89%	1	4,76%	14,29%	0	0,00%	0,00%	1	6,25%	20,00%
Conventional farmers and their associations	3	1,96%	5,36%	3	3,26%	8,33%	0	0,00%	0,00%	0	0,00%	0,00%	0	0,00%	0,00%
Seed and plant breeding companies/ associations	2	1,31%	3,57%	2	2,17%	5,56%	0	0,00%	0,00%	0	0,00%	0,00%	0	0,00%	0,00%
Organic farmers and their associations	2	1,31%	3,57%	2	2,17%	5,56%	0	0,00%	0,00%	0	0,00%	0,00%	0	0,00%	0,00%
Environmental Organisations	1	0,65%	1,79%	0	0,00%	0,00%	0	0,00%	0,00%	1	4,17%	12,50%	0	0,00%	0,00%
Others**	4	2,61%	7,14%	4	4,35%	11,11%	0	0,00%	0,00%	0	0,00%	0,00%	0	0,00%	0,00%
Total	153	100,00 %	273,21%	92	100,00%	255,56%	21	100,00%	300,00%	24	100,00%	300,00%	16	100,00 %	320,00%

***Others**: industry, regulators/politicians; ****Others**: students (from different disciplines), science teachers, schools, and young people

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4_GE.8 Which formats and channels do you use to reach your target group(s)? *(target groups named in previous question)*

Question only presented Academia, Environmental organisations, consumer organisations

	People (n=29)			Journalists (n=27)			National politicians / parties (n=18)			Researchers (n=16)			National offices / authorities (n=10)			Agribusiness companies* (n=7)		
	Responses		Cases	Responses		Cases	Responses		Cases	Responses		Cases	Responses		Cases	Responses		Cases
	freq.	percent	percent	freq.	percent	percent	freq.	percent	percent	freq.	percent	percent	freq.	percent	percent	freq.	percent	percent
Discussion events	18	11,32%	62,07%	14	9,33%	51,85%	13	11,71%	72,22%	5	6,58%	31,25%	8	12,70%	80,00%	5	17,86%	71,43%
Conferences, work-shops, seminars	11	6,92%	37,93%	6	4,00%	22,22%	10	9,01%	55,56%	11	14,47%	68,75%	9	14,29%	90,00%	6	21,43%	85,71%
Personal contacts	14	8,81%	48,28%	13	8,67%	48,15%	13	11,71%	72,22%	9	11,84%	56,25%	7	11,11%	70,00%	2	7,14%	28,57%
Reports, dossiers, brochures	12	7,55%	41,38%	10	6,67%	37,04%	13	11,71%	72,22%	7	9,21%	43,75%	9	14,29%	90,00%	4	14,29%	57,14%
Web pages	17	10,69%	58,62%	14	9,33%	51,85%	9	8,11%	50,00%	6	7,89%	37,50%	4	6,35%	40,00%	1	3,57%	14,29%
Twitter	14	8,81%	48,28%	9	6,00%	33,33%	7	6,31%	38,89%	8	10,53%	50,00%	5	7,94%	50,00%	3	10,71%	42,86%
Press releases	7	4,40%	24,14%	19	12,67%	70,37%	11	9,91%	61,11%	0	0,00%	0,00%	3	4,76%	30,00%	1	3,57%	14,29%
Newspapers / magazines	16	10,06%	55,17%	12	8,00%	44,44%	7	6,31%	38,89%	1	1,32%	6,25%	3	4,76%	30,00%	1	3,57%	14,29%
Scientific publications	2	1,26%	6,90%	8	5,33%	29,63%	4	3,60%	22,22%	11	14,47%	68,75%	4	6,35%	40,00%	1	3,57%	14,29%
Newsletters	9	5,66%	31,03%	8	5,33%	29,63%	5	4,50%	27,78%	4	5,26%	25,00%	3	4,76%	30,00%	1	3,57%	14,29%
Trade newspapers	4	2,52%	13,79%	6	4,00%	22,22%	6	5,41%	33,33%	4	5,26%	25,00%	3	4,76%	30,00%	1	3,57%	14,29%
Facebook	7	4,40%	24,14%	6	4,00%	22,22%	3	2,70%	16,67%	3	3,95%	18,75%	2	3,17%	20,00%	1	3,57%	14,29%
Radio, TV	9	5,66%	31,03%	5	3,33%	18,52%	3	2,70%	16,67%	1	1,32%	6,25%	2	3,17%	20,00%	0	0,00%	0,00%
Members maga-zines	4	2,52%	13,79%	5	3,33%	18,52%	2	1,80%	11,11%	2	2,63%	12,50%	1	1,59%	10,00%	1	3,57%	14,29%
Blogs	7	4,40%	24,14%	4	2,67%	14,81%	1	0,90%	5,56%	1	1,32%	6,25%	0	0,00%	0,00%	0	0,00%	0,00%
YouTube	4	2,52%	13,79%	6	4,00%	22,22%	2	1,80%	11,11%	1	1,32%	6,25%	0	0,00%	0,00%	0	0,00%	0,00%
Podcasts	2	1,26%	6,90%	5	3,33%	18,52%	2	1,80%	11,11%	1	1,32%	6,25%	0	0,00%	0,00%	0	0,00%	0,00%
Others**	2	1,26%	6,90%	0	0,00%	0,00%	0	0,00%	0,00%	1	1,30%	6,30%	0	0,00%	0,00%	0	0,00%	0,00%
Total	159	100,00%	548,28%	150	100,00%	555,56%	111	100,00%	616,67%	76	99,98%	475,05%	63	100,00%	630,00%	28	100,00%	400,00%

***Agribusiness companies (n=7)** is composed of Agricultural and food industries (n=5), and Seed and plant breeding companies (n=2); ****Others**: Instagram

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	European politicians / parties (n=7)			**Consumer Organisations (n=6)**			**European offices / authorities (n=5)**			**Organic and conventional Farmers*** (n=5)**			**Environmental Organisations (n=1)**		
	Responses		Cases	Responses		Cases	Responses		Cases	Responses		Cases	Responses		Cases
	freq.	percent	percent	freq.	percent	percent	freq.	percent	percent	freq.	percent	percent	freq.	percent	percent
Discussion events	4	16,00%	57,14%	4	12,12%	66,67%	2	10,53%	40,00%	1	3,33%	20,00%	0	0,00%	0,00%
Conferences, workshops, seminars	4	16,00%	57,14%	3	9,09%	50,00%	3	15,79%	60,00%	5	16,67%	100,00%	1	14,29%	100,00%
Personal contacts	3	12,00%	42,86%	2	6,06%	33,33%	1	5,26%	20,00%	3	10,00%	60,00%	1	14,29%	100,00%
Reports, dossiers, brochures	5	20,00%	71,43%	0	0,00%	0,00%	5	26,32%	100,00%	3	10,00%	60,00%	0	0,00%	0,00%
Web pages	1	4,00%	14,29%	2	6,06%	33,33%	1	5,26%	20,00%	3	10,00%	60,00%	0	0,00%	0,00%
Twitter	4	16,00%	57,14%	4	12,12%	66,67%	3	15,79%	60,00%	0	0,00%	0,00%	0	0,00%	0,00%
Press releases	3	12,00%	42,86%	3	9,09%	50,00%	2	10,53%	40,00%	1	3,33%	20,00%	0	0,00%	0,00%
Newspapers / magazines	0	0,00%	0,00%	2	6,06%	33,33%	1	5,26%	20,00%	2	6,67%	40,00%	0	0,00%	0,00%
Scientific publications	0	0,00%	0,00%	0	0,00%	0,00%	1	5,26%	20,00%	0	0,00%	0,00%	1	14,29%	100,00%
Newsletters	0	0,00%	0,00%	1	3,03%	16,67%	0	0,00%	0,00%	0	0,00%	0,00%	1	14,29%	100,00%
Trade newspapers	0	0,00%	0,00%	2	6,06%	33,33%	0	0,00%	0,00%	3	10,00%	60,00%	1	14,29%	100,00%
Facebook	0	0,00%	0,00%	3	9,09%	50,00%	0	0,00%	0,00%	3	10,00%	60,00%	0	0,00%	0,00%
Radio, TV	0	0,00%	0,00%	1	3,03%	16,67%	0	0,00%	0,00%	0	0,00%	0,00%	0	0,00%	0,00%
Members magazines	1	4,00%	14,29%	3	9,09%	50,00%	0	0,00%	0,00%	0	0,00%	0,00%	1	14,29%	100,00%
Blogs	0	0,00%	0,00%	1	3,03%	16,67%	0	0,00%	0,00%	2	6,67%	40,00%	0	0,00%	0,00%
YouTube	0	0,00%	0,00%	1	3,03%	16,67%	0	0,00%	0,00%	2	6,67%	40,00%	0	0,00%	0,00%
Podcasts	0	0,00%	0,00%	1	3,03%	16,67%	0	0,00%	0,00%	2	6,67%	40,00%	1	14,29%	100,00%
Others	0	0,00%	0,00%	0	0,00%	0,00%	0	0,00%	0,00%	0	0,00%	0,00%	0	0,00%	0,00%
Total	25	100,00%	357,14%	33	100,00%	550,00%	19	100,00%	380,00%	30	100,00%	600,00%	7	100,00%	700,00%

***Organic and conventional farmers (n=5)** is composed of Conventional Farmers (n=3), and Organic farmers (n=2)

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Division of the categories Agribusiness companies* (n=7) and Organic and conventional farmers (n=5)**

	*Agricultural and food industries (n=5)			*Seed and plant breeding companies (n=2)			**Conventional Farmers (n=3)			**Organic Farmers (n=2)		
	Responses		Cases	Responses		Cases	Responses		Cases	Responses		Cases
	freq.	percent	percent	freq.	percent	percent	freq.	percent	percent	freq.	percent	percent
Discussion events	4	19,05%	80,00%	1	14,29%	50,00%	1	5,88%	33,33%	0	0,00%	0,00%
Conferences, workshops, seminars	5	23,81%	100,00%	1	14,29%	50,00%	3	17,65%	100,00%	2	15,38%	100,00%
Personal contacts	1	4,76%	20,00%	1	14,29%	50,00%	1	5,88%	33,33%	2	15,38%	100,00%
Reports, dossiers, brochures	2	9,52%	40,00%	2	28,57%	100,00%	1	5,88%	33,33%	2	15,38%	100,00%
Web pages	1	4,76%	20,00%	0	0,00%	0,00%	2	11,76%	66,67%	1	7,69%	50,00%
Twitter	3	14,29%	60,00%	0	0,00%	0,00%	0	0,00%	0,00%	0	0,00%	0,00%
Press releases	1	4,76%	20,00%	0	0,00%	0,00%	1	5,88%	33,33%	0	0,00%	0,00%
Newspapers / magazines	1	4,76%	20,00%	0	0,00%	0,00%	1	5,88%	33,33%	1	7,69%	50,00%
Scientific publications	0	0,00%	0,00%	1	14,29%	50,00%	0	0,00%	0,00%	0	0,00%	0,00%
Newsletters	1	4,76%	20,00%	0	0,00%	0,00%	0	0,00%	0,00%	0	0,00%	0,00%
Trade newspapers	1	4,76%	20,00%	0	0,00%	0,00%	2	11,76%	66,67%	1	7,69%	50,00%
Facebook	1	4,76%	20,00%	0	0,00%	0,00%	2	11,76%	66,67%	1	7,69%	50,00%
Radio, TV	0	0,00%	0,00%	0	0,00%	0,00%	0	0,00%	0,00%	0	0,00%	0,00%
Members magazines	0	0,00%	0,00%	1	14,29%	50,00%	0	0,00%	0,00%	0	0,00%	0,00%
Blogs	0	0,00%	0,00%	0	0,00%	0,00%	1	5,88%	33,33%	1	7,69%	50,00%
YouTube	0	0,00%	0,00%	0	0,00%	0,00%	1	5,88%	33,33%	1	7,69%	50,00%
Podcasts	0	0,00%	0,00%	0	0,00%	0,00%	1	5,88%	33,33%	1	7,69%	50,00%
Others	0	0,00%	0,00%	0	0,00%	0,00%	0	0,00%	0,00%	0	0,00%	0,00%
Total	21	100,00%	420,00%	7	100,00%	350,00%	17	100,00%	566,67%	13	100,00%	650,00%

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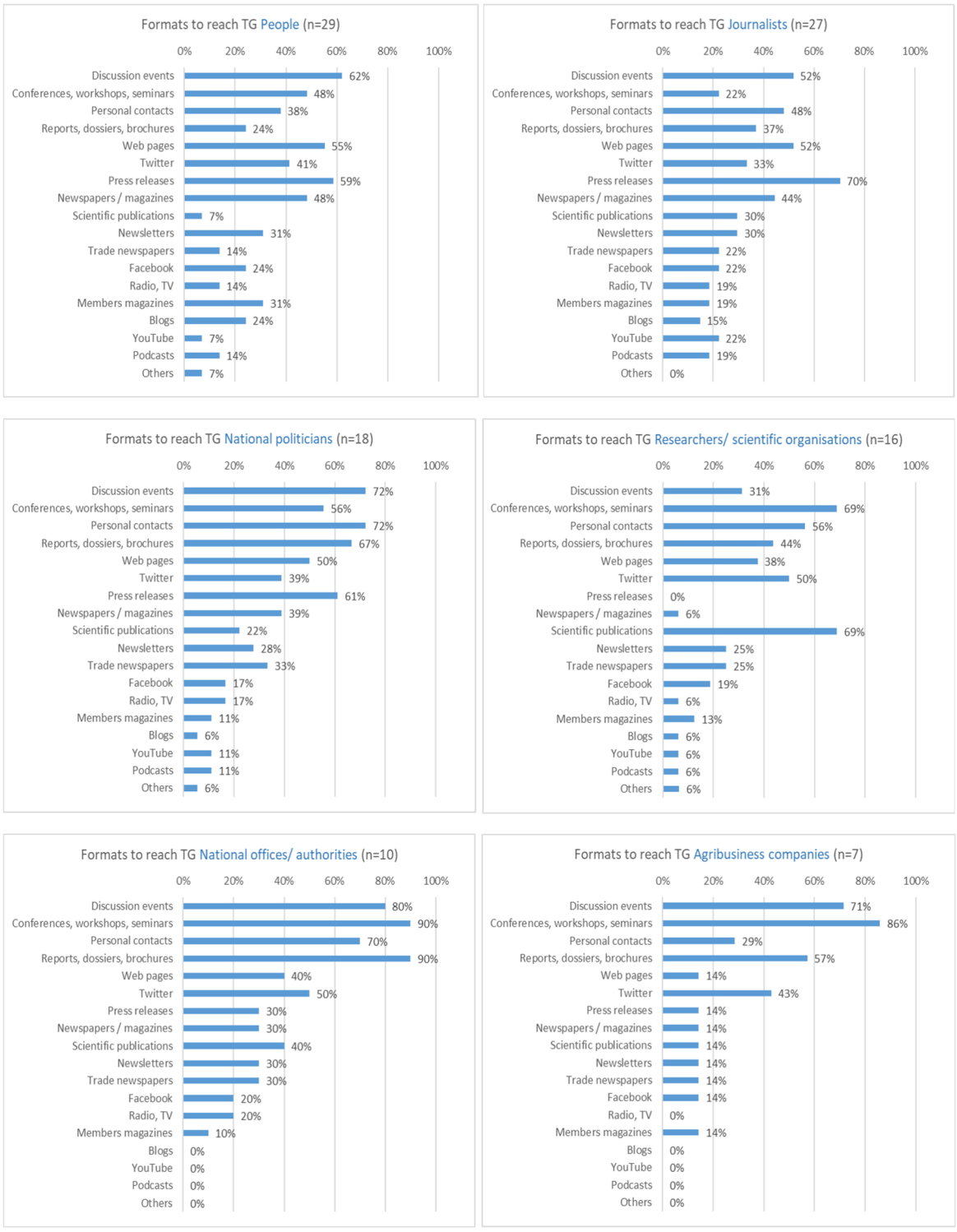

Figure 18: Which formats and channels do you use to reach the target groups? – Target groups: People, journalists, national politicians, researchers/ scientific organisations, national offices/ authorities, Agribusiness companies- (% of respondents)

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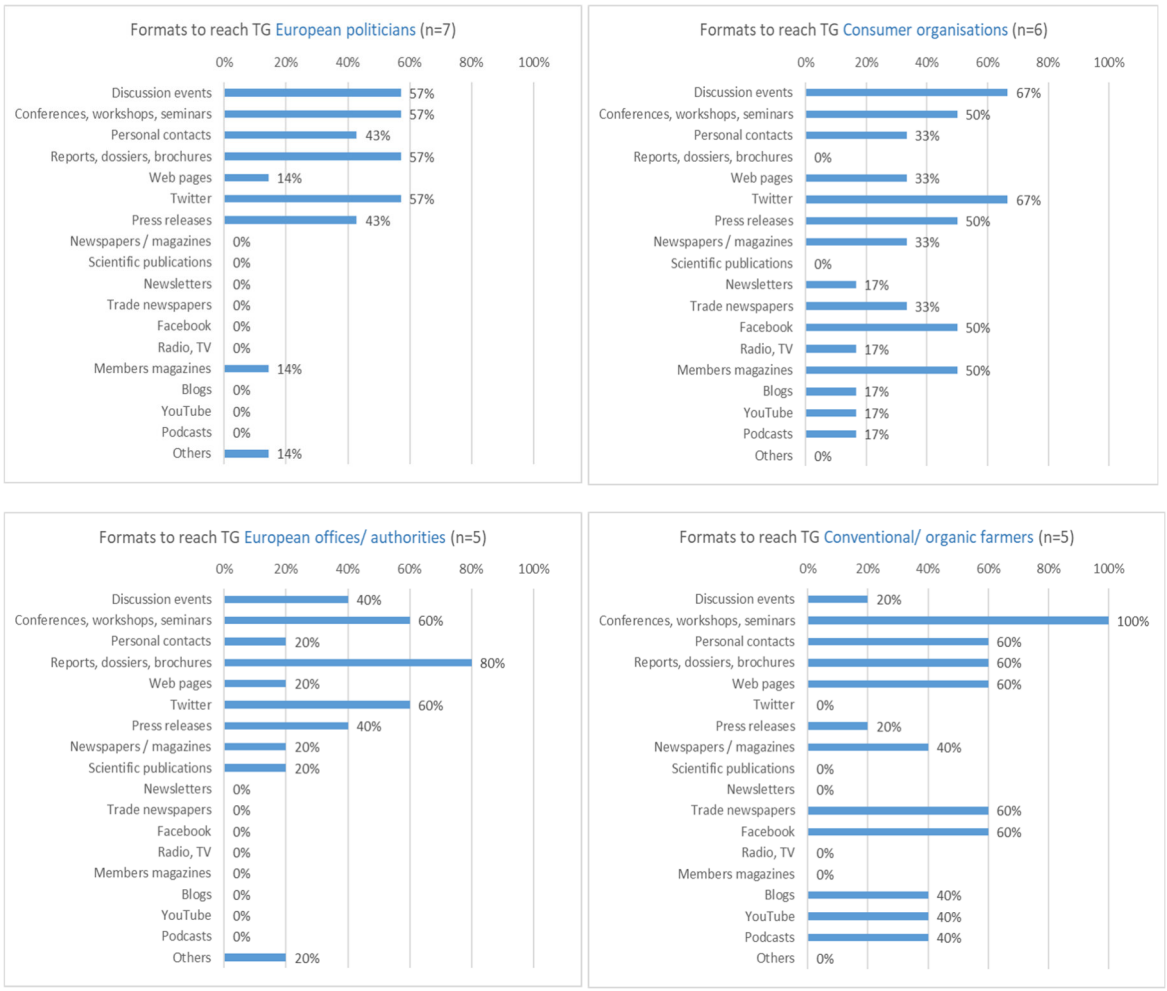

Figure 19: Which formats and channels do you use to reach your target groups? –European politicians, consumer organisations, European offices/ authorities, conventional/ organic farmers- (% of respondents)

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4_GE.7 In which media do you report at least occasionally about genome editing in plants?
(multiple answers possible)

Question only presented to journalists

	Total (n=20)		
	Responses		Cases
	frequency	percent	percent
Online portals	7	17,50%	35,00%
Trade newspaper	6	15,00%	30,00%
Daily newspaper	5	12,50%	25,00%
Radio	4	10,00%	20,00%
Online magazines	4	10,00%	20,00%
TV	3	7,50%	15,00%
Monthly newspaper	3	7,50%	15,00%
Blogs and blog portals	2	5,00%	10,00%
Weekly newspaper	2	5,00%	10,00%
Facebook	2	5,00%	10,00%
Twitter	2	5,00%	10,00%
Podcasts	0	0,00%	0,00%
Instagram	0	0,00%	0,00%
YouTube	0	0,00%	0,00%
Others	0	0,00%	0,00%
Total	40	100,00%	200,00%

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Communication about plant breeding

4_PZ.2 How important is it for you to address the following contents in your communication about/reporting on plant breeding?

	Total			Academia			Consumer Organisations			Environmental Organisations			Journalists			Others*		
	freq.	mean	median	freq.	mean	median	freq.	mean	median	freq.	mean	median	freq.	mean	median	freq.	mean	median
Climate change	4	4,75	5,00	2	5,00	5,00	-	-	-	1	5,00	5,00	-	-	-	1	4,00	4,00
Nutritional quality of food	4	4,00	4,00	2	4,00	4,00	-	-	-	1	4,00	4,00	-	-	-	1	4,00	4,00
Sufficient agricultural yields	4	3,75	4,00	2	4,00	4,00	-	-	-	1	3,00	3,00	-	-	-	1	4,00	4,00
Regulation	4	3,75	3,50	2	3,50	3,50	-	-	-	1	5,00	5,00	-	-	-	1	3,00	3,00
Technological developments	4	3,75	4,00	2	3,50	3,50	-	-	-	1	4,00	4,00	-	-	-	1	4,00	4,00
Farming methods	4	3,75	4,00	2	3,50	3,50	-	-	-	1	4,00	4,00	-	-	-	1	4,00	4,00
Methods of plant breeding	4	3,50	3,50	2	3,50	3,50	-	-	-	1	4,00	4,00	-	-	-	1	3,00	3,00
Safety	3	4,33	4,00	1	5,00	5,00	-	-	-	1	4,00	4,00	-	-	-	1	4,00	4,00
Sustainability	3	4,33	4,00	1	4,00	4,00	-	-	-	1	5,00	5,00	-	-	-	1	4,00	4,00
Transparency	3	4,00	4,00	1	4,00	4,00	-	-	-	1	4,00	4,00	-	-	-	1	4,00	4,00
Basics of plant breeding	3	4,00	4,00	1	5,00	5,00	-	-	-	1	3,00	3,00	-	-	-	1	4,00	4,00
Labelling	3	3,67	4,00	1	4,00	4,00	-	-	-	1	4,00	4,00	-	-	-	1	3,00	3,00

***Others**: regulators/politicians

Likert scale: 1= not important at all, 2=less important, 3=important, 4= very important, 5= extremely important

Safety:	Assessment of the environmental and / or food safety of plant breeding methods
Labelling:	Labelling of new varieties and the products processed from them
Transparency:	Public access to information on the application and funding of plant breeding methods
Farming methods:	Farming methods for a future-orientated European agriculture
Basics of plant breeding:	Explanation of the biological processes and procedures on which plant breeding is based
Technological developments:	Innovations in plant breeding
Regulation:	Regulation of plant breeding and the new crops that result from breeding

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4_PZ.3 Please briefly describe how you address the issue of sustainability in your communication about/reporting on plant breeding:

	Total	
	frequency	percent
Answered	1	33,33%
Not answered	2	66,67%
Total	3	100,00%

Verbatim:

we always try to address sustainable sustainability in all communications that we organize.

4_PZ.4 Please briefly describe how you address the issue of nutritional quality of food in your communication about/reporting on plant breeding:

	Total	
	frequency	percent
Answered	1	25,00%
Not answered	3	75,00%
Total	4	100,00%

Verbatim:

We develop environmental education programmes for students and we try to communicate and aware students about quality food.

4_PZ.5 Please briefly describe how you address the issue of agricultural yields in your communication about/reporting on plant breeding:

	Total	
	frequency	percent
Answered	1	25,00%
Not answered	3	75,00%
Total	4	100,00%

Verbatim:

Variety development only has an impact if the varieties are actually grown. The varieties must therefore provide farmers with an economic return (physical yield x quality-related price - production costs) that is attractive to them.

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4_PZ.6 Who are your main target groups when communicating about plant breeding? (maximum 3)

	Total (n=4)			Academia (n=2)			Consumer Organisations (n=0)			Environmental Organisations (n=1)			Others* (n=1)		
	Responses		Cases	Responses		Cases	Responses		Cases	Responses		Cases	Responses		Cases
	freq.	percent	percent	freq.	percent	percent	freq.	percent	percent	freq.	percent	percent	freq.	percent	percent
Consumers/ general population	2	28,57%	50,00%	1	25,00%	50,00%	-	-	-	1	50,00%	100,00%	0	0,00%	0,00%
Journalists/ media	1	14,29%	25,00%	0	0,00%	0,00%	-	-	-	1	50,00%	100,00%	0	0,00%	0,00%
National politicians/ political parties	0	0,00%	0,00%	0	0,00%	0,00%	-	-	-	0	0,00%	0,00%	0	0,00%	0,00%
Researchers and scientific organisations	0	0,00%	0,00%	0	0,00%	0,00%	-	-	-	0	0,00%	0,00%	0	0,00%	0,00%
National offices/ authorities	0	0,00%	0,00%	0	0,00%	0,00%	-	-	-	0	0,00%	0,00%	0	0,00%	0,00%
European politicians/ political parties	0	0,00%	0,00%	0	0,00%	0,00%	-	-	-	0	0,00%	0,00%	0	0,00%	0,00%
Consumer Organisations	0	0,00%	0,00%	0	0,00%	0,00%	-	-	-	0	0,00%	0,00%	0	0,00%	0,00%
European offices/ authorities	0	0,00%	0,00%	0	0,00%	0,00%	-	-	-	0	0,00%	0,00%	0	0,00%	0,00%
Agricultural and food companies/ associations	0	0,00%	0,00%	0	0,00%	0,00%	-	-	-	0	0,00%	0,00%	0	0,00%	0,00%
Conventional farmers and their associations	2	28,57%	50,00%	1	25,00%	50,00%	-	-	-	0	0,00%	0,00%	1	100,00%	100,00%
Seed and plant breeding companies/ associations	1	14,29%	25,00%	1	25,00%	50,00%	-	-	-	0	0,00%	0,00%	0	0,00%	0,00%
Organic farmers and their associations	0	0,00%	0,00%	0	0,00%	0,00%	-	-	-	0	0,00%	0,00%	0	0,00%	0,00%
Environmental Organisations	0	0,00%	0,00%	0	0,00%	0,00%	-	-	-	0	0,00%	0,00%	0	0,00%	0,00%
Others**	1	14,29%	25,00%	1	25,00%	50,00%	-	-	-	0	0,00%	0,00%	0	0,00%	0,00%
Total	7	100,00%	175,00%	4	100,00%	200,00%	0	0,00%	0,00%	2	100,00%	200,00%	1	100,00%	100,00%

***Others**: regulator/politician; ****Others**: students

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4_PZ.7 Which formats and channels do you use to reach your target group(s)? *(target groups named in previous question)*

	People (n=2)			Organic and conventional farmers* (n=2)			Journalists (n=1)			Seed and plant breeding companies (n=1)		
	Responses		Cases	Responses		Cases	Responses		Cases	Responses		Cases
	frequency	percent	percent	frequency	percent	percent	frequency	percent	percent	frequency	percent	percent
Discussion events	0	0,00%	0,00%	1	10,00%	50,00%	0	0,00%	0,00%	0	0,00%	0,00%
Personal contacts	2	14,29%	100,00%	2	20,00%	100,00%	0	0,00%	0,00%	1	20,00%	100,00%
Conferences, workshops, seminars	1	7,14%	50,00%	1	10,00%	50,00%	0	0,00%	0,00%	1	20,00%	100,00%
Press releases	1	7,14%	50,00%	0	0,00%	0,00%	1	20,00%	100,00%	0	0,00%	0,00%
Reports, dossiers, broschures	0	0,00%	0,00%	0	0,00%	0,00%	0	0,00%	0,00%	0	0,00%	0,00%
Web pages	1	7,14%	50,00%	1	10,00%	50,00%	0	0,00%	0,00%	1	20,00%	100,00%
Newspapers / magazines	2	14,29%	100,00%	1	10,00%	50,00%	0	0,00%	0,00%	0	0,00%	0,00%
Twitter	1	7,14%	50,00%	1	10,00%	50,00%	0	0,00%	0,00%	1	20,00%	100,00%
Scientific publications	0	0,00%	0,00%	0	0,00%	0,00%	0	0,00%	0,00%	0	0,00%	0,00%
Newsletters	1	7,14%	50,00%	0	0,00%	0,00%	1	20,00%	100,00%	0	0,00%	0,00%
Trade newspapers	1	7,14%	50,00%	2	20,00%	100,00%	0	0,00%	0,00%	1	20,00%	100,00%
Facebook	1	7,14%	50,00%	0	0,00%	0,00%	1	20,00%	100,00%	0	0,00%	0,00%
Members magazines	1	7,14%	50,00%	0	0,00%	0,00%	1	20,00%	100,00%	0	0,00%	0,00%
Radio, TV	1	7,14%	50,00%	1	10,00%	50,00%	0	0,00%	0,00%	0	0,00%	0,00%
Blogs	0	0,00%	0,00%	0	0,00%	0,00%	0	0,00%	0,00%	0	0,00%	0,00%
Podcasts	0	0,00%	0,00%	0	0,00%	0,00%	0	0,00%	0,00%	0	0,00%	0,00%
YouTube	1	7,14%	50,00%	0	0,00%	0,00%	1	20,00%	100,00%	0	0,00%	0,00%
Others	0	0,00%	0,00%	0	0,00%	0,00%	0	0,00%	0,00%	0	0,00%	0,00%
Total	14	100,00%	700,00%	10	100,00%	500,00%	5	100,00%	500,00%	5	100,00%	500,00%

*__Organic and conventional farmers (n=5)__ is composed of Conventional Farmers (n=2), and Organic farmers (n=0)

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Limitation of communication

5.1 Which factors limit your communication measures/reporting? (Multiple choices possible)

	Total (n=89)			Academia (n=42)			Consumer Organisations (n=8)			Environmental Organisations (n=10)			Journalism (n=22)			Others* (n=7)		
	Responses		Cases	Responses		Cases	Responses		Cases	Responses		Cases	Responses		Cases	Responses		Cases
	freq.	percent	percent	freq.	percent	percent	freq.	percent	percent	freq.	percent	percent	freq.	percent	percent	freq.	percent	percent
There are no limiting factors	15	9,20%	16,85%	3	3,85%	7,14%	1	6,25%	12,50%	2	12,50%	20,00%	6	14,63%	27,27%	3	25,00%	42,86%
Limited time resources	56	34,36%	62,92%	29	37,18%	69,05%	6	37,50%	75,00%	7	43,75%	70,00%	10	24,39%	45,45%	4	33,33%	57,14%
Limited financial resources	26	15,95%	29,21%	11	14,10%	26,19%	3	18,75%	37,50%	5	31,25%	50,00%	5	12,20%	22,73%	2	16,67%	28,57%
No interest in the topic among my target groups/ the audience	16	9,82%	17,98%	11	14,10%	26,19%	1	6,25%	12,50%	0	0,00%	0,00%	3	7,32%	13,64%	1	8,33%	14,29%
Lack of experience in communicating/ reporting on the subject	12	7,36%	13,48%	9	11,54%	21,43%	1	6,25%	12,50%	0	0,00%	0,00%	2	4,88%	9,09%	0	0,00%	0,00%
No need or interest to communicate/ report on the topic	11	6,75%	12,36%	5	6,41%	11,90%	2	12,50%	25,00%	0	0,00%	0,00%	3	7,32%	13,64%	1	8,33%	14,29%
Lack of examples	11	6,75%	12,36%	5	6,41%	11,90%	2	12,50%	25,00%	0	0,00%	0,00%	4	9,76%	18,18%	0	0,00%	0,00%
Limited access to relevant content	10	6,13%	11,24%	4	5,13%	9,52%	0	0,00%	0,00%	1	6,25%	10,00%	4	9,76%	18,18%	1	8,33%	14,29%
Limited infrastructure	0	0,00%	0,00%	0	0,00%	0,00%	0	0,00%	0,00%	0	0,00%	0,00%	0	0,00%	0,00%	0	0,00%	0,00%
Others**	6	3,68%	6,74%	1	1,28%	2,38%	0	0,00%	0,00%	1	6,25%	10,00%	4	9,76%	18,18%	0	0,00%	0,00%
Total	163	100,00%	183,15%	78	100,00%	185,71%	16	100,00%	200,00%	16	100,00%	160,00%	41	100,00%	186,36%	12	100,00%	171,43%

***Others**: industry, regulators/politicians; ****Others**: internal competition with other issues, no agreement on the subject within the organisation

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6 Recommendations on communication

	Total			Academia			Consumer Organisations			Environmental Organisations			Journalists			Others*		
	freq.	mean	median	freq.	mean	median	freq.	mean	median	freq.	mean	median	freq.	mean	median	freq.	mean	median
The potential disadvantages of genome editing in plants for the population must be better addressed in communication.	88	0,26	0,00	43	-0,02	0,00	8	1,50	2,00	9	1,67	2,00	22	-0,90	0,00	6	-0,17	0,00
An easily accessible transparency register of funding and research methods is necessary to increase confidence in science.	87	0,59	1,00	42	0,36	1,00	8	1,13	1,50	9	1,44	2,00	22	0,55	1,00	6	0,33	0,50
The (possible) implementation of genome editing at the different phases of the breeding process should be better represented.	87	0,90	1,00	42	0,98	1,00	8	0,88	1,00	9	0,56	0,00	22	0,82	1,00	6	1,17	1,00
The costs and benefits of applying genome editing in plants need to be determined.	87	1,00	1,00	42	1,12	1,00	8	1,00	1,00	9	0,56	1,00	22	1,00	1,00	6	0,83	1,00
The potential advantages of genome editing in plants for the population must be better addressed in communication.	87	1,05	1,00	42	1,19	1,00	8	1,25	1,00	9	-0,56	-1,00	22	1,32	1,00	6	1,17	1,00

***Others**: industry, regulators/politicians

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To Academia, CO and EO that do not communicate about genome editing:

7A Communication requests

7A.1 When it comes to communication about genome editing in plants: Which target groups do you think should be addressed primarily? (maximum 2)

☐ I don't know. → *go to 7A.3*

☐ *(answer options of 4A_GE.7)*

	Total (n=14)		
	Responses		Cases
	frequency	percent	percent
I don't know	1	3,85%	7,14%
Consumers/general population	8	30,77%	57,14%
Journalists/media	5	19,23%	35,71%
Consumer Organisations	4	15,38%	28,57%
National offices/authorities	2	7,69%	14,29%
National politicians/political parties	2	7,69%	14,29%
Researchers and scientific organisations	1	3,85%	7,14%
Environmental Organisations	1	3,85%	7,14%
Seed and plant breeding companies/associations	1	3,85%	7,14%
European politicians/political parties	1	3,85%	7,14%
Conventional farmers and their associations	0	0,00%	0,00%
Organic farmers and their associations	0	0,00%	0,00%
Agricultural and food companies/associations	0	0,00%	0,00%
European offices/authorities	0	0,00%	0,00%
Others	0	0,00%	0,00%
Total	26	100,00%	185,71%

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7A.2 Which communication formats do you think are best suited to reach the target group (s)? *(target groups named in previous question)*

(answer options of 4A_GE.8 plus „Don't know-Option)

	Consumers/ general population (n=7)			Journalists/ media (n=4)			Consumer Organisations (n=4)		
	Responses		Cases	Responses		Cases	Responses		Cases
	frequency	percent	percent	frequency	percent	percent	frequency	percent	percent
Web pages	5	11,63%	71,43%	2	9,09%	50,00%	2	8,33%	50,00%
Discussion events	5	11,63%	71,43%	1	4,55%	25,00%	2	8,33%	50,00%
Personal contacts	2	4,65%	28,57%	2	9,09%	50,00%	3	12,50%	75,00%
Press releases	3	6,98%	42,86%	2	9,09%	50,00%	1	4,17%	25,00%
Conferences, workshops, seminars	0	0,00%	0,00%	3	13,64%	75,00%	1	4,17%	25,00%
Reports, dossiers, broschures	1	2,33%	14,29%	2	9,09%	50,00%	2	8,33%	50,00%
Newspapers / magazines	4	9,30%	57,14%	2	9,09%	50,00%	1	4,17%	25,00%
Facebook	3	6,98%	42,86%	1	4,55%	25,00%	2	8,33%	50,00%
Radio, TV	5	11,63%	71,43%	0	0,00%	0,00%	2	8,33%	50,00%
YouTube	3	6,98%	42,86%	1	4,55%	25,00%	2	8,33%	50,00%
Podcasts	3	6,98%	42,86%	1	4,55%	25,00%	0	0,00%	0,00%
Twitter	3	6,98%	42,86%	1	4,55%	25,00%	1	4,17%	25,00%
Newsletters	2	4,65%	28,57%	2	9,09%	50,00%	1	4,17%	25,00%
Blogs	2	4,65%	28,57%	1	4,55%	25,00%	1	4,17%	25,00%
Scientific publications	1	2,33%	14,29%	0	0,00%	0,00%	0	0,00%	0,00%
Trade newspapers	0	0,00%	0,00%	1	4,55%	25,00%	1	4,17%	25,00%
Members magazines	1	2,33%	14,29%	0	0,00%	0,00%	1	4,17%	25,00%
Others	0	0,00%	0,00%	0	0,00%	0,00%	1	4,17%	25,00%
Total*	43	100,00%	614,29%	22	100,00%	550,00%	24	100,00%	600,00%

*Only target groups, which were chosen more than 2 times, were listed.

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7A.3 In your opinion, how important are the following types of content in the communication about/in the media coverage of genome editing in plants?

*The * indicates content where additional information appears when you move the mouse over the text.*

7A.4 Here is a list of four more types of content:

In your opinion, how important are these types of content in communication about/in the media coverage of genome editing in plants?

*The * indicates content where additional information appears when you move the mouse over the text.*

	Total			Academia			Consumer Organisations			Environmental Organisations			Journalism		
	frequency	mean	median	frequency	mean	median	frequency	mean	median	frequency	mean	median	frequency	mean	median
Transparency*	13	4,77	5,00	8	4,75	5,00	2	4,50	4,50	1	5,00	5,00	2	5,00	5,00
Safety*	13	4,38	5,00	8	4,38	5,00	2	4,50	4,50	1	3,00	3,00	2	5,00	5,00
Climate change	13	4,31	5,00	8	4,38	5,00	2	4,00	4,00	1	5,00	5,00	2	4,00	4,00
Labelling*	13	4,23	4,00	8	3,88	4,00	2	4,50	4,50	1	5,00	5,00	2	5,00	5,00
Examples of application	13	4,15	4,00	8	4,13	4,00	2	4,50	4,50	1	4,00	4,00	2	4,00	4,00
Sustainability	12	4,00	4,00	7	3,86	4,00	2	4,00	4,00	1	5,00	5,00	2	4,00	4,00
Nutritional quality of food	13	4,00	4,00	8	4,00	4,00	2	4,00	4,00	1	4,00	4,00	2	4,00	4,00
Basics of plant breeding*	13	3,92	4,00	8	4,38	4,50	2	3,00	3,00	1	4,00	4,00	2	3,00	3,00
Functionality*	13	3,85	4,00	8	3,75	4,00	2	3,50	3,50	1	5,00	5,00	2	4,00	4,00
Farming methods*	13	3,85	4,00	8	3,88	4,00	2	4,00	4,00	1	3,00	3,00	2	4,00	4,00
Use in the breeding process*	13	3,69	4,00	8	4,13	4,00	2	3,50	3,50	1	2,00	2,00	2	3,00	3,00
Regulation*	13	3,54	4,00	8	3,38	3,00	2	3,00	3,00	1	4,00	4,00	2	4,50	4,50
Sufficient agricultural yield	13	3,54	3,00	8	3,75	3,00	2	3,00	3,00	1	3,00	3,00	2	3,50	3,50
Technological developments*	13	3,31	3,00	8	3,38	3,00	2	4,00	4,00	1	3,00	3,00	2	2,50	2,50
Patenting*	12	2,67	2,50	8	2,63	2,50	2	3,00	3,00	1	2,00	2,00	1	3,00	3,00

* Transparency: Public access to information on the application and funding of genome editing in plants
* Safety: Environmental and / or food safety assessment when using genome editing in plants
* Labelling: Labelling of genome-edited plants and the products processed from them
* Basics of plant breeding: Explanation of the biological processes and procedures on which plant breeding is based
* Functionality: Illustration of the mechanisms of genome editing in plants
* Farming methods: Farming methods for a future-orientated European agriculture
* Use in the breeding process: Potential application of genome editing in the different phases of the breeding process and its limitation
* Regulation: Regulation of plants bred through the use of genome editing
* Technological developments: Innovations related to the application of genome editing in plants
* Patenting: Protection of intellectual property in the application of genome editing in plants

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If „sustainability" is rated as very or extremely important in previous question 7A.4:

Please briefly describe how the issue of sustainability could be addressed in communication about/reporting on genome editing in plants:

_____

Overcode	Undercode	Frequency	Percent
Supportive addressing of Genome Editing in the context of sustainability	Use of chemicals (e.g. pesticides)	-	-
	Use of natural resources (e.g. water, land)	-	-
	Plant adaption to biotic and abiotic stresses	-	-
	Food security	-	-
	Sustainable agriculture and food system	-	-
	Long term effects on the whole system	-	-
	Political aspects (e.g. Sustainable Development Goals, regulation)	-	-
	Reference to organic agriculture	-	-
	Others	-	-
	Total	**0**	**0%**
Rejective addressing of Genome Editing in the context of sustainability	Use of chemicals (e.g. pesticides)	-	-
	Use of natural resources (e.g. water, land)	-	-
	Plant adaption to biotic and abiotic stresses	-	-
	Food security	-	-
	Sustainable agriculture and food system	-	-
	Long term effects on the whole system	-	-
	Political aspects (e.g. Sustainable Development Goals, regulation)	-	-
	Reference to organic agriculture	-	-
	Others	-	-
	Total	**0**	**0%**
Neutral addressing of Genome Editing in the context of sustainability	Use of chemicals (e.g. pesticides)	0	0,0%
	Use of natural resources (e.g. water, land)	1	20,0%
	Plant adaption to biotic and abiotic stresses	2	40,0%
	Food security	0	0,0%
	Sustainable agriculture and food system	0	0,0%
	Long term effects on the whole system	1	20,0%
	Political aspects (e.g. Sustainable Development Goals, regulation)	0	0,0%
	Reference to organic agriculture	1	20,0%
	Others	0	0,0%
	Total	**5**	**100%**

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If „nutritional quality" is rated as very or extremely important in previous question 7A.4:

Please briefly describe how the issue of nutritional quality of food could be addressed in communication about/reporting on genome editing in plants:

_____

Overcode	Undercode	Frequency	Percent
Supportive addressing of Genome Editing in the context of nutritional quality	Increase of beneficial ingredients (e.g. essential amino acids, antioxigens, vitamins)	1	100,0%
	Decrease of harmful ingredients (e.g. less allergens)	0	0,0%
	Altered composition	0	0,0%
	Economic aspects	0	0,0%
	Reference to organic agriculture	0	0,0%
	Others	0	0,0%
	Total	**1**	**100%**
Rejective addressing of Genome Editing in the context of nutritional quality	Increase of beneficial ingredients (e.g. essential amino acids, antioxigens, vitamins)	-	-
	Decrease of harmful ingredients (e.g. less allergens)	-	-
	Altered composition	-	-
	Economic aspects	-	-
	Reference to organic agriculture	-	-
	Others	-	-
	Total	**0**	**0%**
Neutral addressing of Genome Editing in the context of nutritional quality	Increase of beneficial ingredients (e.g. essential amino acids, antioxigens, vitamins)	0	0,0%
	Decrease of harmful ingredients (e.g. less allergens)	0	0,0%
	Altered composition	3	60,0%
	Economic aspects	0	0,0%
	Reference to organic agriculture	0	0,0%
	Others	2	40,0%
	Total	**5**	**100%**

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If „agricultural yields“ is rated as very or extremely important in previous question 7A.4:

Please briefly describe how the issue of agricultural yields could be addressed in communication about/reporting on genome editing in plants:

_____

Overcode	Undercode	Frequency	Percent
Supportive addressing of Genome Editing in the context of agricultural yield	Contribution to a sustainable system	-	-
	Environmental impact of agriculture	-	-
	Land use	-	-
	More stable and optimized yield	-	-
	Economic aspects	-	-
	Time use of cultivating adopted plants	-	-
	Food security	-	-
	Use of resources	-	-
	Others	-	-
	Total	**0**	**0%**
Rejective addressing of Genome Editing in the context of agricultural yield	Contribution to a sustainable system	-	-
	Environmental impact of agriculture	-	-
	Land use	-	-
	More stable and optimized yield	-	-
	Economic aspects	-	-
	Time use of cultivating adopted plants	-	-
	Food security	-	-
	Use of resources	-	-
	Others	-	-
	Total	**0**	**0%**
Neutral addressing of Genome Editing in the context of agricultural yield	Contribution to a sustainable system	0	0,0%
	Environmental impact of agriculture	0	0,0%
	Land use	0	0,0%
	More stable and optimized yield	0	0,0%
	Economic aspects	1	50,0%
	Time use of cultivating adopted plants	0	0,0%
	Food security	0	0,0%
	Use of resources	0	0,0%
	Others	1	50,0%
	Total	**2**	**100%**

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To all:

8.1 How convinced are you that genome editing in plants could help to achieve the following EU goals as quickly as possible?

	strongly unconvinced	somewhat unconvinced	Neither convinced nor unconvinced	Somewhat convinced	strongly convinced	Don't know
adequate food supply in the world						
Increased nutritional quality of food						
More sustainability in agriculture						
Reducing the use of chemicals in agriculture						
Adaptation to climate change						

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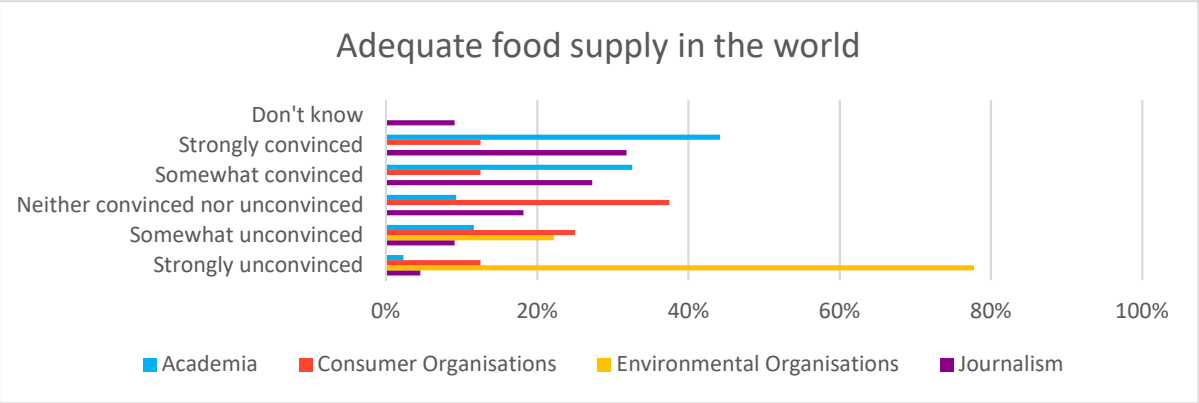
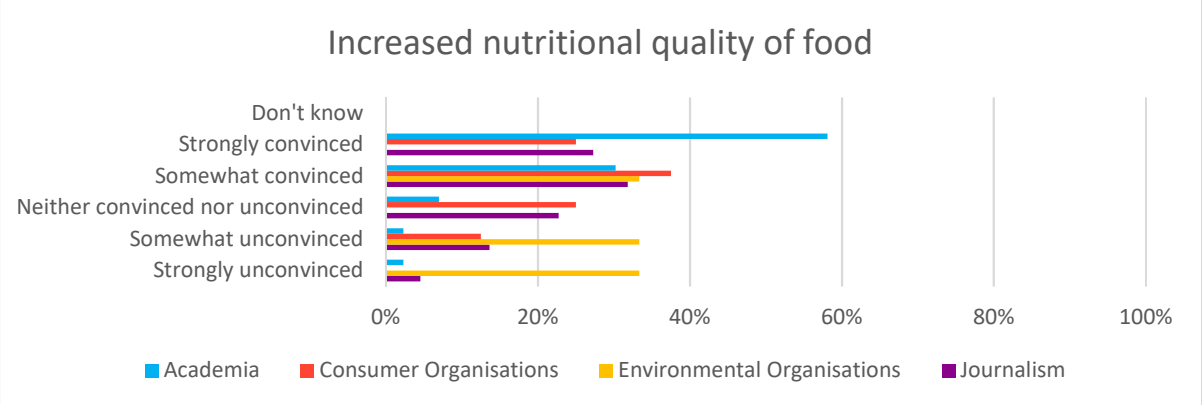


	Academia		Consumer Organisations		Environmental Organisations		Journalism	
	frequency	percent	frequency	percent	frequency	percent	frequency	percent
Strongly unconvinced	1	2,33%	1	12,50%	7	77,78%	1	4,55%
Somewhat unconvinced	5	11,63%	2	25,00%	2	22,22%	2	9,09%
Neither convinced nor unconvinced	4	9,30%	3	37,50%	0	0,00%	4	18,18%
Somewhat convinced	14	32,56%	1	12,50%	0	0,00%	6	27,27%
Strongly convinced	19	44,19%	1	12,50%	0	0,00%	7	31,82%
Don't know	0	0,00%	0	0,00%	0	0,00%	2	9,09%
Total	43	100,00%	8	100,00%	9	100,00%	22	100,00%



	Academia		Consumer Organisations		Environmental Organisations		Journalism	
	frequency	percent	frequency	percent	frequency	percent	frequency	percent
Strongly unconvinced	1	2,33%	0	0,00%	3	33,33%	1	4,55%
Somewhat unconvinced	1	2,33%	1	12,50%	3	33,33%	3	13,64%
Neither convinced nor unconvinced	3	6,98%	2	25,00%	0	0,00%	5	22,73%
Somewhat convinced	13	30,23%	3	37,50%	3	33,33%	7	31,82%
Strongly convinced	25	58,14%	2	25,00%	0	0,00%	6	27,27%
Don't know	0	0,00%	0	0,00%	0	0,00%	0	0,00%
Total	43	100,00%	8	100,00%	9	100,00%	22	100,00%

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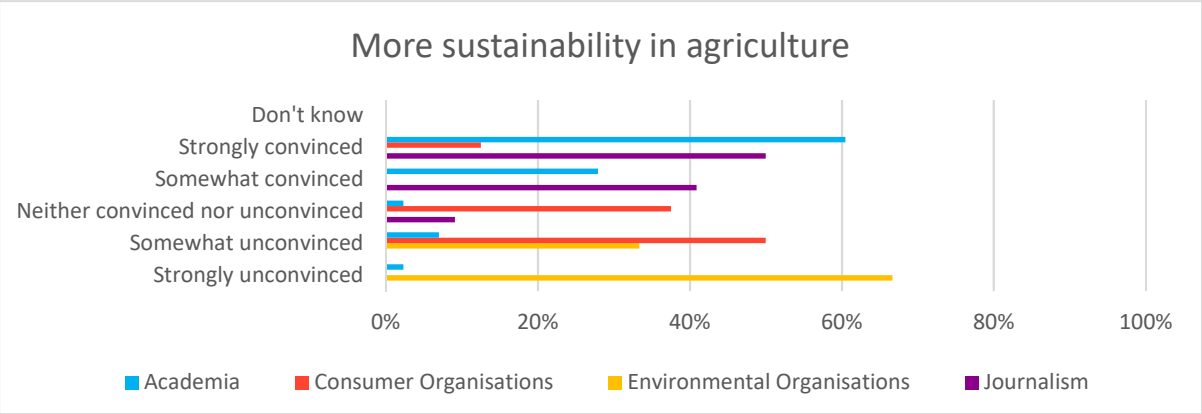
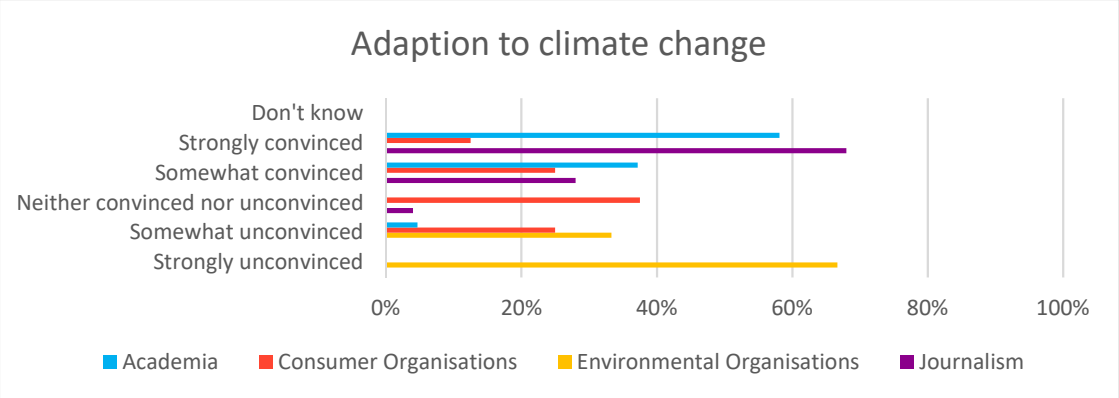


	Academia		Consumer Organisations		Environmental Organisations		Journalism	
	frequency	percent	frequency	percent	frequency	percent	frequency	percent
Strongly unconvinced	1	2,33%	0	0,00%	6	66,67%	0	0,00%
Somewhat unconvinced	3	6,98%	4	50,00%	3	33,33%	0	0,00%
Neither convinced nor unconvinced	1	2,33%	3	37,50%	0	0,00%	2	9,09%
Somewhat convinced	12	27,91%	0	0,00%	0	0,00%	9	40,91%
Strongly convinced	26	60,47%	1	12,50%	0	0,00%	11	50,00%
Don't know	0	0,00%	0	0,00%	0	0,00%	0	0,00%
Total	43	100,00%	8	100,00%	9	100,00%	22	100,00%



	Academia		Consumer Organisations		Environmental Organisations		Journalism	
	frequency	percent	frequency	percent	frequency	percent	frequency	percent
Strongly unconvinced	0	0,00%	0	0,00%	6	66,67%	0	0,00%
Somewhat unconvinced	2	4,65%	2	25,00%	3	33,33%	0	0,00%
Neither convinced nor unconvinced	0	0,00%	3	37,50%	0	0,00%	1	4,76%
Somewhat convinced	16	37,21%	2	25,00%	0	0,00%	6	28,57%
Strongly convinced	25	58,14%	1	12,50%	0	0,00%	14	66,67%
Don't know	0	0,00%	0	0,00%	0	0,00%	0	0,00%
Total	43	100,00%	8	100,00%	9	100,00%	21	100,00%

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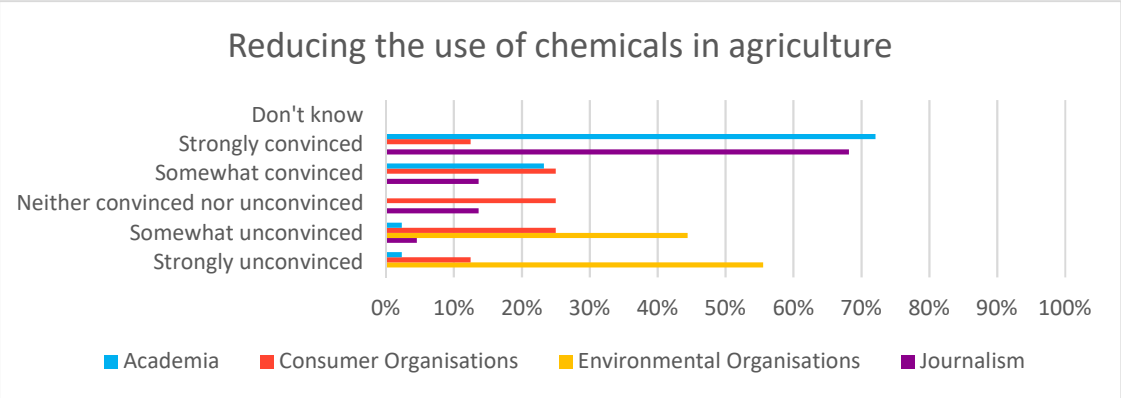

	Academia		Consumer Organisations		Environmental Organisations		Journalism	
	frequency	percent	frequency	percent	frequency	percent	frequency	percent
Strongly unconvinced	1	2,33%	1	12,50%	5	55,56%	0	0,00%
Somewhat unconvinced	1	2,33%	2	25,00%	4	44,44%	1	4,55%
Neither convinced nor unconvinced	0	0,00%	2	25,00%	0	0,00%	3	13,64%
Somewhat convinced	10	23,26%	2	25,00%	0	0,00%	3	13,64%
Strongly convinced	31	72,09%	1	12,50%	0	0,00%	15	68,18%
Don't know	0	0,00%	0	0,00%	0	0,00%	0	0,00%
Total	43	100,00%	8	100,00%	9	100,00%	22	100,00%

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9.1 How much do you trust the following groups when they communicate about genome editing in plants in [country]? *(Actors named in question 2.2*

3)

	not at all	not much	neutral	a little	fully
[group 1]					
[group 2]					
….					

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	Researchers and scientific organisations (n=31)	Environmental organisations (n=27)	Journalists/ media (n=22)	Politicians/ political parties (n=13)	Seed and plant breeding companies (n=16)	Organic farmers (n=8)	Consumer organisations (n=7)	Conventional farmers (n=7)	Agricultural and food industries (n=5)	European offcies/ authorities (n=5)	National offices/ authorities (n=4)
trust not at all	0,00%	33,33%	4,55%	15,38%	0,00%	37,50%	28,57%	0,00%	0,00%	0,00%	0,00%
trust not much	0,00%	33,33%	27,27%	53,85%	12,50%	37,50%	28,57%	14,29%	20,00%	0,00%	0,00%
neutral	3,23%	18,52%	40,91%	30,77%	31,25%	12,50%	28,57%	42,86%	40,00%	0,00%	0,00%
trust a little	16,13%	11,11%	27,27%	0,00%	37,50%	0,00%	14,29%	42,86%	20,00%	20,00%	25,00%
trust fully	80,65%	3,70%	0,00%	0,00%	18,75%	12,50%	0,00%	0,00%	20,00%	80,00%	75,00%

Academia

	Researchers and scientific organisations (n=10)	Environmental organisations (n=13)	Journalists / media (n=8)	Politicians / political parties (n=5)	Seed and plant breeding companies (n=12)	Organic farmers (n=6)	Consumer organisations (n=5)	Conventional farmers (n=3)	Agricultural and food industries (n=4)	European offcies / authorities (n=3)	National offcies / authorities (n=3)
trust not at all	0,00%	30,77%	0,00%	0,00%	0,00%	50,00%	20,00%	0,00%	0,00%	0,00%	0,00%
trust not much	0,00%	38,46%	12,50%	40,00%	25,00%	33,33%	40,00%	33,33%	25,00%	0,00%	0,00%
neutral	10,00%	23,08%	37,50%	60,00%	25,00%	16,67%	20,00%	33,33%	50,00%	0,00%	33,33%
trust a little	30,00%	7,69%	37,50%	0,00%	41,67%	0,00%	20,00%	33,33%	25,00%	33,33%	33,33%
trust fully	60,00%	0,00%	12,50%	0,00%	8,33%	0,00%	0,00%	0,00%	0,00%	66,67%	33,33%

Journalism

	Researchers and scientific organisations (n=9)	Environmental organisations (n=4)	Journalists/media (n=2)	Politicians / political parties (n=4)	Seed and plant breeding companies (n=5)	Organic farmers (n=3)	Consumer organisations (n=1)	Conventional farmers (n=3)	Agricultural and food industries (n=4)	European offcies / authorities (n=4)	National offcies / authorities (n=2)
trust not at all	0,00%	0,00%	0,00%	20,00%	100,00%	0,00%	0,00%	66,67%	25,00%	0,00%	0,00%
trust not much	33,33%	0,00%	0,00%	25,00%	0,00%	0,00%	0,00%	33,33%	50,00%	25,00%	0,00%
neutral	33,33%	25,00%	50,00%	50,00%	0,00%	0,00%	0,00%	0,00%	0,00%	25,00%	50,00%
trust a little	33,33%	25,00%	50,00%	0,00%	0,00%	66,67%	100,00%	0,00%	25,00%	25,00%	50,00%
trust fully	0,00%	50,00%	0,00%	0,00%	0,00%	33,33%	0,00%	0,00%	0,00%	25,00%	0,00%

Environmental Organisation

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	Researchers and scientific organisations (n=4)	Environmental organisations (n=2)	Journa-lists/media (n=3)	Politicians / political parties (n=1)	Seed and plant breeding com-panies (n=1)	Organic far-mers (n=2)	Consumer or-ganisations (n=2)	Conventional farmers (n=2)	Agricultural and food in-dustries (n=2)	European offcies / autho-rities (n=1)	National offcies / autho-rities (n=2)
trust not at all	0,00%	0,00%	33,33%	0,00%	0,00%	0,00%	0,00%	0,00%	50,00%	0,00%	0,00%
trust not much	0,00%	0,00%	0,00%	0,00%	100,00%	50,00%	0,00%	50,00%	50,00%	0,00%	50,00%
neutral	25,00%	0,00%	33,33%	0,00%	0,00%	50,00%	0,00%	0,00%	0,00%	100,00%	0,00%
trust a little	50,00%	100,00%	33,33%	100,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
trust fully	25,00%	0,00%	0,00%	0,00%	0,00%	0,00%	100,00%	50,00%	0,00%	0,00%	50,00%

Consumer Organisations

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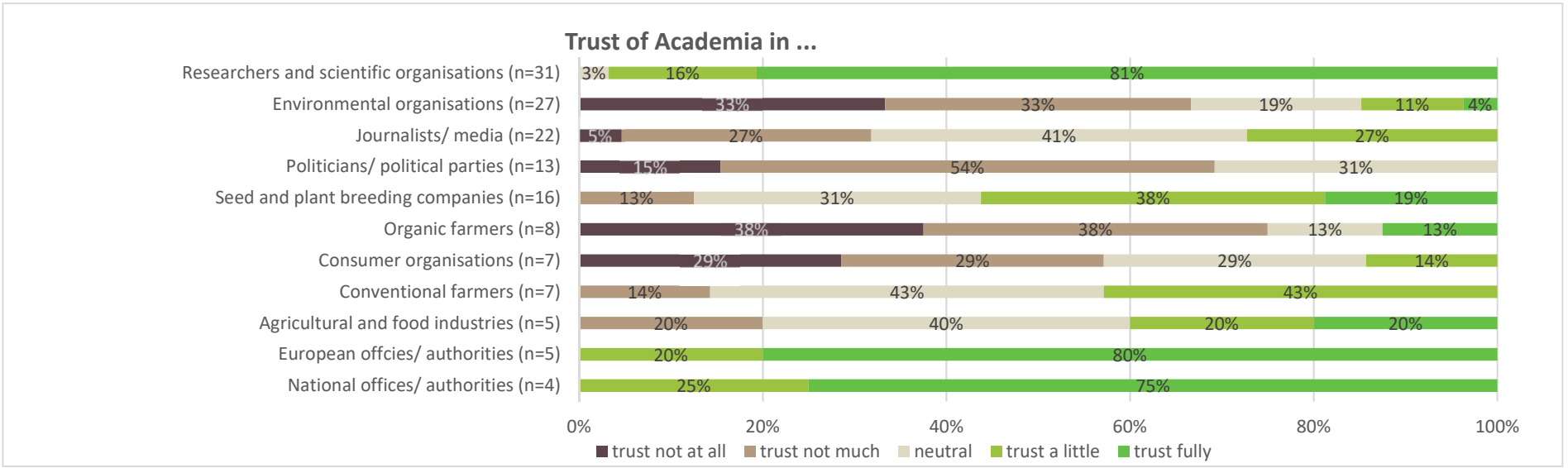

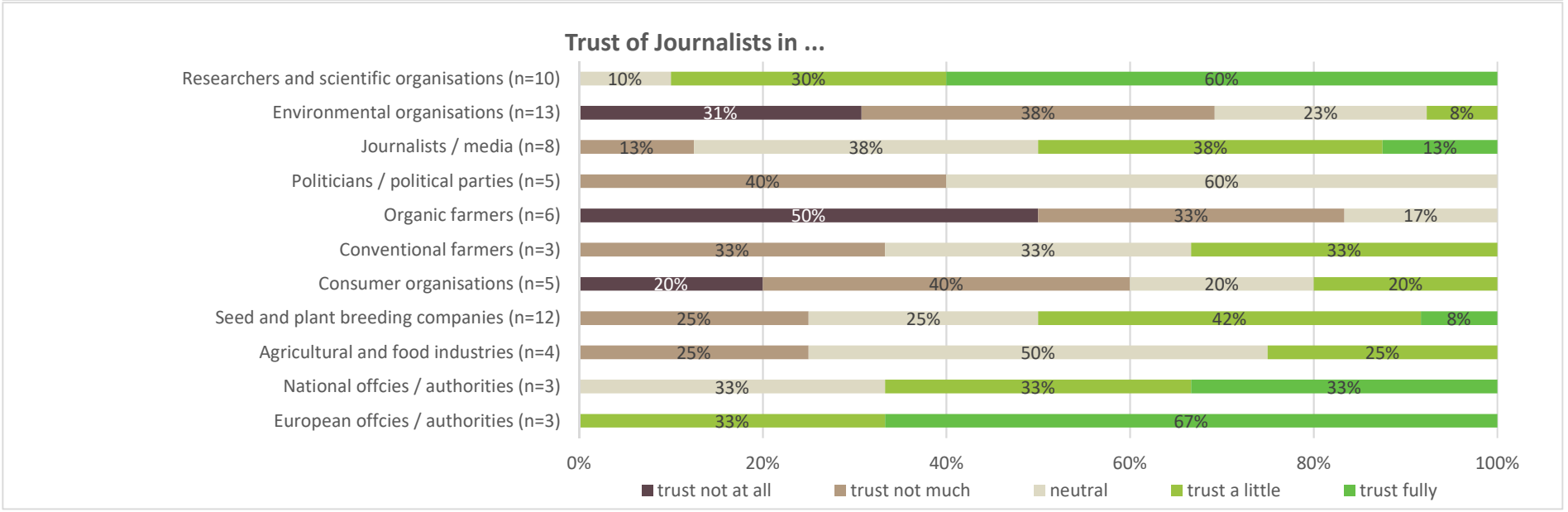

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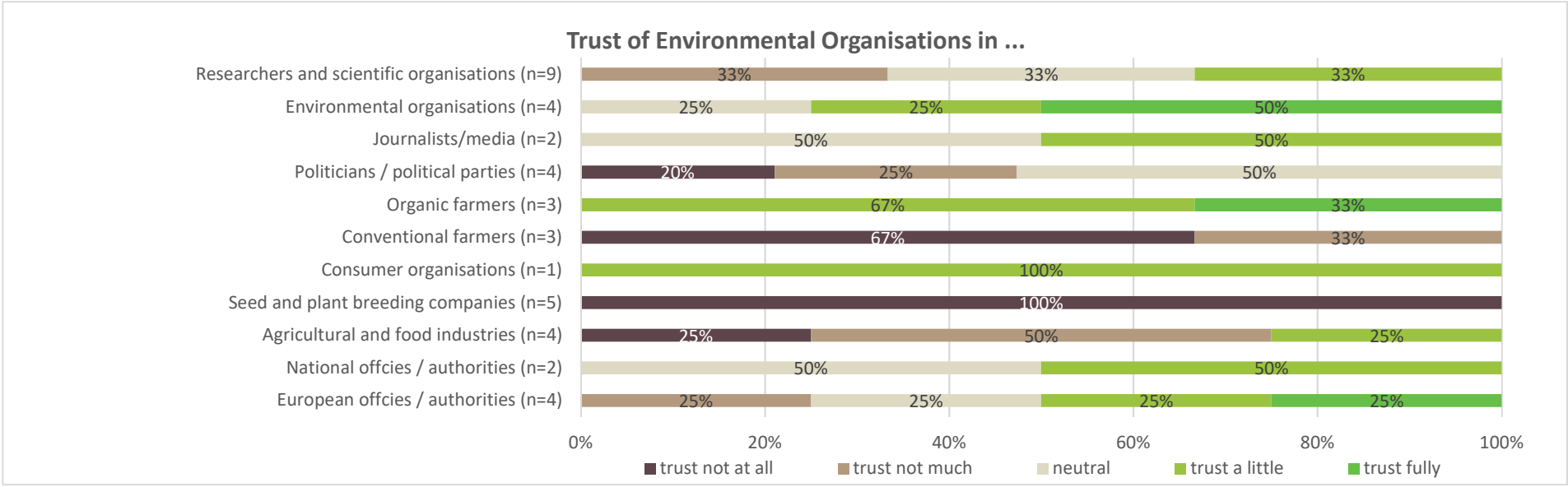

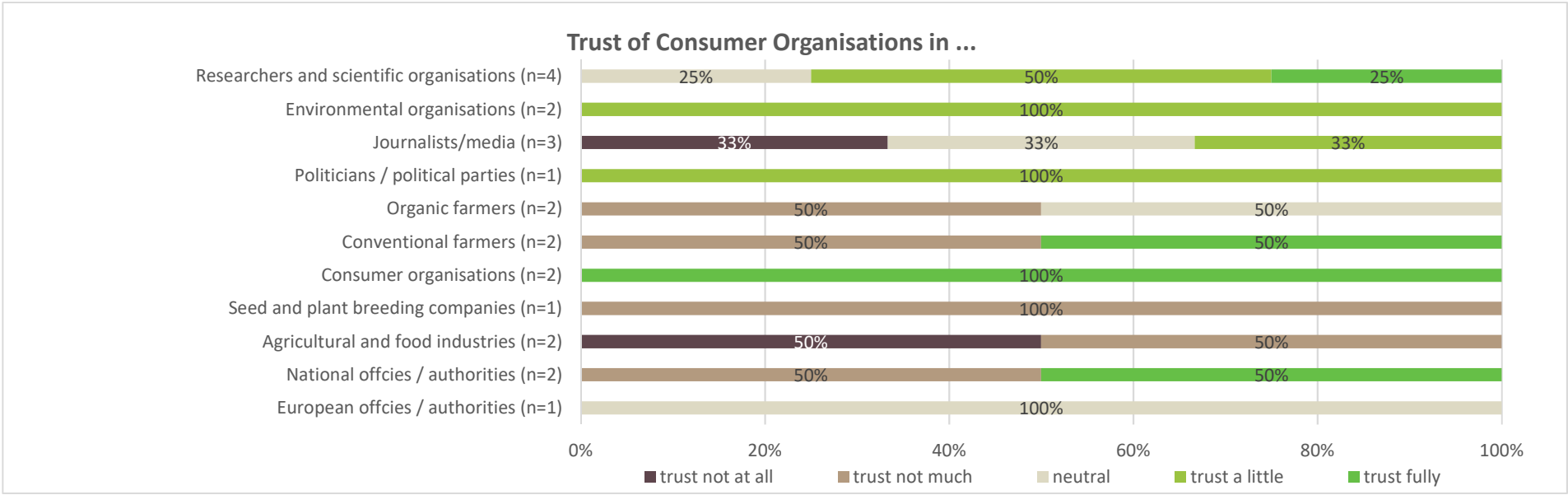

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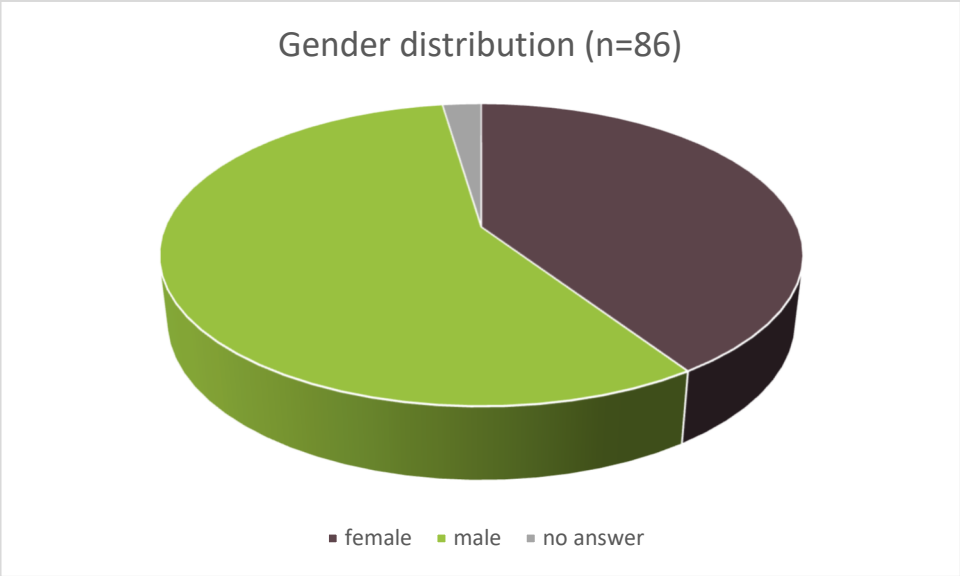
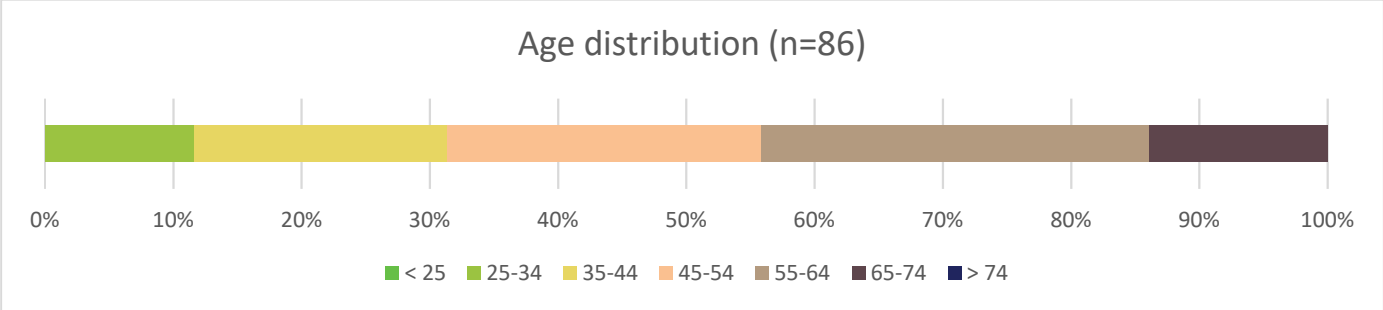
Please indicate your gender.

- ☐ Male
- ☐ Female
- ☐ Other
- ☐ Not specified



What age group do you belong to?

- ☐ under 25
- ☐ 25-34
- ☐ 35-44
- ☐ 45-54
- ☐ 55-64
- ☐ 65-74
- ☐ over 74



To Academia, CO, EO according 1.1:

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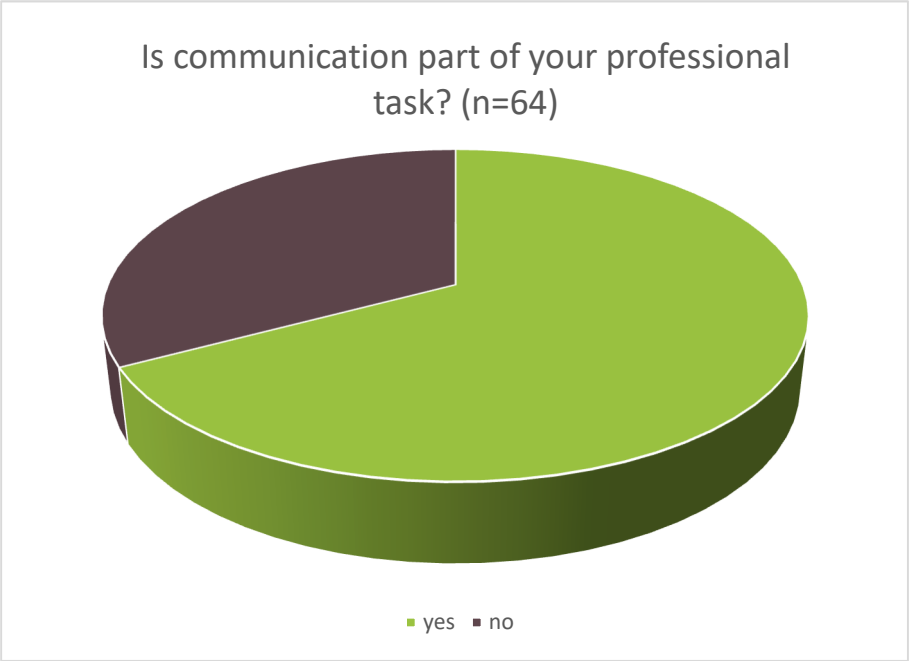
10.1 Is communication part of your professional tasks?

☐ Yes
☐ No



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10.2 Is there anything else you would like to tell us?

☐ Yes, that is _____

☐ No

SHG	*European region*	*Kind of comment*	*Verbatim*
Journalism	MEC	Recommendation	It is important to keep communicating the opportunities for sustainable plant breeding. And it is even more important not to place breeding goals and marketing of the technology completely in the hands of the big seed companies. Breeding goals should follow social and ecological requirements, only then will the products be accepted. (transl.)
Academia	MEC	Recommendation	Trust in new technologies cannot be generated with exaggerated promises. The "old" genetic engineering already failed because of this. It should be communicated that NGT enables better research into metabolic mechanisms. The significance for research is significant. It will probably not be possible to produce new superplants that are successful in cultivation. Sustainable agriculture must pay more attention to ecosystems and research plants in the context of the system. Research should aim to strengthen the resilience of plants and not to develop new pesticides with CRISPR. (transl.)
Journalism	MEC	Recommendation	publish more science-based consumer-friendly articles (transl.)
Journalism	EEC	Recommendation	I need more information and clarification on the topic in non-scientific language. To me at least it sounds like an attempt to develop another GMO to poison our bodies along with vaccines and drugs. (transl.)
Journalism	SEC	Recommendation	The fact that genome editing makes it possible to mimic the natural adaptation mechanisms of plants. (transl.)
Academia	EEC	Recommendation	Case studies addressing the topic under discussion. (transl.)
Academia	SEC	Recommendation	I have been involved in outreach for 25 years. Focusing on teachers and journalists seems to me to be the winning strategy in the long run. In communication, I always put a lot of emphasis on the concept of domestication and on the fact that cultivated plants are genetically modified and that these modifications are among the most profound that a plant can undergo. One last suggestion: create a repository of effective images and presentations to help communicators. (transl.)
Academia	MEC	Description of the public discourse Recommendation	Genome editing is often used synonymously with CRISPR-Cas, although CRISPR-Cas can be used to do everything from mutation initiation, transgenics to gene drive. It would be good to clearly define how genome editing works, not only the replacement of single nucleotides but also how the construct gets into the plant. Genome editing is often compared to conventional breeding and it is assumed that the standard procedure is chemical or radiation induced mutation initiation, but in reality it is still cross breeding. In order to regain the credibility of the science/seed industry it is necessary to have good examples of genome-edited products that have a benefit for the environment or society, it is necessary to have transparency and labelling and it is also important to communicate what the technology cannot do. Genome editing has many potentials but it is not the panacea for securing the world's food supply in the context of climate change, as it involves significant socio-political aspects. Critics of the technology should be taken seriously, as they are usually well informed but have different values and priorities. [transl.)
Journalism	MEC	Description of the public discourse	If you ask me, the problem in the communication on genome editing is that scientists and seed producers cannot convince the public of their intentions and fail to refute the argument that the technology has serious risks. In addition, ideologically oriented environmental associations even infiltrate ministries with alleged information - research does not defend itself against this either, or at least not noticeably. Finally, (…), politicians are shirking from even touching the issue and dealing with the real core problems such as regulation, patenting and sustainability-oriented legislation for GE plants. If neither research nor scientific organisations nor associations interested in sustainable agriculture demand this debate, precisely nothing will happen. (transl.)
Journalism	MEC	Description of the public discourse	Exciting topic! It is about a core question that has been discussed more and more for the past five years: How do we get more expertise back into discussions and how do we manage to transport these facts credibly to the outside world? In times of (…) fake news supporters; there are an infinite number of experts - the louder, the more competent. (transl.)
Journalism	MEC	Description of the public discourse	The topic of genome editing is little understood by the general public and even the higher educated parts of it. Also people tend not to think a lot about plantbased food production by whatever means. In some circles there appears to be some romantic, but not very realistic ideas about (organic) farming of food crops. But to many people producing food and all of its ramifications appears to be little of an issue at all. I believe this should be changed, long before any inroads into communication about (novel) breeding technologies is attempted.
CO	EEC	Description of the public discourse	The creators of the survey have no idea how the GMO issue is developing in country A (*anonymised by the authors*). In the discussions, as far as there are any, mainly activists of eco-organisations or populist politicians participate. Expert or scientific opinion is rarely quoted, often there are personal attacks and threats to scientists. [transl.]

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EO	MEC	Description of the public discourse	The discussion in the media and among experts is extremely one-sided. There seems to be a real propaganda battle going on, orchestrated by the agribusiness industry, with the scientific community joining in to ensure that the rules for GMOs do not apply to the release of genome-edited plants and that they can be released without a risk assessment. [transl.]
Academia	MEC	others	Thank you for the survey. I'm looking forward to the results. (transl.)
Academia	MEC	others	If the future could whisper, it would call out for crispr!
EO	MEC	others	The association I represent is association A (anonymised by the authors). (transl.)
CO	SEC	others	I invite the consortium to interact with the promoters of this initiative (*anonymised by the authors*). [transl.]

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Supplementary information 2

CropBooster-P

Survey analysis report contributing to the mid-term outreach strategy of Deliverable No. 3.3

Farmers, plant breeders and policy maker's communication activities linked to plant research, crop production & improvement and plant gene editing in Europe

Authors: Nick Vangheluwe (Plant ETP & Euroseeds), Amrit Nanda (Plant ETP) and Petra Jorasch (Euroseeds)

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EXECUTIVE SUMMARY

The global and interlinked challenges that food and agricultural systems are currently facing highlights the need to increase crop productivity in a sustainable manner. The Horizon Europe 2020-funded project CropBooster-P aims to develop a roadmap to future-proof European crops for these challenges. It is employing a stakeholder-focused approach to identify opportunities to adapt and boost crop performance in a context of climate and societal challenges.

In order to engage efficiently with multiple stakeholders, a communication strategy is essential and should be tailored to each stakeholder group (SHG), taking into account their values, needs, and expectations associated with plant research, crop production and improvement as well as the innovative plant breeding technique, gene editing.

Therefore, information was gathered on the communication activities, needs and challenges of farmers & farmer organisations, breeders and seed & plant breeding organisations, as well as policy makers, via an online survey and a multi-stakeholder focus group.

Based on the survey results, insights and trends could be deduced and recommendations for future communication activities formulated:

Observation I - SHGs communicate preferably about topics and values that they are most familiar with and have experience due to their professional activities and not necessarily about what is most important to their target audience.

- **Recommendation I** - Take into account the interests of the target audience and include these topics of interest in the communication activities towards the respective audience.

Observation II - Magazines, professional magazines, scientific journals and activities that facilitate personal interactions such as conferences & meetings were found to be most relevant for sourcing information and for communication purposes.

- **Recommendation II** - Consider reaching out to the target audience through SHG-specific (professional) magazines and facilitate informational activities via personal interactions.

Observation III - Social media platforms are considered valuable by SHGs to improve visibility and increase engagement with target audiences, however differences in preferences towards social media platforms according to age, education and country could be observed.

- **Recommendation III** – Develop tailored communication strategies to use social media as an effective communication channel by taking into account the target audience's preferences.

Observation IV – Websites are the only preferred online source to obtain information about crop-related topics or plant gene editing.

- **Recommendation IV** - Frequently update websites with the latest information to provide interested SHGs with relevant in-depth information about crop-related topics and gene editing.

Observation V - Communication about a diverse subset of aspects related to plant gene editing (*e.g.*, applications, legal aspects, safety etc.) are important to different stakeholders.

- **Recommendation V** – Use examples, and narrate technological developments, global context and transparency in future communication activities related to plant gene editing because these are the common prioritised topics by all stakeholders.

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1 INTRODUCTION

1.1 *Aims*

In the survey analysis report we share initial findings for Task 3.2 of Work Package 3 of CropBooster-P about different societal actors their experience in communication about crop production and improvement as well as novel technologies for increasing crop yield and nutritional quality in future agriculture in order to identify how they communicate, to whom, about what and how to tailor communication strategies for future research projects for highest impact.

This document reports the results for the societal actors: farmers/farmer organisations, breeders/seed & plant breeding organisations and policy makers and serves as a base for the mid-term outreach strategy of Task 3.2 that will be reported in Deliverable 3.3.

1.2 *Introduction to CropBooster-P*

Food and agricultural systems are currently facing important global challenges. From population growth, to changes in dietary choices and climate change: the future and sustainability of the global food and agricultural systems will be shaped by how it meets these challenges. The world's population is expected to grow to 9.73 billion by 2050, boosting agricultural demand by approximately 50% compared to 2013 in a scenario of modest economic growth (FAO, 2017).

Moreover, the European Green deal outlines the transition from a fossil fuel-based economy towards a bioeconomy in order to mitigate the effects of global climate change. This will require a boost of global crop productivity to produce enough plant biomass to achieve both food and nutritional security, as well as to meet the demands of a circular bioeconomy (**Figure 1**).

Although agricultural investments and technological innovations are boosting productivity, yield growth has slowed down over the past decades. Since the 1990s, average annual productivity gains of staple crops have been slightly more than 1 percent, much lower than in the 1960s (FAO, 2017). The required acceleration in crop productivity is furthermore hampered by climate change, the degradation of natural resources, the loss of biodiversity and the spread of plant pests and diseases (FAO, 2017).

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Figure 1. Illustration of the problem setting and aim of the Europe Horizon 2020 project CropBooster-P.

Increased crop productivity must be accomplished in a sustainable manner without compromising biodiversity or negatively impacting natural resources and the environment. To meet these challenges, our current crop plants need to be re-designed and thus mapping out how they can be "future proofed" is urgently needed.

CropBooster-P is a Coordination and Support Action within the Europe H2020 research programme that aims to address this by identifying opportunities to adapt and boost productivity in a context of environmental and societal changes (Harbinson *et al.*, 2021). The Cropbooster-P objective is the development of a roadmap for future proofing our food systems and the European bioeconomy, with a specific focus on making crop production more sustainable, resilient, and responsible, while at the same time guaranteeing nutritional food quality (**Figure 1**).

CropBooster-P engages with a *plethora* of stakeholders, such as scientists, businesspersons, farmers, consumers/citizens, and policy makers, to align the process and its outcomes with the values, needs and expectations of society. The roadmap will outline the research agenda of future projects and initiatives, considering scientific knowledge, companies' perspectives and societal views and concerns.

1.3 *Research questions for the information retrieval process*

A situation analysis is required to develop a draft communication strategy: the status quo/actual state to be illuminated from a life- social and communication science point of view was analysed to identify how the stakeholder groups (SHGs) communicate, to whom, about what and how to tailor communication strategies for future research projects for highest impact.

Before initiating the survey design, research questions were formulated according to the information that was aimed to retrieve from the respective SHGs for the situation analysis.

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The situation analysis focusses on two aspects:

1) Mapping of involved SHGs and their characteristics (*e.g.*, policy makers, regulators, stakeholders of the agri-food value chain including consumers, journalists, and academics and, if needed, their subgroups).

Research questions:

- What is the SHG's degree of trust SHGs?

- What is the SHG's self-assessment of knowledge about plant breeding?

2) Mapping of ongoing communication activities of involved SHGs

Research questions:

- What is the SHG's experience in communication about plant research, crop improvement and breeding or crop production?

- What are the SHG's limitations & needs regarding communication?

- What is the SHG's experience on gene editing in plants?

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2 METHODOLOGY

The methodology of the study can be described as mixed methods, combining quantitative data in the form of a survey with qualitative data derived from a multi-stakeholder focus group workshop to develop more in-depth insights of the survey results and to verify certain results.

2.1 *Survey design, development, and distribution*

2.1.1 SURVEY DESIGN

An online survey was designed to retrieve information about the knowledge, experience, limitations and needs related to communication from the three different SHGs (farmers/farmer organisations, breeders/seed & plant breeding organisations, and policy makers) (see Annex 1). At the beginning, the participants indicated if their response was on an individual basis or on behalf of the organisation that they work for (*e.g.*, a communication manager at a regional farmer organisation). To adapt to the needs of different SHGs, the questions were differentiated between experience in communication on (1) plant research (2) crop improvement and breeding (3) crop production or (4) no experience in communication about aforementioned topics. Finally, questions about the plant breeding innovation, gene editing, were asked to all participants, because this innovation is currently being widely debated in the ongoing discussion on the future of farming in Europe (*cf.* Farm-to-Fork strategy) and in the context of the regulatory discussion related to the European Commission study on new genomic techniques.

The questions of the survey were primarily quantitative (*e.g.*, fixed choice selection or Likert style scale) and participants were classified into three SHGs: (1) farmers and farmer organisations (2) breeders, and seed & plant breeding organisations (3) policy makers (**Table 1**). The survey did not collect any personal data and the free text question results were anonymized in accordance with the data management plan of the CropBooster-P project. The survey was implemented on the Jotform online survey software. All questions in the survey were mandatory, except for the free text question types.

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Table 1. Overview of the structure of the survey and question types.

1) Background information	Question type
Age, gender, educational level, communication as profession, location of work	Fixed choice selection
Which crops does the participant deal with?	Fixed choice selection
Specific questions to make distinctions within the SHGs	Fixed choice selection
2) Perception and knowledge of the participants	
Degree of trust in SHGs	Likert scale
Self-assessment of knowledge	Likert scale
3) Communication experience of the participants	
Experience/opinion on a particular topic: crop production - crop improvement & breeding - plant research? Or no experience/opinion in communication about these topics?	Fixed choice selection
Why does the participant communicate?	Fixed choice selection
Which crops, crop characteristics/improvements and plant breeding techniques does the participant communicate about?	Fixed choice selection
Which food values does the participant communicate about?	Likert scale
Personal example(s) of effective communication	Free text
4) Sources of information for the participants	
From which SHGs does the participant obtain information?	Likert scale
From which channels does the participant obtain information?	Fixed choice selection
Which are the target groups of the participant to communicate with?	Fixed choice selection
Which channels/tools does the participant use and why?	Fixed choice selection
5) Limitations & needs of the participants	
What are limiting factors to communicate?	Fixed choice selection
Which aspects need to be addressed according to the participant?	Likert scale
6) Communication experience of and sources of information for the participants on gene editing in plants	
Does the participant communicate about gene editing in plants?	Fixed choice selection
Which are the target groups of the participant to communicate with?	Fixed choice selection
Which are important topics for the participant to communicate about?	Fixed choice selection
What are limiting factors for the participant to communicate?	Fixed choice selection
From which SHGs does the participant obtain information?	Likert scale
From which channels does the participant obtain information?	Fixed choice selection
Which aspects of plant gene editing need to be addressed according to the participant?	Likert scale

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Based on the number of breeding companies, national associations in the seed & plant breeding sector and farmer organisations, as well as aiming to obtain a representative sample for different European regions, a selection of 10 countries was prioritised: Denmark, France, Germany, Greece, Italy, Netherlands, Poland, Romania, Spain, and United Kingdom (**Figure 2**). In addition, information from the SHGs at the European level from policy makers was retrieved as well.

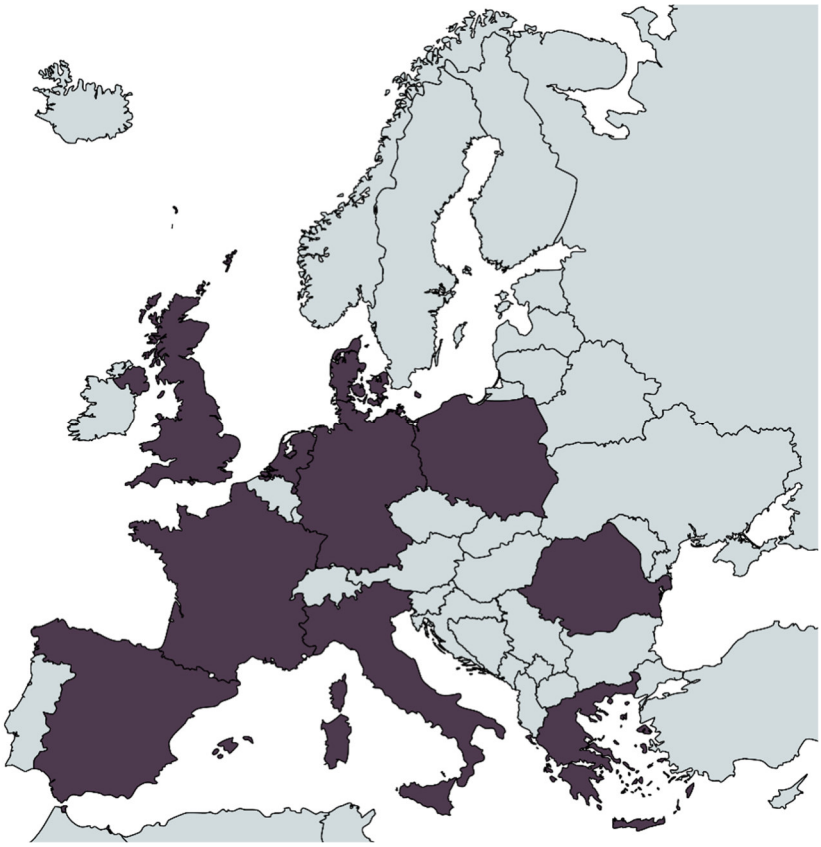

Figure 2. Targeted countries in Europe for information retrieval (indicated in brown).

To enable comprehensive participation, in particular for the SHG farmers/farmer organisations, and to reduce English-language only bias, the survey was translated into the official national language of each of the prioritised countries: Danish, Dutch, French, German, Greek, Italian, Polish, Romanian and Spanish.

2.1.2 PILOT SURVEY

The survey was piloted in English prior to translation. The pilot was designed to identify potential areas of bias, check that the language used was comprehensible, that question instructions were clear, check the survey timing, and flag any problems with the survey flow. The feedback was incorporated into the final draft of the survey. Changes made to the survey following pilot feedback included improved signposting, minor corrections to grammar, and the clarification of some terminology.

2.1.3 TRANSLATION PROCESS

The translation process consisted of an automated translation from the English version of the survey to the respective language via the online available tool DeepL or alternatively Google Translate.

Revision and refinement of the generic translation was conducted by bilingual or native speakers providing context-specific details relevant for the addressed topics in the survey including agricultural practices, crop improvement, plant research and gene editing of plants.

The questions of the survey were mainly quantitative, which minimized the required translation of the survey responses to English afterwards to merge the data obtained in different languages for analysis.

2.1.4 SAMPLING

The survey was accessible online from 8th of March 2021 till 3rd of May 2021. Targeted invitations to participate to the survey were sent to individuals and entities within each SHG via email. Furthermore, the survey links had been widely shared on social media platforms Twitter and LinkedIN and through direct contact with external organisations of relevance, such as for example COPA-COGECA and CEJA to reach out to farmers.

2.1.5 SURVEY ANALYSIS APPROACH

An agreed framework was used to analyse and compare the survey results for each of the three SHGs. The in-depth results for each SHG are described in this report in different sections. Analysis of the survey results depended on the question type (fixed choice selection, Likert scale or free text). The different analyses for each question type are detailed further below.

Fixed choice selection data analysis

For the fixed choice-style questions, responses were tallied for each of the options available according to the SHG and a distinction was made between individual responses versus responses on behalf of an organisation. The percentage of each option relates to the total number of options chosen by a particular SHG. Significant options are described in the results section when the proportion of the option equals or is above the average proportion.

Likert scale data analysis

For the Likert scale-style questions, responses were tallied for each of the 5 options available, and the percentage of participants choosing each option of the Likert scale was calculated. The median option corresponds to the option in the middle of the graph and is described in the results section.

Free text data analysis

The free text data collected for optional questions were thematically analysed for each SHG to identify recurring themes/trends which participants felt sharing.

Additional stakeholder group-specific analysis and synthesis

Additional analysis of relevance to each SHG was carried out as needed, based on the group-specific demographic questions used, and is described in the relevant sections of this report.

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2.2 *Multi-stakeholder focus group*

Focus groups provide a mechanism for both the generation of new ideas and the assessment of potential ideas and offer insights into the differences of opinion that exist among selected groups of people. Focus groups were thus considered an appropriate tool to investigate a broad range of opinions on identified trends of communication activities.

A virtual multi-stakeholder focus group was held with stakeholder representatives from three SHGs: the farming community, seed & plant breeding sector, and European institutions to better understand and develop more in-depth insights into the survey results.

2.2.1 FOCUS GROUP PROTOCOL

A structured focus group presentation and protocol was created aimed at a virtual focus group because due to Covid-19 restriction measures, face to face workshops and interviews were not possible in the current project period (Menary *et al.*, 2021).

The primary questions for each trend were:

- Do you expect/agree with the identified trend?
- Do you think this result is representative for your SHG?
- Do you have an explanation for this result?
- Which follow-up question(s) do you have?

The following protocol was used to facilitate the discussion:

- each trend was introduced starting with stating the research question followed by presenting the slide in which the three SHGs are compared with each other.
- For each trend 20 minutes of discussion was foreseen.
- The moderator asked the participants to share their opinion and made sure that everyone had the chance. We provided 2-3 minutes speaking time for each participant.

It was decided that Microsoft Teams would serve as a suitable hosting platform for the virtual discussions as:

- Meetings can be audio and video recorded.
- Screensharing made it possible to show a presentation during the introduction.
- Participants can join meetings from an internet browser and are not required to create an account to attend the meeting.
- It is a widely available platform with fair stability and security options.

In addition, specific for the online environment; safe collection and storage of video images (which contain personal data in terms of recognizable faces) became a demand for the platform. Microsoft Teams met these demands as it saves recorded meetings to a secure, encrypted platform called Microsoft Stream.

Subsequently, recruitment of potential participants began. As our research population was specified as experts, primarily purposive sampling was applied. We targeted people identified by Euroseeds and Plant ETP as being expert in the field and belonging to one of the three SHGs outlined above. Potential participants were approached using an email with accompanying agenda & introduction based on a standardised template which is given in Annex 2.

2.2.2 FOCUS GROUP

The focus group took place on June 29, 2021, with a total of 6 participants. These involved:

- 2 stakeholder representatives from the farming community
- 1 stakeholder representative from the seed & plant breeding sector
- 3 stakeholder representatives from the European institutions

The focus group was convened by one researcher, who has experience with qualitative data collection. The focus group lasted ninety minutes.

2.2.1 SURVEY RESULTS PRESENTED IN THE FOCUS GROUP WORKSHOP

To facilitate discussion and to enable each of the participants to share their opinion and experience in a relative short amount of time, three identified trends based on the analysis of the survey results were introduced in the invitation for the focus group as well as in the presentation at the beginning of the focus group. The presentation is provided in Annex 3.

2.2.2 ANALYSIS APPROACH

The video recording of the focus group workshop was analyzed to better understand the survey results and to provide more in-depth insights. This information is included in the description of the survey results for each SHG and in the comparative analysis.

In the next sections of the report are the survey results described for each SHG as well as a comparative analysis of the three SHGs.

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3 SURVEY RESPONSES

A total of 168 participants participated to the online survey. Two of the responses were removed from analysis, as the respondents had not completed the survey. The option to save temporarily the progress of the survey to continue later was used by 18 participants. The survey took participants a median of 17.5 minutes to complete.

A total of 166 responses were therefore recorded for participants who had completed all data collection segments: 55 for farmers/farmer organisations, 100 for breeders/seed & plant breeding organisations, and 11 for policy makers.

Most of these participants came from Germany (48) and France (26), with additional participation from: Austria (1), Belgium (13), Denmark (4), Finland (2), Greece (1), Italy (17), Latvia (2), Netherlands (9), Poland (15), Portugal (3), Romania (10), Spain (7), Sweden (1), Switzerland (2), United Kingdom (5) (**Figure 3**).

Figure 3. Country distribution of the survey responses in Europe.

Participants had to indicate which one of the three proposed aspects of food systems: plant research, crop improvement and breeding or crop production they had most experience communicating about. Most of the participants indicated experience in communication about crop production (66) and crop improvement & breeding (69) followed by plant research (16) and no experience in communication about these topics (15) (**Figure 4**).

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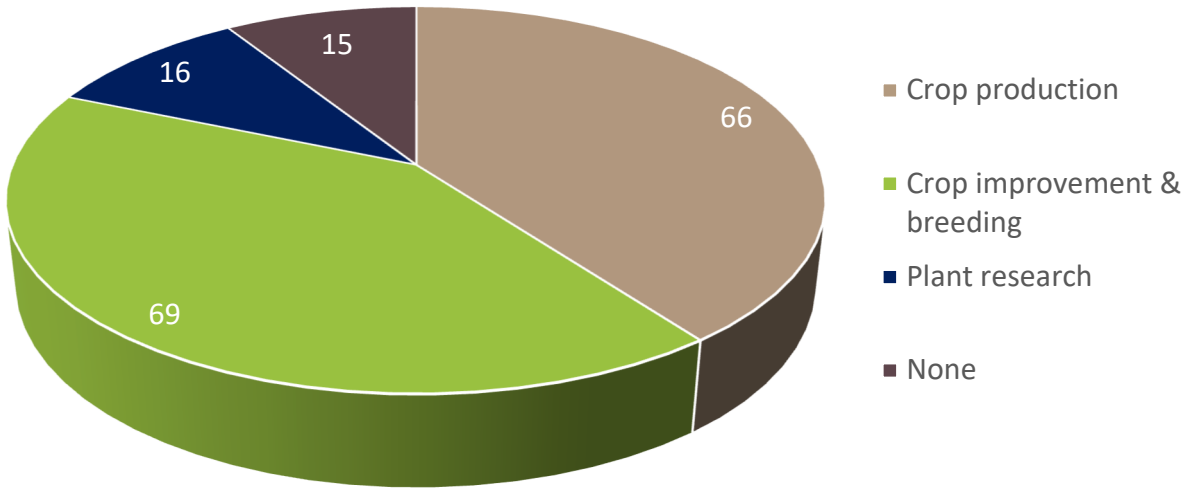

Figure 4. Distribution of themes survey participants primarily communicated on.

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4 FARM-LEVEL SURVEY RESULTS

4.1 *Description of the survey sample*

A total of 55 farm-level participants completed the survey. The number of responses were divided between participants that answered on behalf of themselves (= farmers; 29) and on behalf of the farmer organisation they work for (26). Individual responses were primarily from France, Germany, Romania, and Italy, while responses on behalf of farmer organisations were primarily from Germany, Belgium, Romania, Italy, and Spain.

Approximately 75% of the farmers were male and the age range of the farmers was predominantly between 35-44 and 55-64 years old. Approximately 75% of the farmers had at least a Bachelor's degree and nearly half of the farmers had a university degree in agriculture/ agronomy. Nearly half of the farmers worked on a farm with a size of 100 hectares (ha) or more (**Figure 6**).

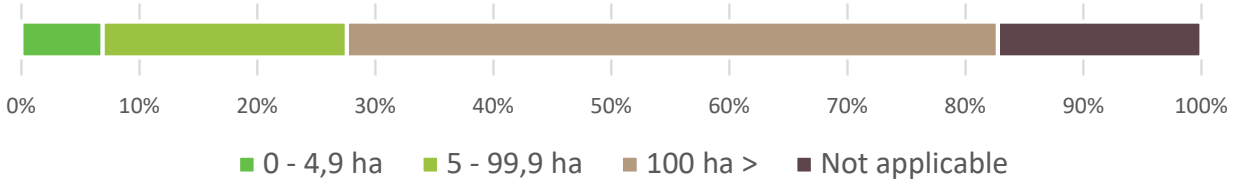

Figure 6. Distribution of the farmers according to farm size. N=29

Farmers indicated that they are primarily dealing with cereals and to a lesser extent with maize/sorghum, sugar beets, legumes, potatoes, and oilseed crops, while farmer organisations are dealing with all the enlisted crops. A total of 21% of the farmers indicated having a farm with a specific certification[1] (*e.g.*, GLOBALGAP) or a specific agri-environmental scheme[2] (*e.g.*, Higher Level Stewardship). The low proportion of farmers who are involved in a specific certification or scheme hints towards an under-representation in the survey results (personal communication, COPA-COGECA), which could for example be explained by the type of production system on the farm of the respondents.

Regarding experience in communication, a total of 62% of the farmers responded that communication is part of their professional tasks. At least 90% of the farmers and farmer organisations completely agreed or mainly agreed with the statement that they understand what plant breeding is as well as the difference between conventional and new plant breeding methods.

Farm-level participants indicated that they trust the European Food Safety Agency (EFSA), education providers and academia, farmers and farmer organisations, seed/plant breeding sector, government agencies/authorities, and agribusinesses & industry associations[3] regarding information and communication about food production in Europe (**Figure 7**). On the contrary, farm-level participants indicated they distrust media, consumer -and environmental organisations.

[1] Certifications are a set of standards that assures for instance quality or good agricultural practices.

[2] Environmental schemes are mechanisms to incentivise farmers to undertake actions that benefit the environment.

[3] In the survey a distinction was made between the SHG seed/plant breeding sector on the one hand and the SHG agribusinesses & industry associations, which represent a broader portfolio of agricultural solutions on the other hand.

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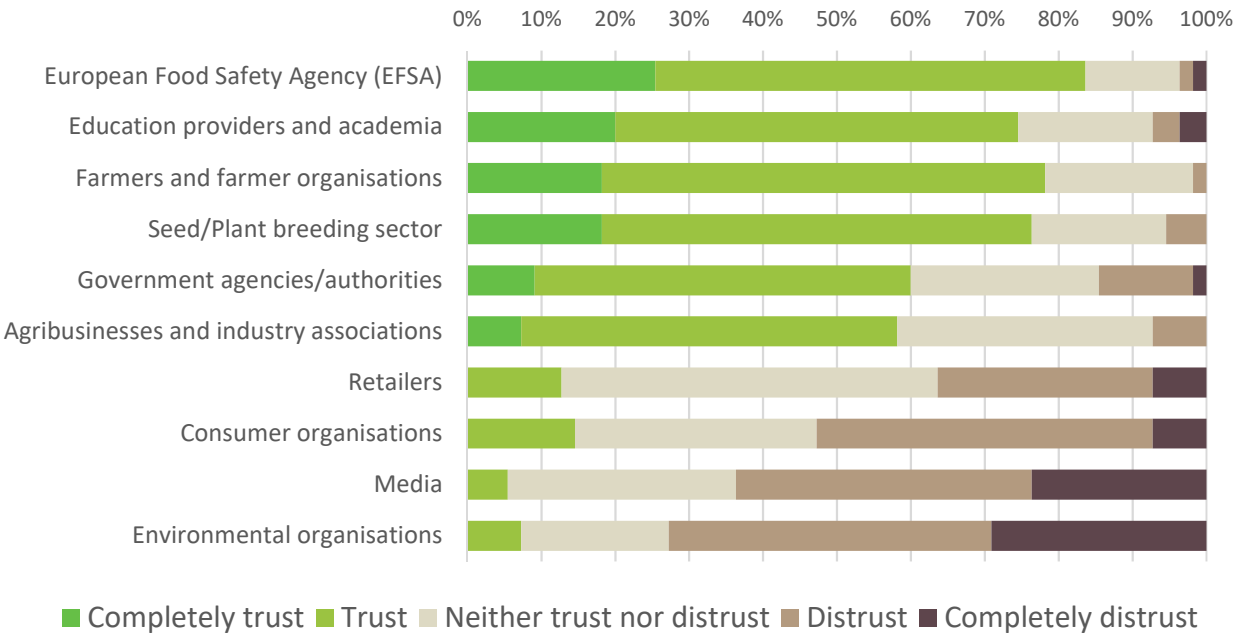

Figure 7. Degree of trust of farmers and farmer organisations in different SHGs regarding information and communication about food production in Europe. N=55

4.2 *Communication topics of farmers and farmer organisations*

Farm-level participants indicated that they often use information in their communication about plant research, crop improvement and breeding or crop production from farmers and farmer organisations, seed/plant breeding sector, agribusinesses & industry associations, education providers and academia, while they seldom use information from retailers, as well as consumer -and environmental organisations.

Participants were queried which of the three proposed themes they have the most experience communicating: plant research, crop improvement & breeding or crop production. Nearly three-quarters of the farmers and farmer organisations indicated having most experience in communication about crop production, the theme that is most closely related to agricultural practices.

When asked why farmers and farmer organisations engage with others in communication, three options in the survey were equally selected as important:

- It is important for my business/job.
- It is important to stay informed about innovation(s).
- It can provide solutions to more sustainable agriculture.

Farmers communicate mainly about cereals and to a lesser extent about oilseed crops, maize/sorghum, potatoes, and sugar beets. This largely corresponds with the crops that the farmers are dealing with (*cf.* 4.1). Similarly, farmer organisations communicate primarily as well about cereals, and to a lesser extent about oilseed crops, and sugar beets. This is a selection of the crops that farmer organisations are in general dealing with, which suggests that farmer organisations prefer to refer to these crops for communication activities.

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Regarding crop characteristics, farmers indicated they mainly communicate about "increased pest and disease resistance", while farmer organisations indicated they communicate primarily about "sufficient yields/ harvests". The characteristic "adaptation to climate change" is equally important for farmers and farmer organisations to communicate about (**Figure 8**).

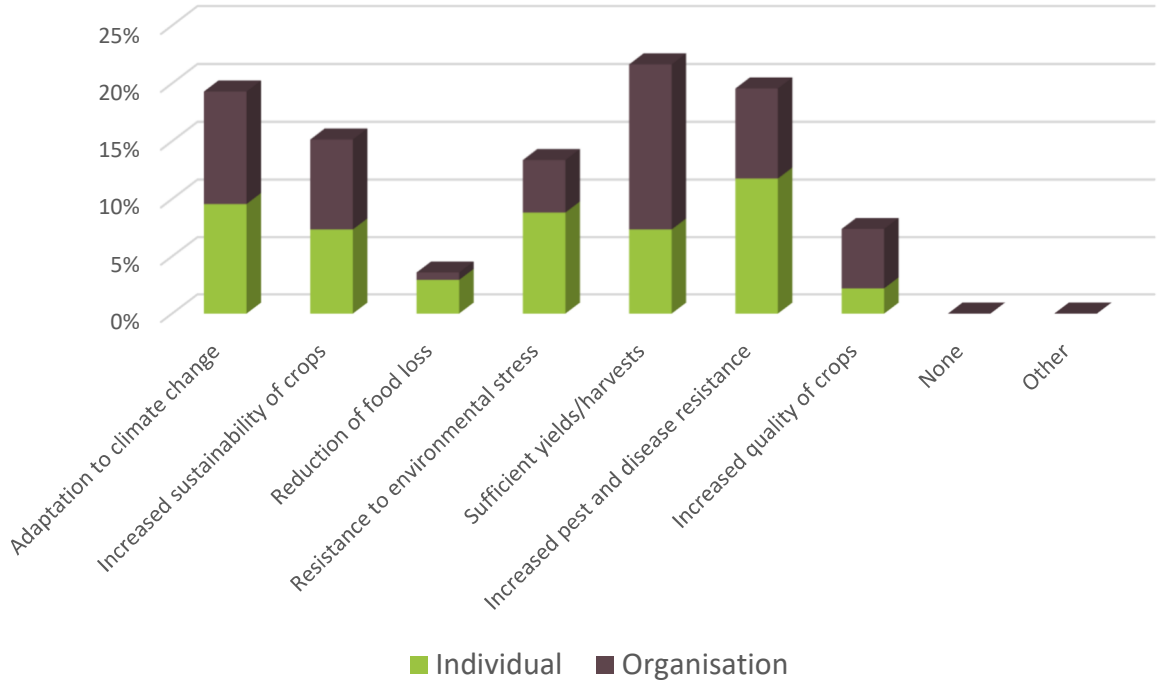

Figure 8. Crop characteristics that farmers and farmer organisations communicate about. The percentage of each option relates to the total number of options chosen by the participants. N=51

Because improved seeds and plant varieties are the starting point of food production, farmers and farmer organisations were asked which plant breeding techniques are used in their communication about food production. Farmers communicate mainly about methods in plant research, and to a lesser extent about plant breeding in general, and precision breeding (*e.g.*, targeted genetic changes using genome editing), while farmer organisations communicate rather about the overall toolbox of plant breeding techniques. Interestingly, of all plant breeding techniques, farmers communicate primarily about precision breeding.

Participants had the possibility to share in the survey examples of a communication relating to plant research, crop improvement and breeding or crop production which, in their experience was effective. The answers were thematically analysed to identify recurring themes/trends which are depicted in the word cloud below (**Figure 9**). The majority of shared experiences involve explaining the basics of crop production & plant breeding as well as providing specific examples and highlighting the benefits for consumers or producers. A farmer representative highlighted in the focus group workshop that specific examples to illustrate why a farmer uses a particular technology or innovation are most effective to get the message across, while providing a lot of scientific data to support one's message appears not to be effective.

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Figure 9. Word cloud of examples for effective communication based on the free text answers from the respondents.

Furthermore, a selection of food values also referred to as "food choice motives" that farm-level participants use in their communication were assayed (Rankin *et al.*, 2018). Assessing motives of food choice are broadly used in social sciences and help to understand participant's priorities and concerns because these motives are determined by a multitude of individual, social and environmental factors (Kearney *et al.*, 2000).

Participants were asked how frequently they use certain food values in their communication (**Figure 10**). The impact of food production on human health and the environment as well as where food was grown or produced and its price, are the major food values used in the communication of farmers and farmer organisations (**Figure 10**). No difference in food value preference between farmers and farmer organisations was observed.

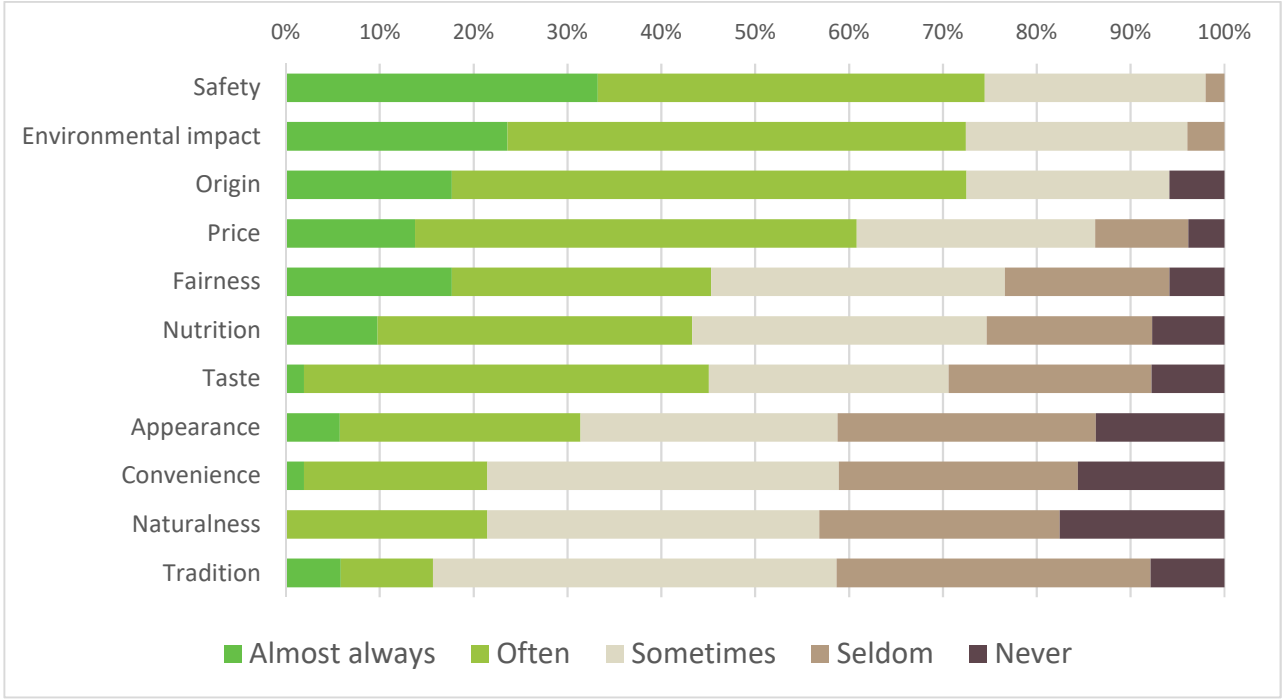

Figure 10. Overview of how frequently farmers and farmer organisations use food values in their communication. N=51

Furthermore, a farmer representative shared in the focus group workshop that food safety is the most important topic to communicate about followed by environmental impact, because these are the two most essential aspects of their profession: "Is it OK/safe what I am producing?" and "Is it OK for the agricultural land/the environment?". In addition, farmers are to a large extent responsible for the food safety & environmental/health requirements related to crop production.

4.3 *Sources of information for farmers and farmer organisations*

Farmers and farmer organisations primarily use magazines, professional/technical magazines, and websites, and participate to activities that facilitate personal interactions such as conferences/meetings/workshops/webinars to learn more about plant research, crop improvement and breeding or crop production (**Figure 11**). Furthermore, websites, and to a lesser extent scientific journals are important media. However, social media platforms are not the main sources to use information from.

Analysis of the preference of communication channels according to age suggests that farmers older than 44 more frequently prefer to use professional/technical magazines and participate to conferences & meetings to inform themselves (**Annex 4**). On the contrary, social media platforms including Instagram and TikTok appear to be more frequently used by younger farmers as sources of information.

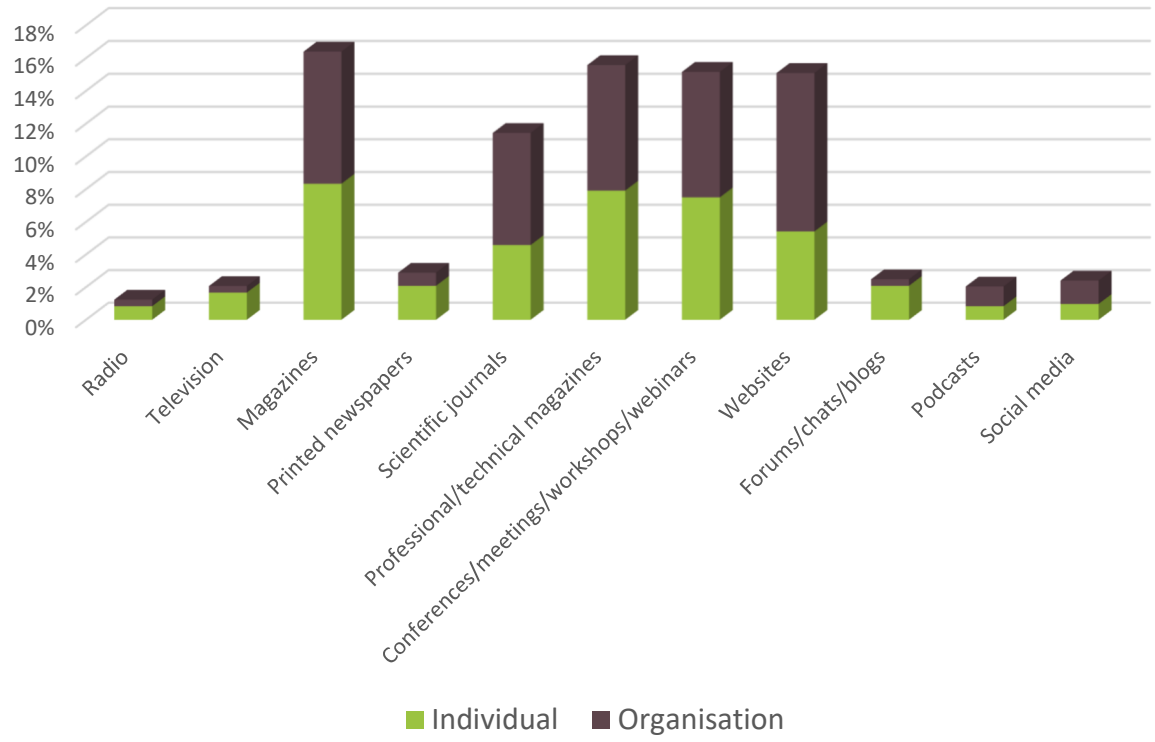

Figure 11. Communication channels used by farmers and farmer organisations to learn more about plant research, crop improvement and breeding or crop production. The percentage of each option relates to the total number of options chosen by the participants. N=51

According to the survey, farmers and farmer organisations mainly communicate about plant research, crop improvement and breeding or crop production to farmers, policy makers, and consumers and prefer to communicate via personal interaction including conferences/meetings/

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workshops/webinars (**Figure 12**). Moreover, websites, magazines and professional/technical magazines were indicated as important media for communication purposes. Facebook and Twitter are the main social media platforms that farmers and farmer organisations use to communicate with their target groups.

Analysis of the preference for communication channels according to age suggests that farmers older than 44 more frequently prefer to use professional/technical magazines and Twitter for communication purposes (**Annex 4**). The survey results hint furthermore that younger farmers are more active on other social media platforms such as WhatsApp, Youtube, Instagram and TikTok for communication purposes.

In the focus group workshop, a farmer representative highlighted that a social media platform such as Twitter is a helpful medium for public outreach (*e.g.*, posting a picture or video of agricultural practices) and for engagement with policy makers. The advantage for the farmer is that a social media platform enables to reach out to more individuals at once and to engage more easily with relevant policy makers about agricultural policies because many of them are active on social media platforms as well. The farmer representative shared the observation that over the past years the number of farmers actively communicating on social media has increased.

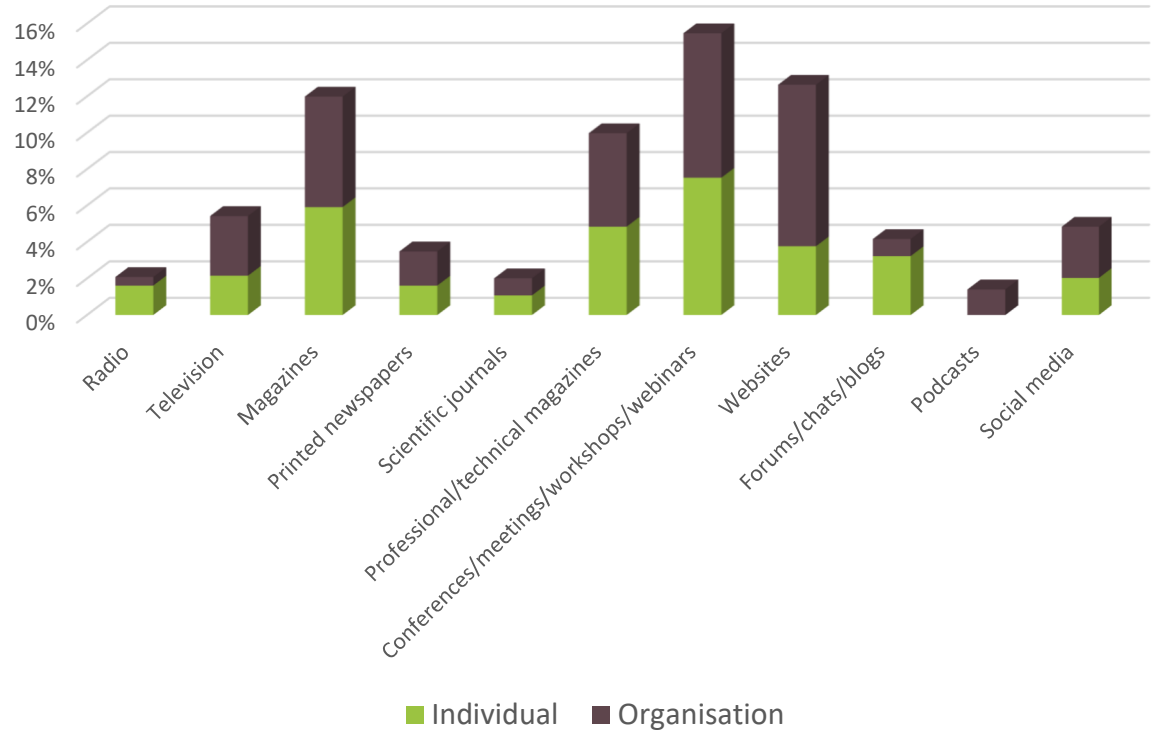

Figure 12. Communication channels used by farmers and farmer organisations to communicate with their main target groups. The percentage of each option relates to the total number of options chosen by the participants. N=51

When asked why farmers and farmer organisations engage with others in communication, two options in the survey were selected as important:

- My target audience is mainly reached through these channels.
- I have easy access to these channels.

The main limiting factor to communicate to others was time to dedicate to communication.

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4.4 *Future communication efforts by farmers and farmer organisations*

To gain insights into the needs of participants regarding communication, farmers and farmer organisations were asked to indicate the importance of addressing certain topics in their future communication activities.

Communication about sustainability, which was defined in the survey as "production methods that respect planetary boundaries, benefit society and ensure financial viability" is the main priority in communication efforts (**Figure 13**). Furthermore, communication about safety described as "guarantees safe and nutritious food that is not contaminated by food-borne diseases/pathogens", and fair competition, which refers to "a free market in which all the players operate on a level playing field" was indicated as of high importance as well.

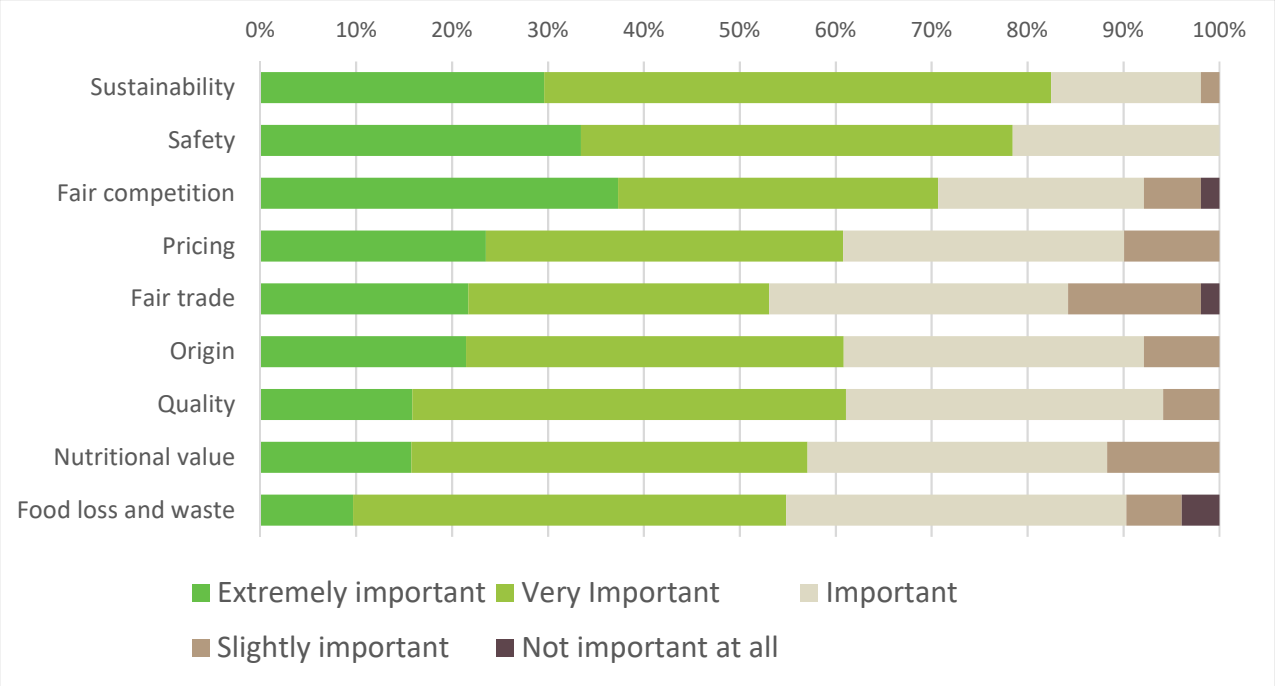

Figure 13. Ranking of topics for future communication efforts by farmers and farmer organisations towards their target groups. N=51

4.5 *Communication experience and sourcing of information about gene editing in plants by farmers and farmer organisations*

Communication activities about the new plant breeding technique, gene editing, were surveyed because this innovation is currently being widely debated in the ongoing discussion on the future of farming in Europe (*cf.* Farm-to-Fork strategy). A total of 78% of the respondents indicated that they are familiar with gene editing in plants.

Farm-level participants indicated that they often engage with the seed/plant breeding sector and sometimes with farmer and farmer organisations, education providers and academia, agribusinesses & industry associations, EFSA, government agencies and authorities, and media to inform themselves about plant gene editing (**Figure 14**). On the contrary, farm-level participants seldom engage with consumer -and environmental organisations and retailers. A

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farmer representative stated in the focus group workshop that the information from retailers is not relevant because they are mainly active at the end of the agri-food chain, and there is a lack of trust of farmers in consumer -and environmental organisations.

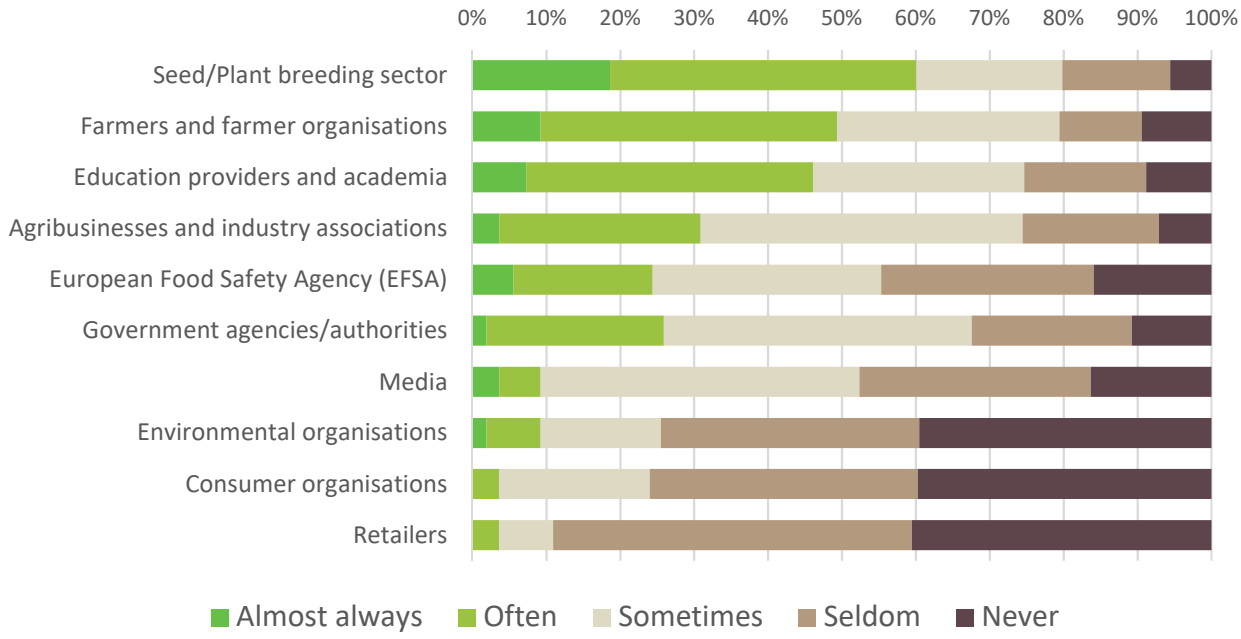

Figure 14. Overview of how frequently farmers and farmer organisations engage with specific SHGs to inform themselves about gene editing in plants. N=55

Farmers and farmer organisations primarily use magazines, professional/technical magazines, scientific journals, websites, and conferences/meetings/workshops/webinars to learn more about gene editing in plants. These sources do not differ from those that were selected by the farm-level participants for information about plant research, crop improvement and breeding or crop production (*cf.* 4.3; **Figure 11**). Their main target groups do not differ as well.

Analysis of the preference for communication channels according to age hints that farmers older than 44 prefer to use more frequently scientific journals, professional/technical magazines, and websites to inform themselves about plant gene editing, while younger farmers prefer to use in addition Facebook as a source of information (**Annex 4**).

Nearly half of the farmers and farmer organisations indicated that they communicate about gene editing in plants. The following topics were identified as most important when communicating about gene editing in plants:

- Potential benefits associated with gene editing in plants
- Examples of the applications of gene editing in plants
- Comparisons of gene editing and conventional breeding methods

Furthermore, farmers and farmer organisations indicated that there were no main limiting factors to communicate about gene editing in plants.

Farm-level participants were asked about the importance of addressing various aspects in future communication about gene editing in plants (**Figure 15**). Communication about safety, which was defined in the survey as "environmental and/or food safety risk assessment of applications of gene editing in plants" should be the main priority in communication efforts. Furthermore, communication about examples and innovations related to the application of gene editing in

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plants as well as global context and public access to information about applications of plant gene editing were indicated by the respondents as important topics in future communication.

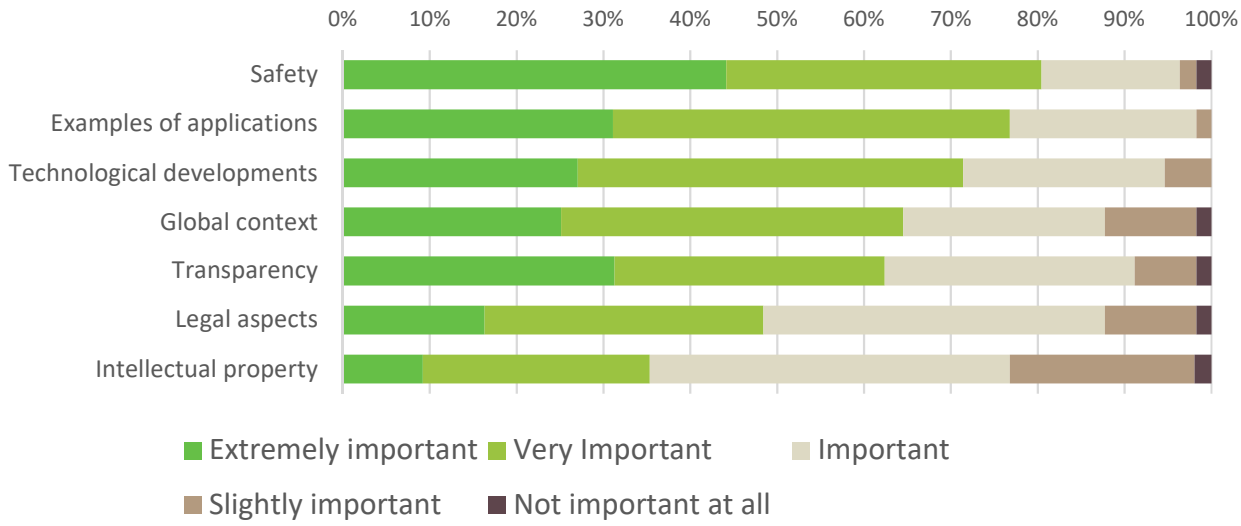

Figure 15. The importance of addressing certain aspects in future communication about gene editing in plants according to farmers and farmer organisations. N=55

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4.6 *Farm-level conclusions*

Farm-level participants mostly trust EFSA, academia, the seed & plant breeding sector as well as the farming community as sources of information. They preferably use information from these SHGs in their communication activities, which suggests that the degree of trust is an important determinant in the selection of sources for communication purposes or *vice versa*.

The crop characteristics that farmers and farmer organisations communicate about mostly relate to yield and yield stability (*e.g.*, adaptation to climate change). Furthermore, they highlighted the need for future communication about the aspects that are most relevant for primary producers: (pre-market) safety considerations, as well as environmental impact (*cf.* agricultural practices). The need to address fair competition might be a consequence of the increasing unequal playing field for European farmers in an international context (*cf.* impact of European trade deals). Taken together, **farm-level participants appear to communicate preferably about the topics that are most relevant to them due to their profession and experience.**

The majority of farm-level participants indicated that of all plant breeding techniques they **primarily communicate about gene editing in plants.** It is furthermore an interesting observation that communication about comparisons between gene editing and conventional breeding methods are important as well. These observations correspond largely with the ongoing discussions in Europe to propose a differentiated regulatory framework for gene-edited plants with genetic changes that could have occurred spontaneously or as a result of conventional breeding methods (*cf.* European Commission study on new genomic techniques).

The analysis of the preferred food values, food production aspects, and plant gene editing topics of farm-level participants revealed that **safety is the most important topic for farmers to communicate about, presumably because they are to a large extent responsible for the food safety & environmental/health requirements related to crop production.** This is an interesting observation because it is questionable if the general public and stakeholders are aware about the high level of attention being addressed by farmers to safety considerations in their profession and communication efforts.

Farm-level participants primarily use professional magazines, scientific journals, websites, and participate to activities that facilitate personal interactions such as conferences or meetings for sourcing of information and communication purposes regardless of the topic (*e.g.*, crop production vs. plant gene editing). Furthermore, **Facebook and Twitter are the main social media platforms** that the farming community uses to communicate with their target groups. Analysis of the preference for communication channels according to age suggests that **younger farmers prefer a more diverse set of social media platforms** including Youtube, Instagram and even TikTok, while older farmers prefer to use more frequently professional magazines and websites.

A further synthesis of the farm-level results with the results from the other SHGs is described in section 7: "Integrative analysis of the survey results between the three SHGs".

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5 BREEDERS AND SEED & PLANT BREEDING ORGANISATION SURVEY RESULTS

5.1 *Description of the survey sample*

A total of 100 participants from the seed & plant breeding sector completed the survey. The number of responses was equally divided between participants that answered on behalf of themselves (49) and on behalf of the organisation that they work for (51).

Individual responses were primarily from Germany, Italy, Poland, France, The Netherlands, and UK. Approximately 73% of the respondents were male and the age range was predominantly between 25-44 and 55-64 years old. Almost all respondents had at least a Bachelor's degree and nearly three-quarters had a university degree in agriculture/agronomy. Participants from the seed & plant breeding sector were mainly working with cereals, legumes, oilseed crops, vegetables, maize/sorghum, and fodder plants/amenity grasses.

The survey results show the globalised and diverse nature of the sector in Europe: nearly three-quarters of the participants worked in a company or organisation that is internationally active and participants worked respectively for 45%, 35% and 20% at small, medium-sized, and large companies (**Figure 16**). The headquarter of the companies and organisations were primarily located in Germany, France, The Netherlands, Poland, and Italy. These results correspond largely with the survey sample of the European seed & plant breeding sector of another survey conducted in 2020 (Jorasch *et al.*, 2020).

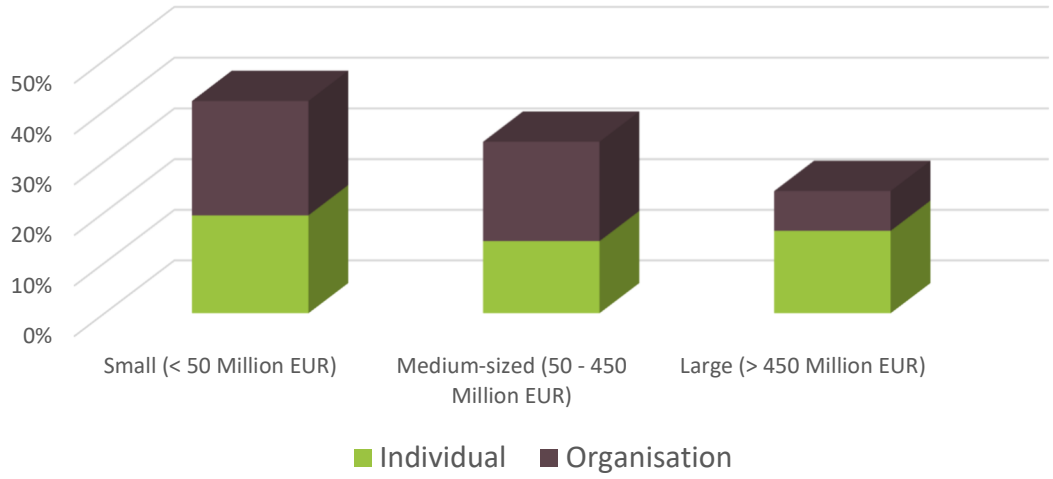

Figure 16. Distribution of the participants from the seed & plant breeding sector according to the size of their company or organisation. N=100

Regarding experience in communication, a total of 80% of the participants indicated that communication is part of their professional tasks. Furthermore, they were asked to indicate their degree of trust in different SHGs regarding information and communication about food production in Europe (**Figure 17**). Participants indicated having trust in the seed/plant breeding sector, EFSA, education providers and academia, agribusinesses & industry associations, farmers and farmer organisations, and government agencies/authorities. On the contrary, participants indicated having distrust in media, consumer -and environmental organisations.

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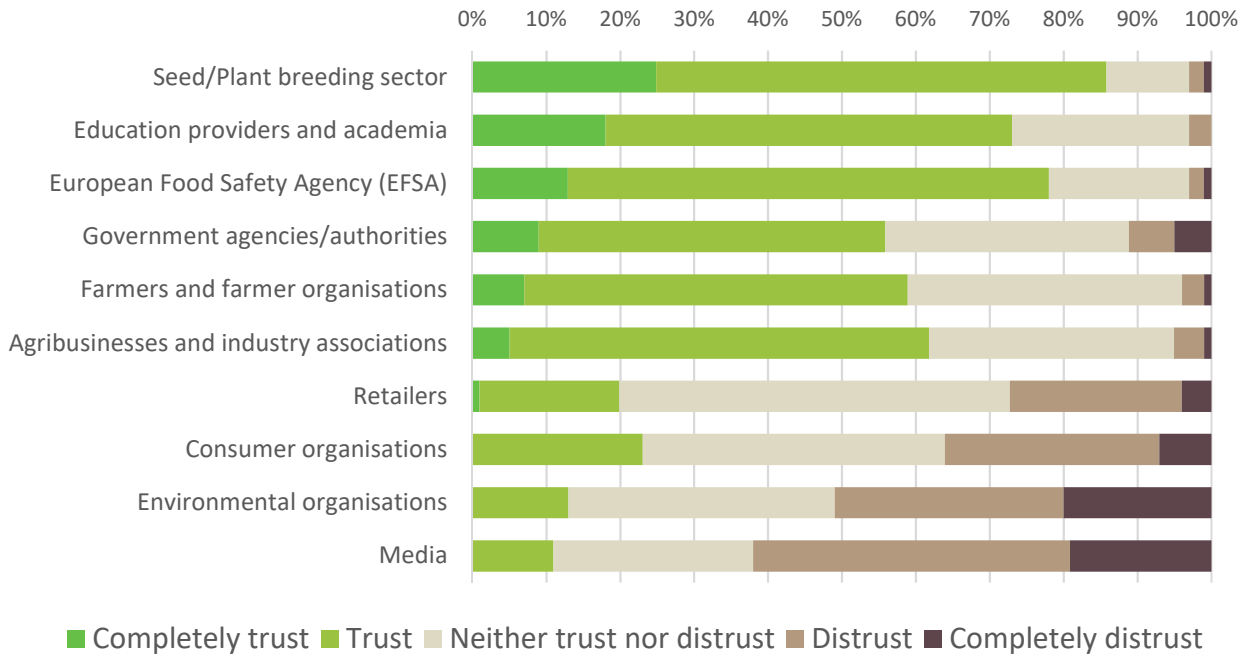

Figure 17. Degree of trust of participants from the seed & plant breeding sector in different SHGs regarding information and communication about food production in Europe. N=100

5.2 *Communication topics of breeders and seed & plant breeding organisations*

Participants indicated that they often use information in their communication about plant research, crop improvement and breeding or crop production from the seed/plant breeding sector, education providers and academia, and agribusinesses & industry associations, while they seldomly use information from retailers, consumer -and environmental organisations.

Respondents were furthermore queried about which of the three suggested themes they have the most experience communicating: plant research, crop improvement & breeding or crop production. A total of 63% has most experience in communication about crop improvement and breeding, while 22% has most experience in crop production.

When asked why they engage with others in communication, two options in the survey were selected as important:

- It is important for my business/job.
- It can provide solutions to more sustainable agriculture.

Of a wide selection of plant breeding techniques, respondents indicated that they mainly communicate about plant breeding in general as well as hybrid breeding in their communication about crop production (**Figure 18**). Furthermore, no remarkable differences between individual responses and responses on behalf of an organisation were observed concerning the preference in plant breeding techniques for communication efforts (**Figure 18**).

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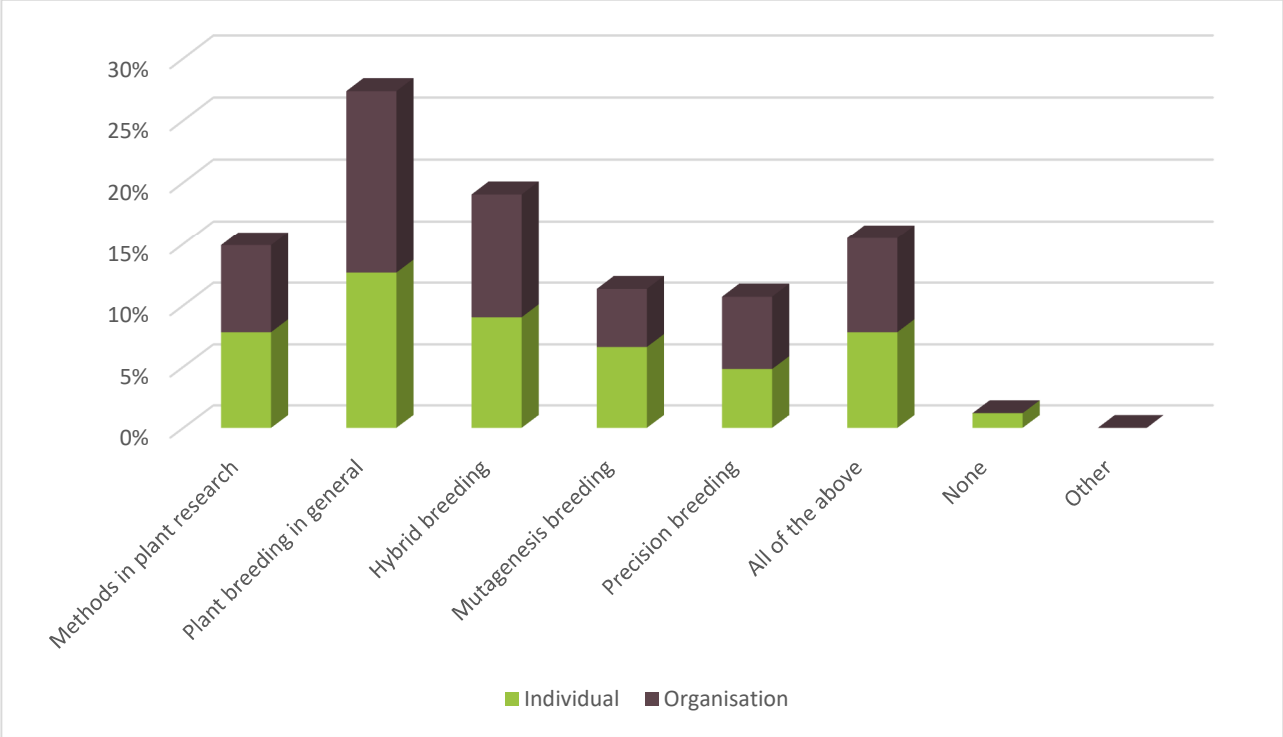

Figure 18. Plant breeding techniques that breeders and seed & plant breeding organisations communicate about. The percentage of each option relates to the total number of options chosen by the participants. N=94

Breeders and seed & plant breeding organisations communicate mainly about cereals, and to a lesser extent about vegetables, oilseed crops, maize/sorghum, legumes, and fodder plants/amenity grasses. The preferred crops in communication efforts correspond with those crops that the participants are primarily dealing with (*cf.* 5.1).

Regarding crop characteristics, they communicate first and foremost about "increased pest and disease resistance", and to a lesser extent about "sufficient yields/harvests", and "adaptation to climate change", while the characteristic "reduction of food loss" is not relevant at all for this SHG (**Figure 19**). In addition, there are no noticeable differences in preference in crop characteristics between individual responses and responses on behalf of an organisation (**Figure 19**).

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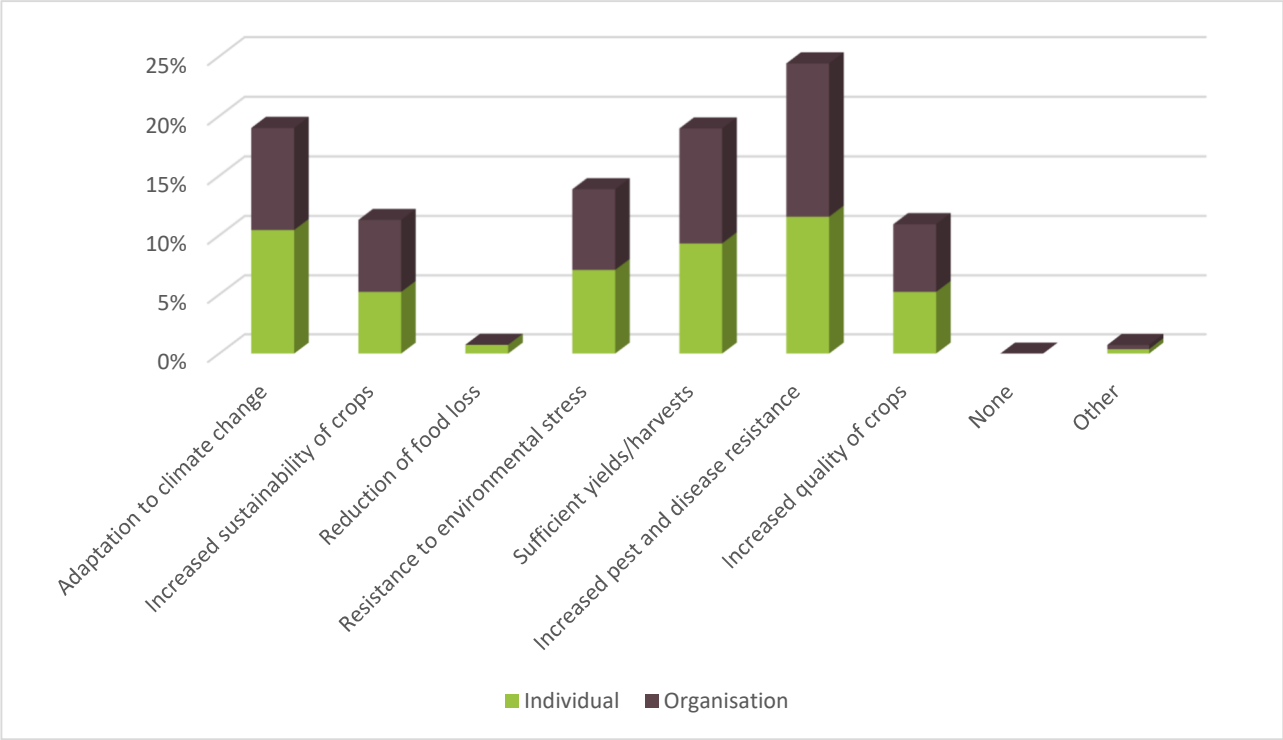

Figure 19. Crop characteristics that breeders and seed & plant breeding organisations communicate about. The percentage of each option relates to the total number of options chosen by the participants. N=94

Respondents could share in the survey examples of a communication relating to plant research, crop improvement and breeding or crop production which, in their experience was effective. The answers were thematically analysed to identify recurring topics, which are depicted in the word cloud below (**Figure 20**). The majority of shared experiences are about providing specific examples and highlighting the benefits for consumers or producers as well as explaining the basics of plant breeding and engaging with the general public via field days and participatory events.

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Figure 20. Word cloud of examples for effective communication based upon the free text answers from the respondents.

Breeders and seed & plant breeding organisations were asked how frequently they use certain food values in their communication, and the survey results revealed that the impact of food production on the environment is the most frequently used food value (**Figure 21**). Furthermore, a seed sector representative shared in the focus group workshop that safety and environmental impact are the most important topics in communicate activities, although there is currently a trend to address other topics as well such as for instance nutrition and origin.

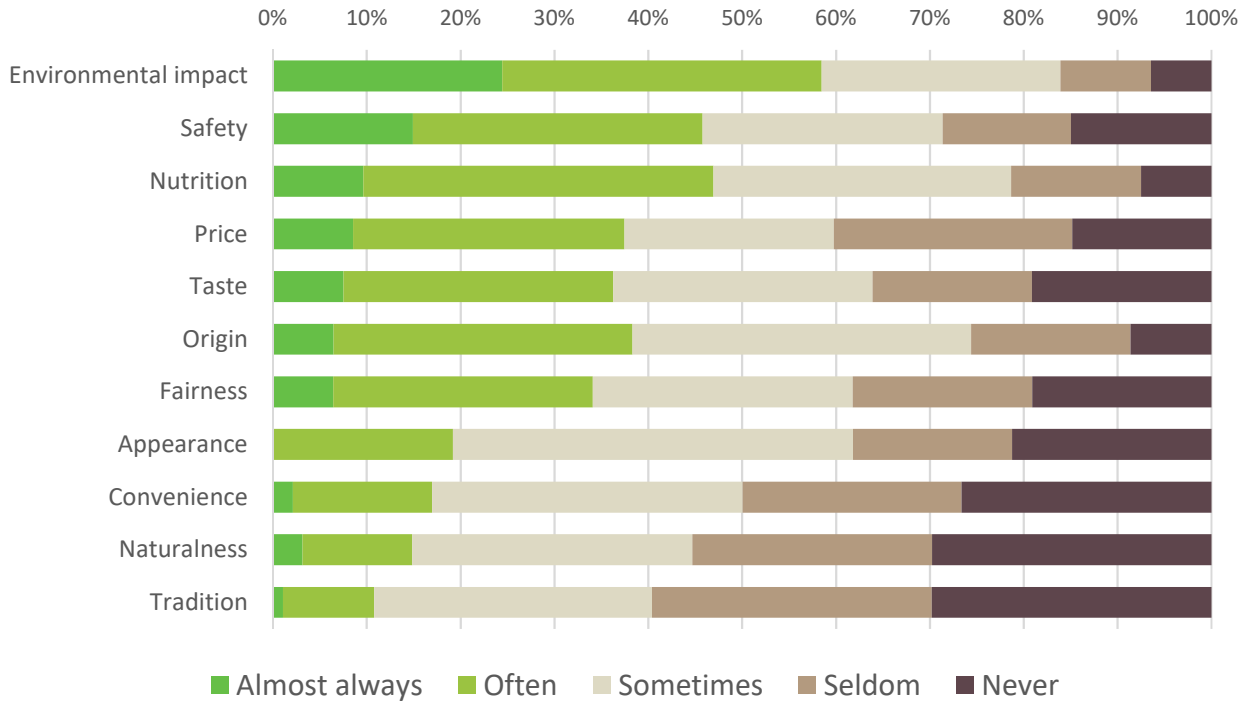

Figure 21. Overview of how frequently breeders and seed & plant breeding organisations use food values in their communication. N=94

5.3 *Sources of information for breeders and seed & plant breeding organisations*

Breeders and seed & plant breeding organisations preferably use magazines, professional/ technical magazines, conferences/meetings/workshops/webinars, websites, and scientific journals to learn more about plant research, crop improvement and breeding or crop production (**Figure 22**). Besides websites, online sources such as social media, podcasts, blogs etc. are not the major sources of information.

Analysis of the preference for communication channels according to age suggests that breeders older than 44 more frequently prefer to use professional/technical magazines & websites and participate to conferences & meetings to inform themselves (**Annex 4**). Interestingly, younger participants appear to use podcasts as a relevant source of information.

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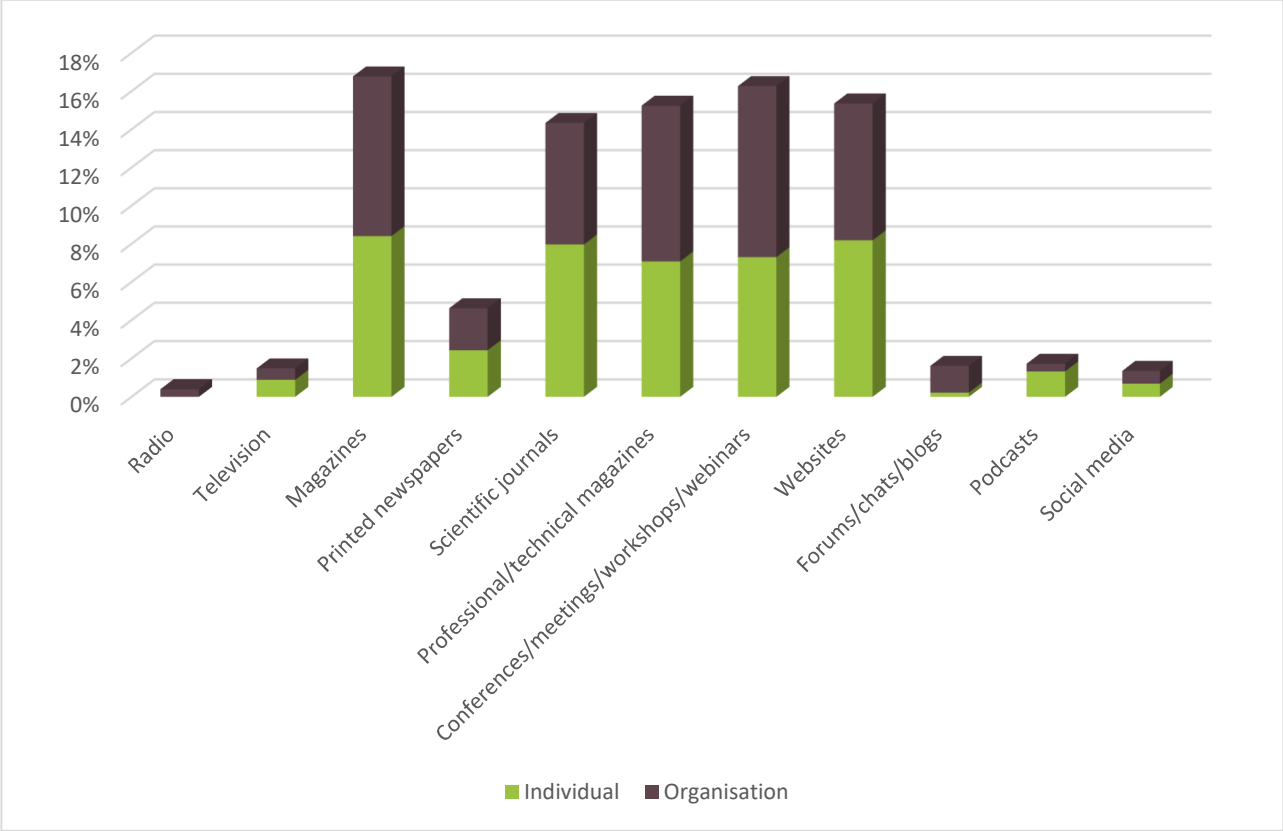

Figure 22. Communication channels used by breeders and seed & plant breeding organisations to learn more about plant research, crop improvement and breeding or crop production. The percentage of each option relates to the total number of options chosen by the participants. N=94

According to the survey, breeders and seed & plant breeding organisations mainly communicate about plant research, crop improvement and breeding or crop production to farmers. As stated by a representative from the seed sector in the focus group workshop, this is presumably because farmers are customers of the seed & plant breeding sector.

Important media for communication purposes are conferences/meetings/workshops/webinars, magazines, professional/technical magazines, and websites (**Figure 23**). Moreover, Facebook, LinkedIN, and Twitter are respectively the main social media platforms that participants use to communicate with their target groups. A seed sector representative highlighted in the focus group workshop that the digital world provides a unique opportunity to improve your visibility and increase engagement with important stakeholders, however there is nowadays a lot of competition online, so you need to have tailored communication strategies to use social media as relevant communication channels.

Analysis of the preference for communication channels according to age suggests that breeders older than 44 more frequently prefer to use professional/technical magazines and scientific journals for communication purposes, while younger breeders appear to be more active on Twitter (**Annex 4**).

When asked why breeders and seed & plant breeding organisations engage with others in communication, two options in the survey were selected as important:

- My target audience is mainly reached through these channels.
- I have easy access to these channels.

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The main limiting factor to communicate to others was time to dedicate to communication.

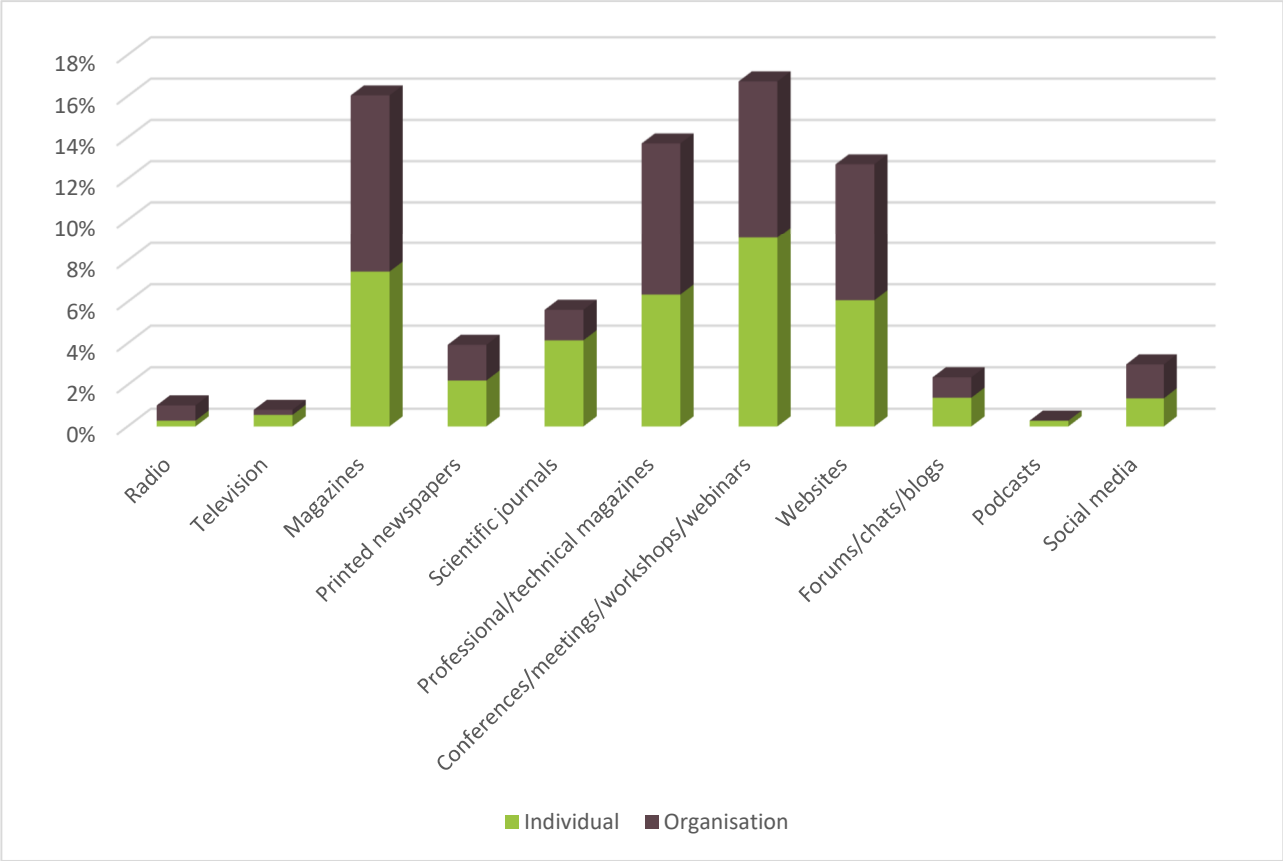

Figure 23. Communication channels used by breeders and seed & plant breeding organisations to communicate with their main target groups. The percentage of each option relates to the total number of options chosen by the participants. N=94

5.4 *Future communication efforts by breeders and seed & plant breeding organisations*

To garner insights into the needs of participants regarding communication, breeders and seed & plant breeding organisations were asked to indicate the importance of addressing certain topics in their future communication activities.

Communication about safety as well as about sustainability, which was defined in the survey as "production methods that respect planetary boundaries, benefit society and ensure financial viability" are the main priorities in communication efforts (**Figure 24**). Furthermore, communication about quality described as "linked to aspects such as food appearance, texture, flavour and nutrition", and nutritional value, which refers to "the measure of a well-balanced ratio of the essential nutrients in items of food or diet in relation to the nutrient requirements of their consumer" was indicated as of high importance as well.

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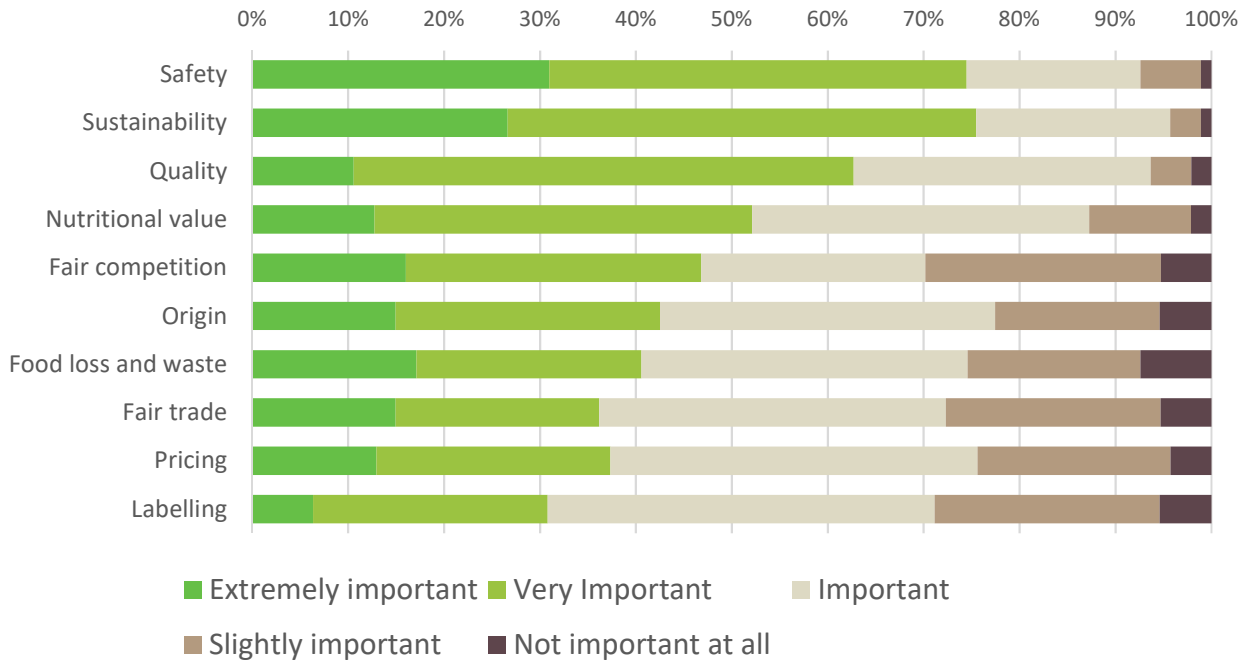

Figure 24. Ranking of topics for future communication efforts by breeders and seed & plant breeding organisations towards their target groups. N=94

5.5 *Communication experience and sourcing of information about gene editing in plants by breeders and seed & plant breeding organisations*

A total of 86% of the participants indicated that they are familiar with gene editing in plants. Furthermore, they engage often with the seed/plant breeding sector, and education providers & academia to inform themselves about this innovation (**Figure 25**). On the contrary, participants engage seldom with farmers and farmer organisations, EFSA, consumer -and environmental organisations and retailers as sources for information about plant gene editing.

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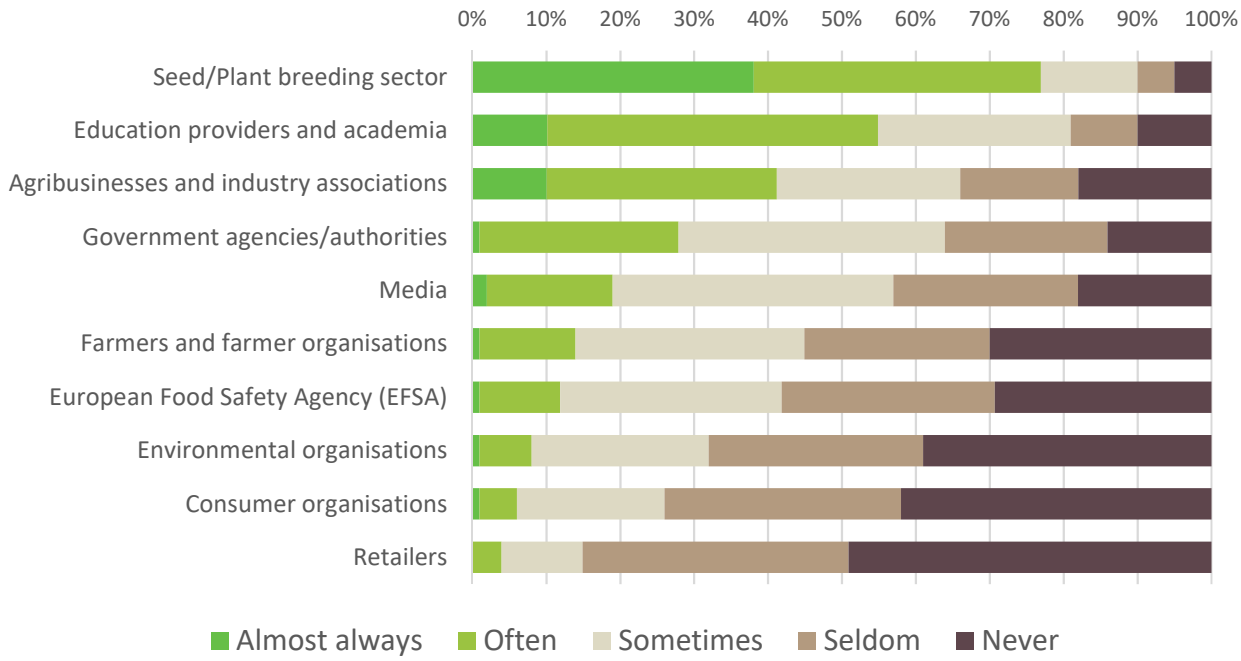

Figure 25. Overview of how frequently breeders and seed & plant breeding organisations engage with specific SHGs to inform themselves about gene editing in plants. N=100

Breeders and seed & plant breeding organisations primarily use the same sources to learn more about gene editing in plants as for about plant research, crop improvement and breeding or crop production (*cf.* 4.3; **Figure 22**).

Analysis of the preference for communication channels according to age hints that breeders older than 44 prefer to use more frequently professional/technical magazines and participate to conferences & meetings to inform themselves about plant gene editing, while younger breeders prefer to use more frequently Twitter and LinkedIN as sources of information (**Annex 4**).

According to the survey, nearly half of the respondents from the seed & breeding sector indicated that they communicate about gene editing in plants and that they primarily communicate to policy makers, farmers, and plant breeders, which differs when communicating about plant research, crop improvement and breeding or crop production, because in that case the main target group is only farmers (*cf.* 4.3).

The most important topics when communicating about gene editing in plants were identified as:

- Potential benefits associated with gene editing in plants
- Examples of the applications of gene editing in plants
- Comparisons of gene editing and conventional breeding methods

One of the prioritised topics: "Comparisons of gene editing and conventional breeding methods" corresponds largely with the regulatory discussion on gene editing, that currently concentrates on a policy aim for a differentiated regulatory approach of genome-edited plants (*cf.* European Commission study on new genomic techniques). Furthermore, the seed & plant breeding sector indicated that there are no main limiting factors to communicate about gene editing in plants.

Breeders and seed & plant breeding organisations were asked about the importance of addressing various aspects in future communication about gene editing in plants (**Figure 26**). Future communication about examples of applications as well as safety should be the main

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priority. Furthermore, transparency and technological developments related to the application of gene editing in plants as well as the global context were indicated by the respondents as important topics in future communication efforts (**Figure 26**).

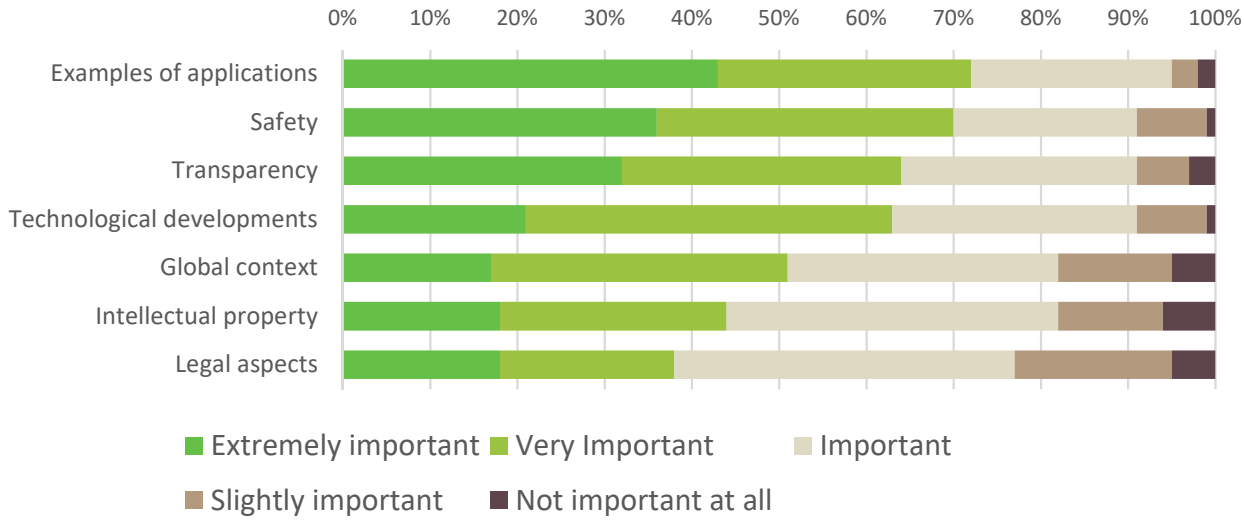

Figure 26. The importance of addressing certain aspects in future communication about gene editing in plants according to breeders and seed & plant breeding organisations. N=100

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5.6 *Breeders and seed & plant breeding organisation conclusions*

Breeders and seed & plant breeding organisations **mostly trust their own SHG, academia, and EFSA as sources of information and they preferably use information from these SHGs in their communication activities.** Besides the seed & plant breeding sector, academia and public research institutes are relevant sources of information for this SHG, which could be explained by the fact that not only the private sector but also the public sector in Europe has been conducting a lot of research activities related to crop improvement and gene editing in plants (Parisi *et al.*, 2021).

The most preferred crop characteristics that breeders and seed & plant breeding organisations communicate about relate to yield and yield stability, which corresponds with the preferences of the farming community, and which suggests that communication about economic aspects of crop production and economic competitiveness are key for these SHGs. Furthermore, breeders highlighted the necessity for future communication about the aspects that are most relevant for primary producers: safety and environmental impact. Taken together, **this SHG appears to communicate preferably about the topics that are most relevant to them due to their profession and to their customers, the farming community.**

Breeders and seed & plant breeding organisations indicated that of all plant breeding techniques they primarily communicate about hybrid breeding, which could be explained because of the relevance of this technique in major crops as well as a substantial number of plant breeding activities in the sector. Interestingly, the survey results suggest that gene editing in plants is a relevant breeding technique for the seed & plant breeding sector to communicate about, however, it is not of the highest importance in view of communication. A possible explanation is that corporate communication, would prioritise hybrid breeding while advocacy and related communication that target political stakeholders would focus more on gene editing.

Future communication about examples of plant gene editing was top-ranked by the breeders and seed & plant breeding organisations, which supports the assumption that communication and advocacy efforts are currently focused on related policy discussions. **Examples of effective communication according to this SHG are explaining the basics of plant breeding and its benefits to consumers as well as using specific examples** (*e.g.*, the need to reduce pesticide use) and inviting interested stakeholders on field days and participatory events.

Breeders and seed & plant breeding organisations prefer professional magazines, scientific journals, websites, meetings & workshops for sourcing of information and communication purposes. **Moreover, Facebook, LinkedIN, and Twitter are the main social media platforms that the seed & plant breeding sector uses to communicate** with their target groups. Analysis of the preference for communication channels according to age suggests that **younger breeders use podcasts** as a relevant source of information **and more frequently use Twitter** for communication purposes, while older breeders prefer more frequently professional magazines and to participate in conferences & meetings.

A further synthesis of the seed & plant breeding sector-level results with the results from the other SHGs is described in section 7: "Integrative analysis of the survey results between the three SHGs".

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6 POLICY MAKER-LEVEL SURVEY RESULTS

6.1 *Description of the survey sample*

A total of 11 policy maker-level participants completed the survey. Most responses were from participants that answered on behalf of themselves. The data of the single response on behalf of an institution was therefore combined with the data of the ten individual responses for the survey analysis of this SHG. Responses are primarily from Belgium (45%), and to a lesser extent from Germany, Italy, Poland, and Portugal, which indicates that nearly half of the responses are from European institutions active in Belgium.

A total of respectively 36% and 18% of the responses are from participants who work at the European Parliament and European Commission (**Figure 27**). The nationality of the four Members of the European parliament who responded is Italian (2), Portuguese (1) and Luxembourgish (1). The remaining responses are from respondents who work at a National Government, Regional Parliament or Government, European agency or for political education and consultancy (**Figure 27**).

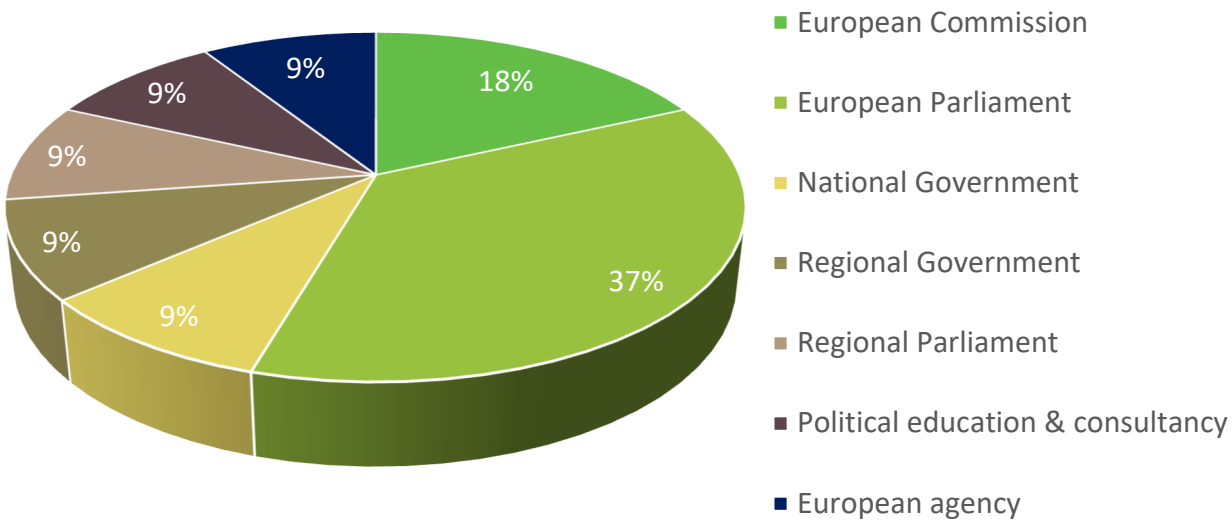

Figure 27. Distribution of the policy makers according to their organisation. N=11

Approximately 80% of the policy makers were male and their age range was predominantly between 35-54 years old. All respondents had at least a Bachelor's degree and a total of 30% of the policy makers had a university degree in agriculture/agronomy.

Regarding experience in communication, most policy makers responded that communication is part of their professional tasks. Interestingly, at least 80% of the policy makers completely agreed or mainly agreed with the statement that they understood what plant breeding is as well as the difference between conventional and new plant breeding methods (**Figure 28**). Furthermore, nearly 90% of the policy makers completely agreed or mainly agreed with the statement that they were interested in the difference between conventional and new plant breeding methods, while only 50% of the policy makers were interested in plant breeding in general (**Figure 28**). The high proportion of participants interested in plant breeding innovation indicates that predominantly policy makers familiar to this topic responded to the survey.

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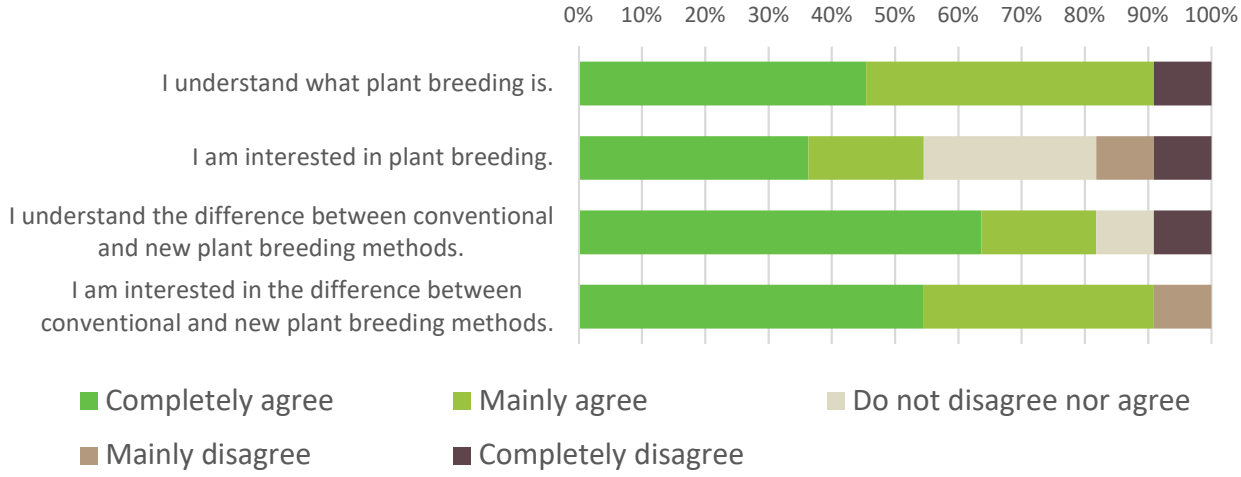

Figure 28. Overview of policy maker's self-assessment of knowledge and interest in plant breeding (innovation). N=11

Policy makers indicated having trust in EFSA, education providers and academia, government agencies/authorities, environmental -and consumer organisations regarding information and communication about food production in Europe, while they have distrust in agribusinesses and industry associations (**Figure 29**).

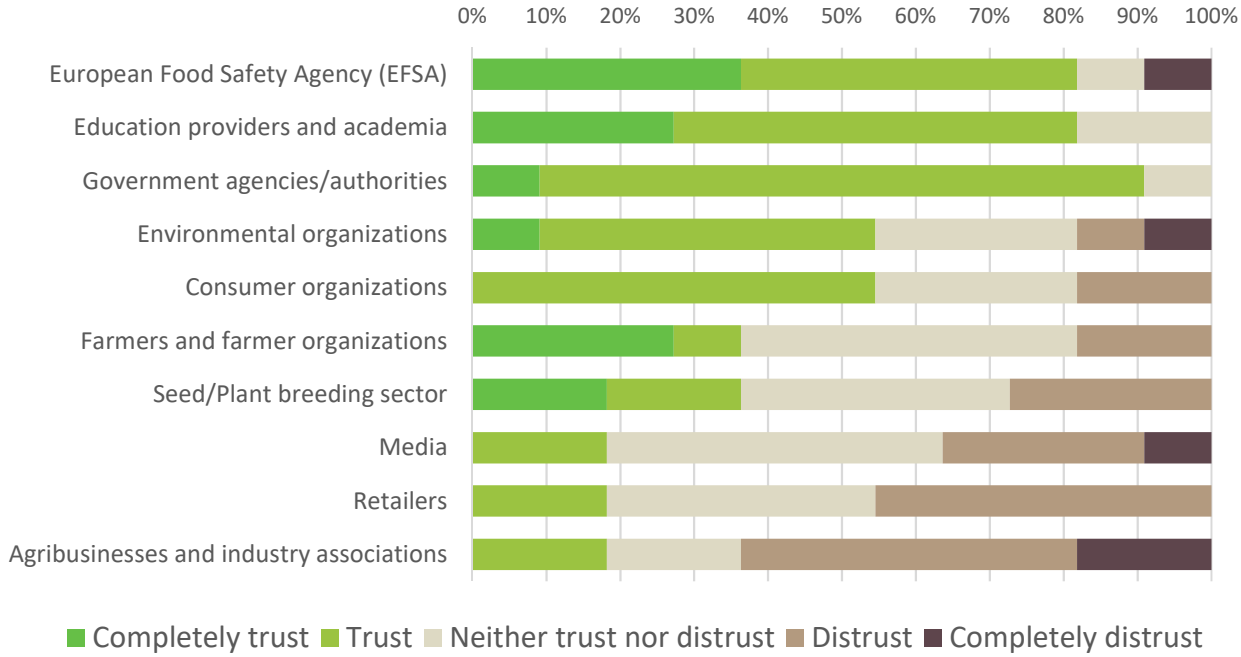

Figure 29. Degree of trust of policy makers in different SHGs regarding information and communication about food production in Europe. N=11

Nearly half of the policy makers responded that they do not communicate about crop-related themes. Furthermore, respectively 36%, 9% and 9% of the policy makers indicated that they have most experience in communication about crop production, crop improvement and breeding, and plant research (**Figure 30**). Given the low number of responses (N=6) for the survey questions related to what and how policy makers communicate about plant research, crop

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improvement and breeding or crop production as well as the importance of addressing food-related aspects in future communication efforts, it is disproportionate to conclude SHG-specific results for these questions. Nevertheless, for the survey questions related to communication about plant gene editing, the maximum number of responses (N=11) were received and the results are described in the next section (6.2).

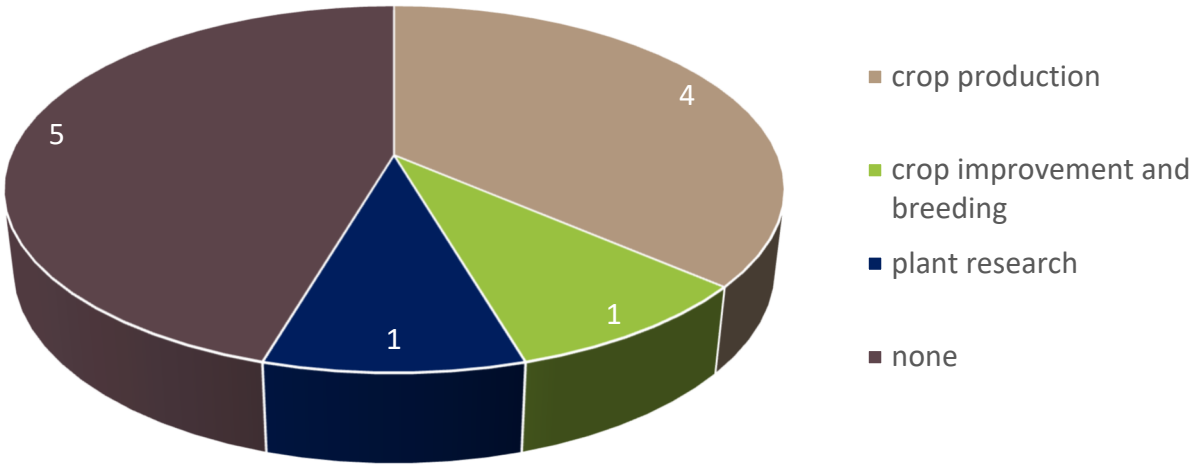

Figure 30. Overview of policy maker's experience in communication about crop-related topics. N=11

6.2 *Communication experience and sourcing of information about gene editing in plants by policy makers*

Surprisingly, a total of 91% of the respondents indicated that they are familiar with gene editing in plants. Although, the invitation for participation to the survey was sent to a large range and number of policy makers, this high proportion indicates that preferably policy makers familiar to the topic responded to the survey. This is also reflected in the proportion of policy makers who indicated that they communicate about gene editing in plants (36%).

Policy makers engage most preferably with education providers & academia for sourcing of information about gene editing in plants (**Figure 31**). Second, EFSA and environmental -and consumer organisations appear to be important to policy makers as well. However, there is an equal proportion of policy makers who indicated that they never engage with environmental -and consumer organisations, which suggests that the preference among policy makers towards these organisations varies outermost (**Figure 31**).

A policy maker representative clarified in the focus group workshop that MEPs do not necessarily reach out to environmental -and consumer organisations, but engagement is rather occurring in the opposite direction. Many organisations reach out to policy makers to discuss plant gene editing and to share their point of view, doubts, and concerns. Because of the high frequency of engagement, most information about plant gene editing is gathered by policy makers from these stakeholders.

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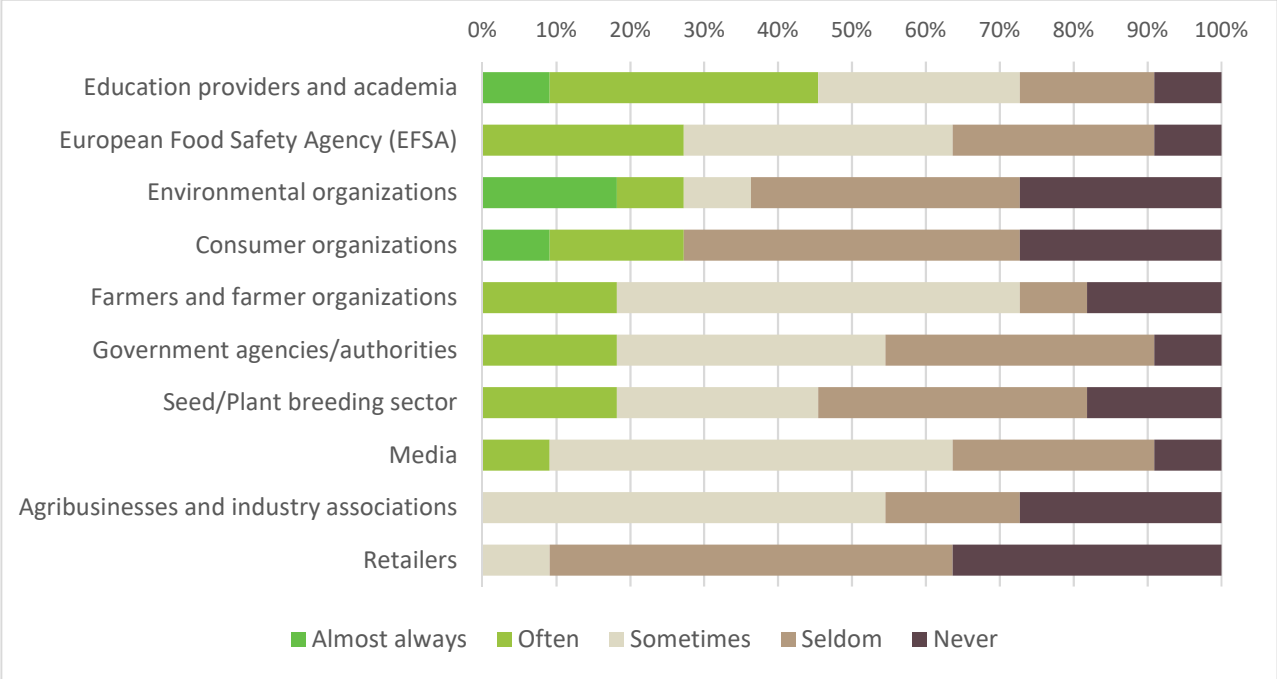

Figure 31. Overview of how frequently policy makers engage with specific SHGs to inform themselves about gene editing in plants. N=11

Policy makers prefer conferences/meetings/workshops/webinars, scientific journals, websites, magazines, and professional/technical magazines to learn more about gene editing in plants (**Figure 32**). Besides websites, online sources such as social media, podcasts, blogs etc. are not relevant sources for information about plant gene editing (**Figure 32**).

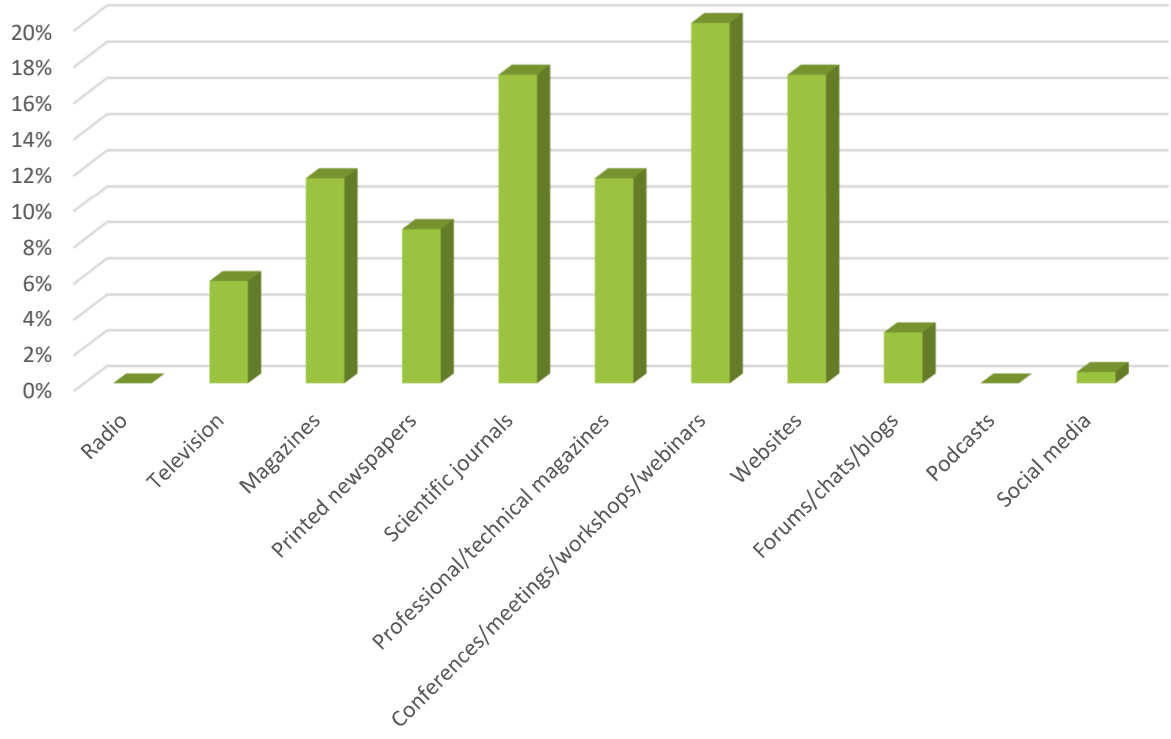

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Figure 32. Communication channels used by policy makers to learn more about gene editing in plants. The percentage of each option relates to the total number of options chosen by the participants. N=11

According to the survey, policy makers primarily communicate to other policy makers, farmers, and consumers about gene editing in plants. A policy maker representative shared in the focus group workshop that policy makers mainly communicate with other policy makers as well as consumers to address questions or doubts and to increase trust in plant gene editing.

The most important topics when communicating about gene editing in plants are:

- Mechanisms of gene editing in plants
- Potential risks associated with gene editing in plants
- Potential benefits associated with gene editing in plants
- Funding for research on gene editing in plants

Furthermore, policy makers indicated that there are no main limiting factors to communicate about gene editing in plants. Future communication should focus according to policy makers on examples of plant gene editing and innovations related to the application of gene editing in plants (**Figure 33**). Second, the legal status of applications of gene editing in plants is another priority according to policy makers. Surprisingly, communication about safety, which was defined in the survey as "environmental and/or food safety risk assessment of applications of gene editing in plants" is the least important aspect in future communication efforts according to policy makers (**Figure 33**).

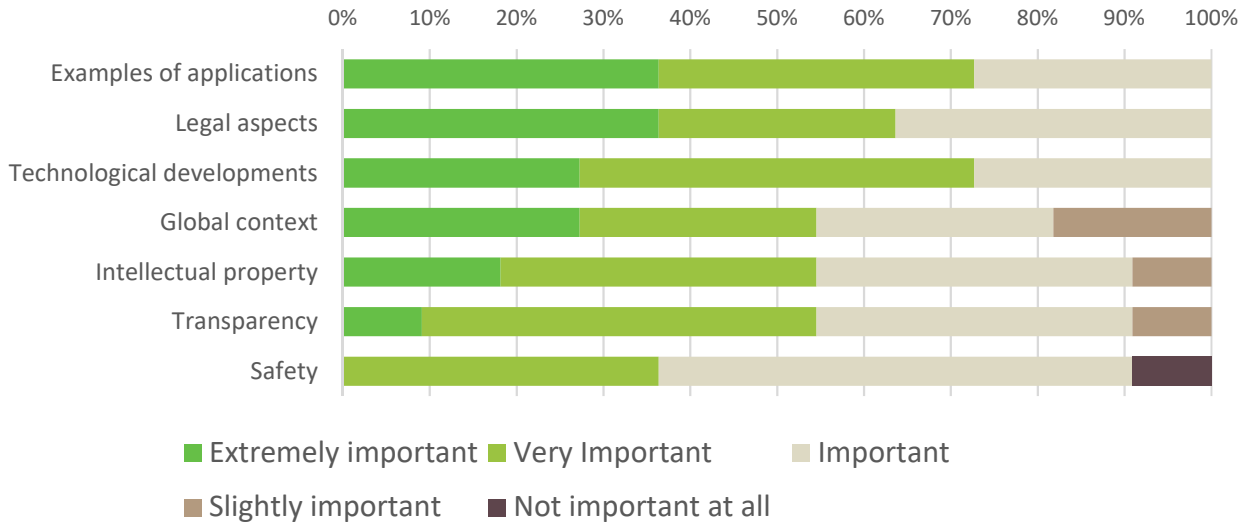

Figure 33. The importance of addressing certain aspects in future communication about gene editing in plants according to policy makers. N=11

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6.3 *Policy maker-level conclusions*

Important to note is that **the sample size of this SHG was very small** and that a high proportion of participants were interested in plant gene editing, which indicates that the communication interest of this SHG is triggered by the current policy discussions around the regulation of more recent breeding methods like gene editing.

According to the survey results, **government agencies and authorities including EFSA as well as education providers and academia are most trusted by policy makers** regarding information and communication about food production in Europe. Policy makers **appear to distrust agribusinesses and industry associations, which is in strong contrast with environmental -and consumer organisations, who are trusted by policy makers.** Interestingly, the survey results revealed that the seed & plant breeding sector is neither trusted nor distrusted by policy makers in contrast to agribusinesses and industry associations, which suggests that the perception of agribusinesses (*i.e.,* entities that represent a broader portfolio of agricultural solutions such as plant protection products and with an international character) is different compared to seed companies.

Policy makers prefer meetings & workshops, scientific journals, websites, and professional magazines to learn more about gene editing in plants. Besides websites, online sources such as social media, podcasts, blogs etc. are not relevant sources. Regarding sources of information about plant gene editing, policy makers engage preferably with academia, EFSA, environmental -and consumer organisations. **In the focus group workshop, it was highlighted that many environmental -and consumer organisations reach out to policy makers to discuss plant gene editing and to share their views.** It is possible that because of this intense engagement, information about plant gene editing is most frequently gathered by policy makers from these stakeholders.

The main target groups to communicate with about plant gene editing are other policy makers, farmers, and consumers. It is an interesting observation that farmers are one of the target groups for communication about gene editing. This might be explained by the fact that they are the primary producers and as such have an important role in adopting (or rather cultivating) crops resulting from gene editing in the future. According to policy makers, **future communication should focus on examples of plant gene editing and innovations related to the application of gene editing in plants.** Both aspects relate to the science behind gene editing, so education providers and academia, the seed & plant breeding sector, all have a potential role to play in future communication efforts and should engage more intense with policy makers.

A further synthesis of the policy maker-level results with the results from the other SHGs is described in section 7: "Integrative analysis of the survey results between the three SHGs".

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7 INTEGRATIVE ANALYSIS OF THE SURVEY RESULTS FROM FARMERS, BREEDERS AND POLICY MAKERS

7.1 *Trends in farmers, breeders, and policy maker's current communication activities*

The survey assessed the degree of trust in different SHGs regarding information and communication about food production in Europe. Analysis of the responses revealed that education providers, and government agencies including EFSA are trusted sources for all three SHGs (**Figure 34a**). Furthermore, the farming community, breeders and seed & plant breeding organisations indicated trust in their sectors as well as in agribusinesses and industry associations. However, policy makers did not indicate having trust in any of these SHGs, and instead indicated having trust in consumer -and environmental organisations. On the contrary, the farming community and seed & plant breeding sector indicated having distrust in media, consumer -and environmental organisations, while policy makers appear to distrust agribusinesses and industry associations regarding information and communication about food production (**Figure 34b**).

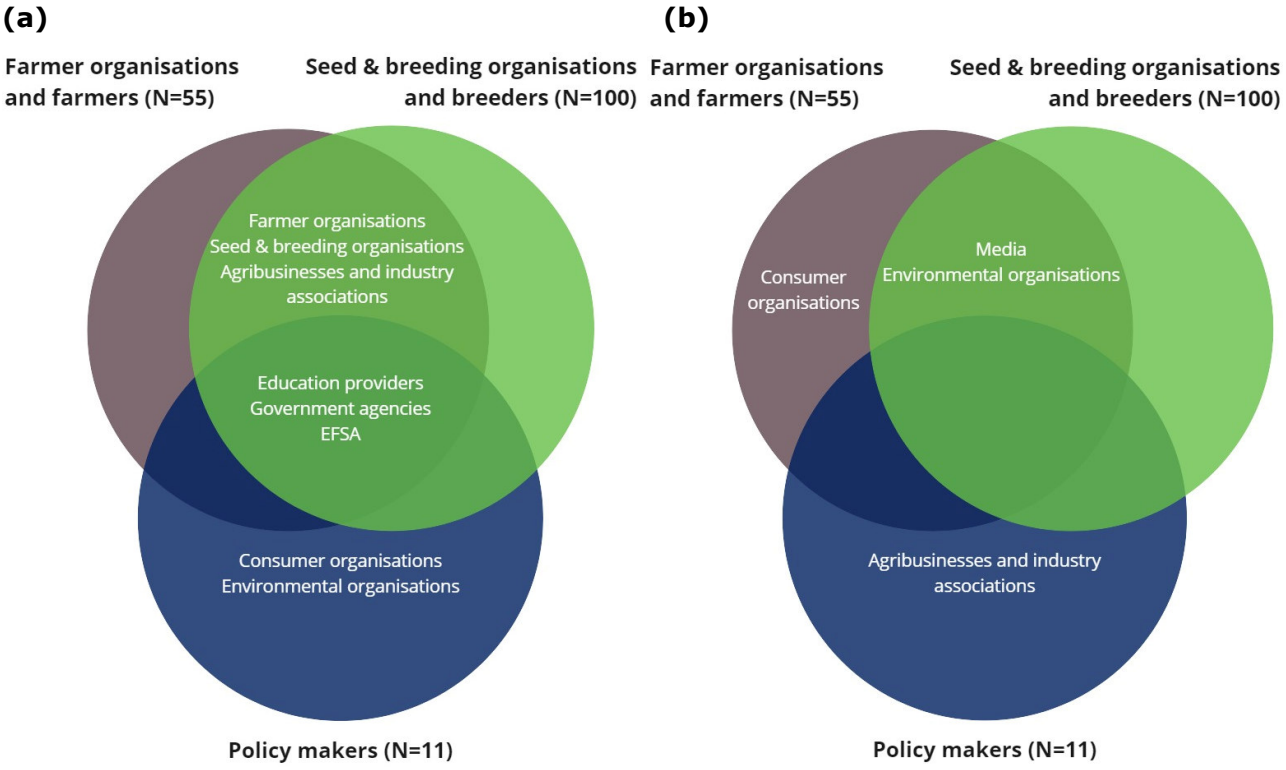

Figure 34. Comparison of trust (a) and distrust (b) in SHGs regarding information and communication about food production in Europe.

The most preferred crop characteristics to communicate about indicated by the three SHGs were: adaptation to climate change and sufficient yields & harvests (**Figure 35**). Moreover, increased pest and disease resistance as well as increased sustainability of crops were indicated as well. Most of these characteristics relate to yield and yield preservation, which suggests that crop

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productivity is the overarching topic in communication activities. Furthermore, climate change and sustainability are also important topics, which might resonate with broader societal discussions in Europe on the impact of food production on the environment and human health, and which are reflected in current policy developments *i.e.,* EU Green Deal.

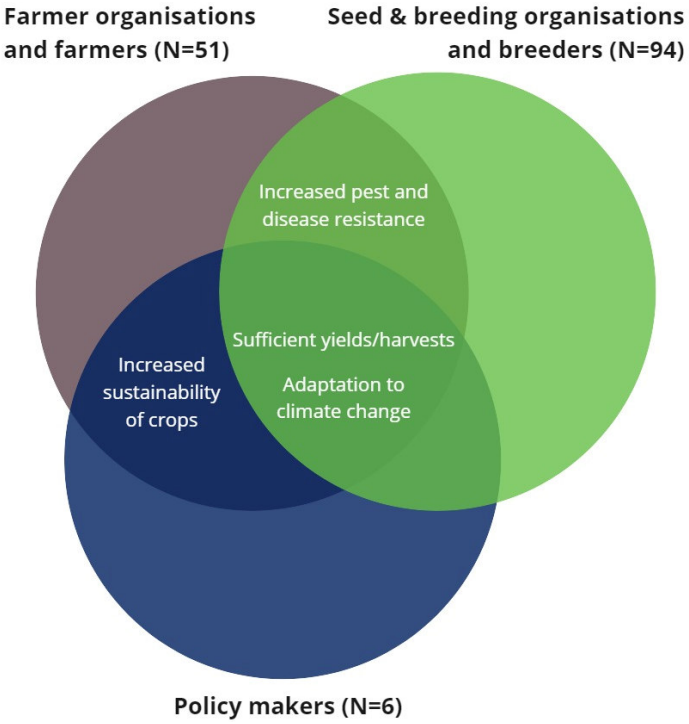

Figure 35. Comparison of crop characteristics that SHGs communicate about.

Participants were asked how frequently they use certain food values in their communication efforts. Food values are researched in social sciences and help to better understand SHG's priorities and concerns. Environmental impact was top-listed by the three SHGs, and in addition safety described in the survey as "the extent to which consumption of food will not cause illness" appeared to be important in communication efforts by the farming community and the seed & plant breeding sector (**Figure 36**). According to the survey, policy makers prefer to communicate about a more diverse set of food values: nutritional value, traditional consumption patterns, the price that is paid for food, where it was produced, as well as the extent to which food is produced without modern technologies ("naturalness").

Analysis of the preference for food values according to age among all stakeholders suggests that older survey respondents (above 44 years of age) prefer to communicate more frequently about traditional consumption patterns.

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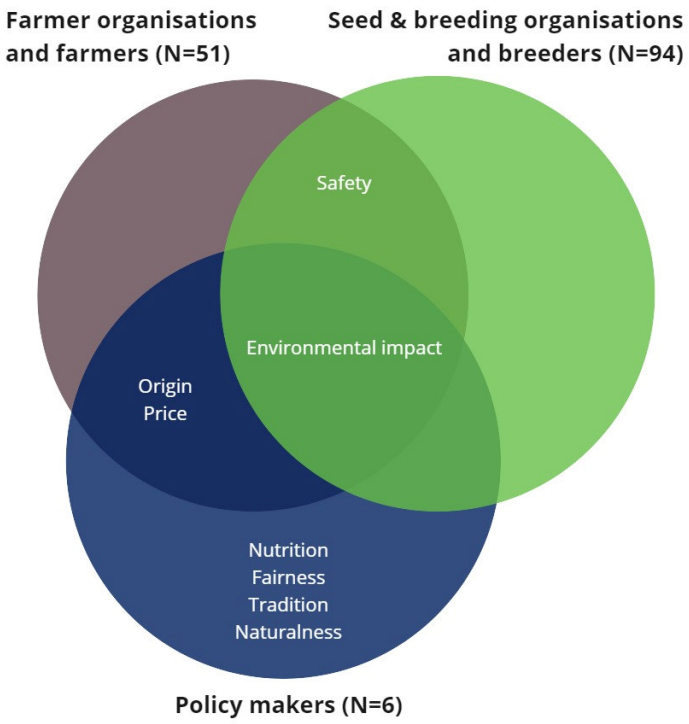

Figure 36. Comparison of the food values that are frequently used in SHG's communication activities.

7.2 *Trends in preferred communication channels for farmers, breeders, and policy makers*

Magazines, scientific journals, websites, and activities that facilitate personal interactions were indicated as important to all three SHGs for sourcing information about plant research, crop improvement and breeding, and crop production (**Figure 37a**). In addition, professional and technical magazines were also important to the farming community and the seed & plant breeding sector. Besides websites, SHG-specific preferences for online sources were identified such as LinkedIN for the seed & plant breeding sector and Twitter for policy makers.

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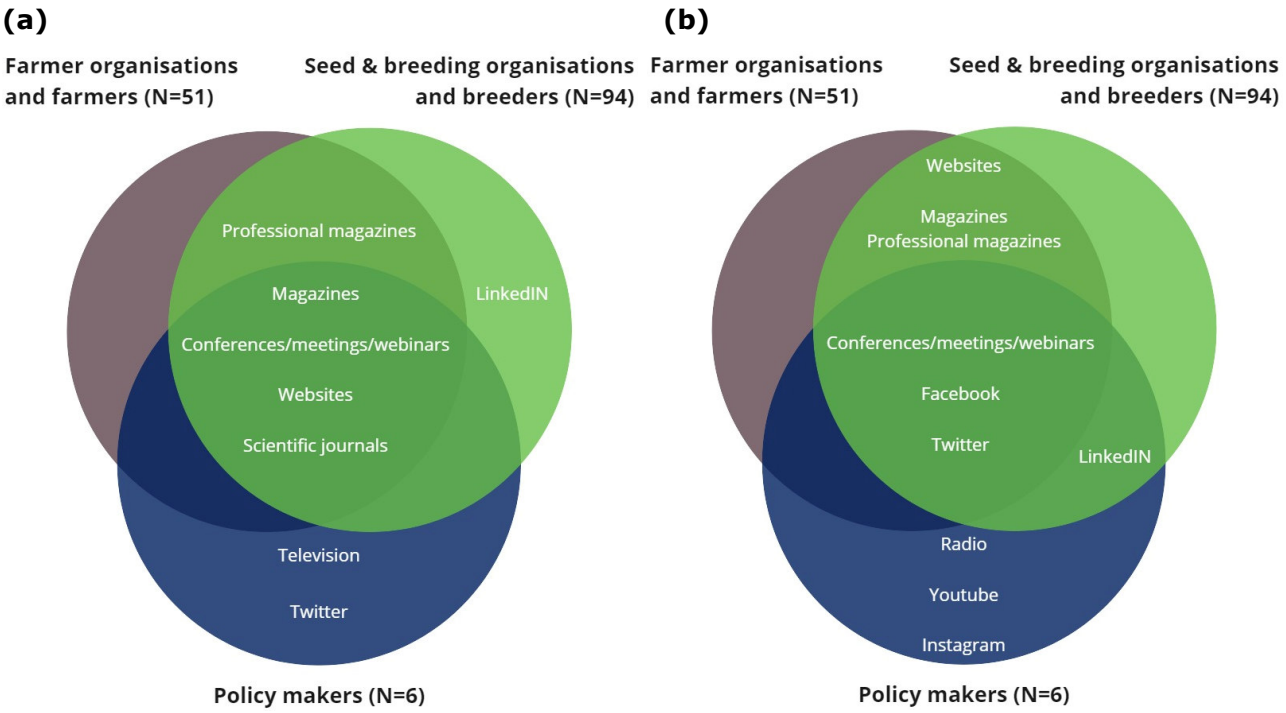

Figure 37. Comparison of the communication channels used by SHGs for sourcing information (a) and for communication purposes (b).

Important channels for communication purposes were similar to those described for sourcing of information (**Figure 37b**). However, in the case of social media, Facebook and Twitter were the preferred online platforms used by the three SHGs to communicate. Moreover, it appeared that policy makers prefer to communicate via many different social media platforms including LinkedIN, Youtube and Instagram. In the focus group meeting, a policy maker representative highlighted that Twitter is the most relevant social media platform to communicate with a broad audience and is most suitable for a more factual and rational debate compared to Facebook, while a farmer representative shared that besides Twitter, Facebook is important.

Analysis of demographic parameters in the compiled survey results from the three SHGs revealed additional trends in preferred communication channels according to age, education and European countries:

- Older respondents (above 44 years of age) more frequently preferred professional magazines and conferences & meetings for sourcing of information as well as communication purposes.
- Respondents with at least a Master level of education more frequently favoured websites, LinkedIN, scientific journals and conferences & meetings for sourcing of information as well as communication purposes, while Facebook, Twitter and television appeared to be more frequently used by respondents with a Bachelor level of education or below.
- Based on the number of survey responses (minimum 10), survey results between specific countries (France, Germany, Italy, Poland and Romania) and all countries together were compared (see **Annex 4**), which suggested that:
  - Magazines are very important in Poland and less important in Romania.
  - Scientific journals appear to be less important in Romania.

- Facebook is very popular in Poland and Italy for communication.
- Twitter and LinkedIN appear not to be relevant social media platforms in Poland.
- WhatsApp and podcasts seem to be very popular in Romania.
- Youtube was not indicated by participants from France as a preferred communication channel.

The identified trends suggest that there are distinct differences in the use of mainly online communication channels among different regions in Europe and hints that an effective communication strategy needs to take into account these differences, which might quickly change over time.

7.3 *Farmers, breeders and policy maker´s preferred topics for future communication efforts*

To gain insights into stakeholder's needs regarding communication, participants were asked to indicate the importance of addressing certain food-related aspects in future communication activities (**Figure 38**). Sustainability, food safety and nutritional value were indicated as important by the three SHGs. In addition, both the farming community and policy makers highlighted the need to communicate in the future about fair trade and competition as well as the price and origin of food. Most prioritised food-related aspects correspond to a large extent with the preferred food values in current communication activities (**Figure 36**).

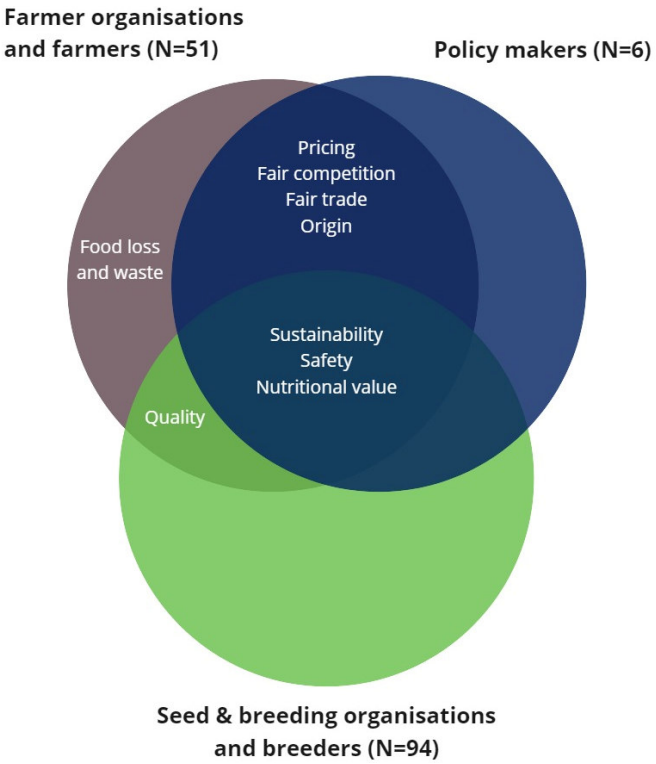

Figure 38. Comparison of important topics to address in future communication efforts towards specific target groups.

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7.4 *Farmers, breeders and policy maker's communication experience and sourcing of information about gene editing in plants*

Education providers were indicated as the preferred source of information about gene editing in plants by all three SHGs (**Figure 39**). Moreover, the farming community, breeders and seed & plant breeding organisations indicated a preference for information from their sectors as well as agribusinesses and industry associations. However, policy makers did not seem to use information from any of these SHG. Furthermore, EFSA was just below the threshold to be selected in the analysis as a relevant source of information for policy makers.

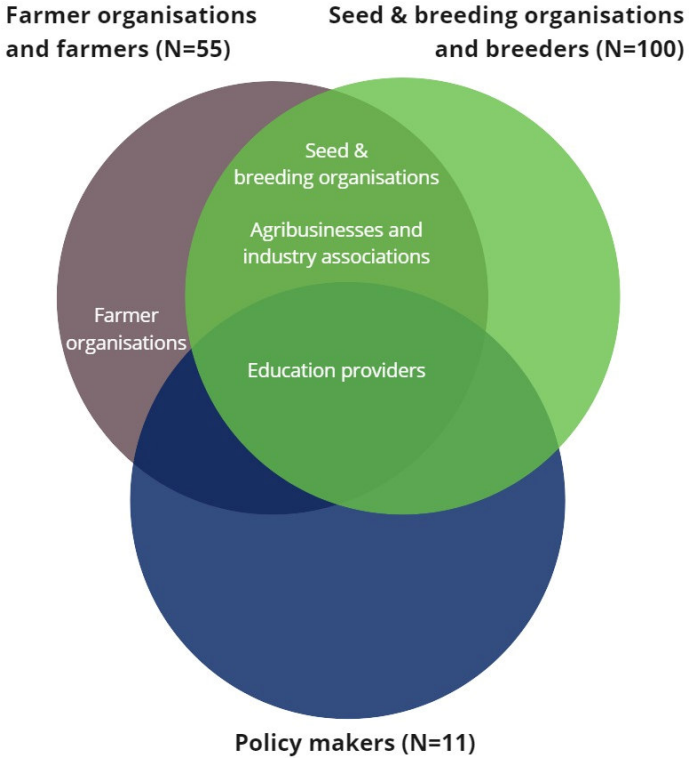

Figure 39. Comparison of how frequently SHGs engage with specific SHGs to inform themselves about gene editing in plants.

The topic related to plant gene editing which was most frequently used in communication activities by all three SHGs was the "potential benefits of the applications of this innovation" (**Figure 40**). Moreover, the farming community and the seed & plant breeding sector also indicated communicating about examples and comparisons with conventional breeding methods, in line with their advocacy for a differentiated regulatory approach for gene-edited plants with genetic changes that could have resulted spontaneously or as a result of conventional breeding methods. On the contrary, policy makers appeared to communicate rather about research funding, mechanisms of plant gene editing, and potential risks associated with this plant breeding innovation.

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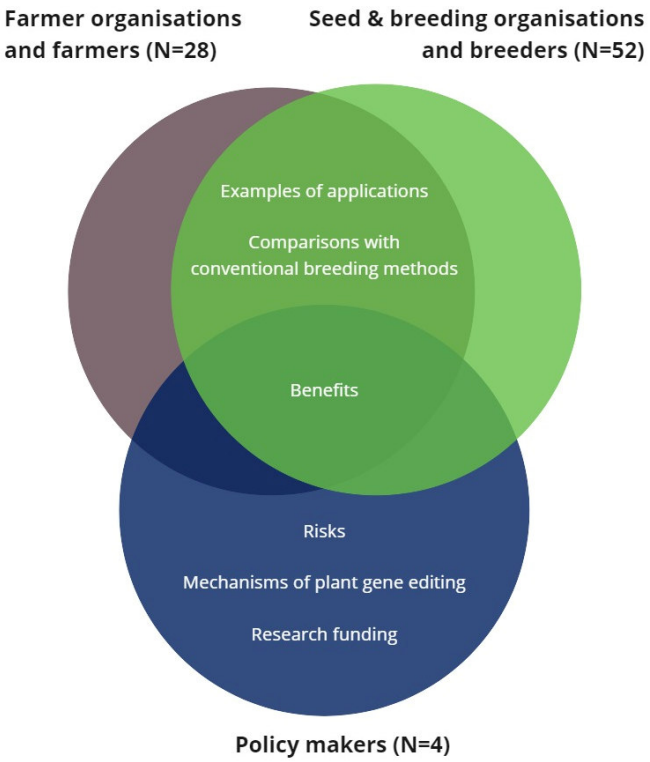

Figure 40. Comparison of important topics in communication activities about gene editing in plants according to SHGs.

To identify SHG's needs regarding communication, participants were asked to indicate the importance of addressing certain plant gene editing aspects in future communication efforts (**Figure 41**). Examples of applications, technological developments, global context and transparency were indicated as priorities for communication by the three SHGs. Interestingly, communication about safety, which was defined in the survey as "environmental and/or food safety risk assessment of applications of gene editing in plants" was also indicated as a priority by the farming community and the seed & plant breeding sector, but was considered less important according to policy makers, who in turn prioritised communication about legal -and intellectual property aspects related to plant gene editing.

Analysis of the preference for certain plant gene editing aspects according to participant's communication experience suggests that respondents who do not consider communication as part of their professional tasks, prefer to communicate less frequently about legal -and intellectual property aspects related to plant gene editing.

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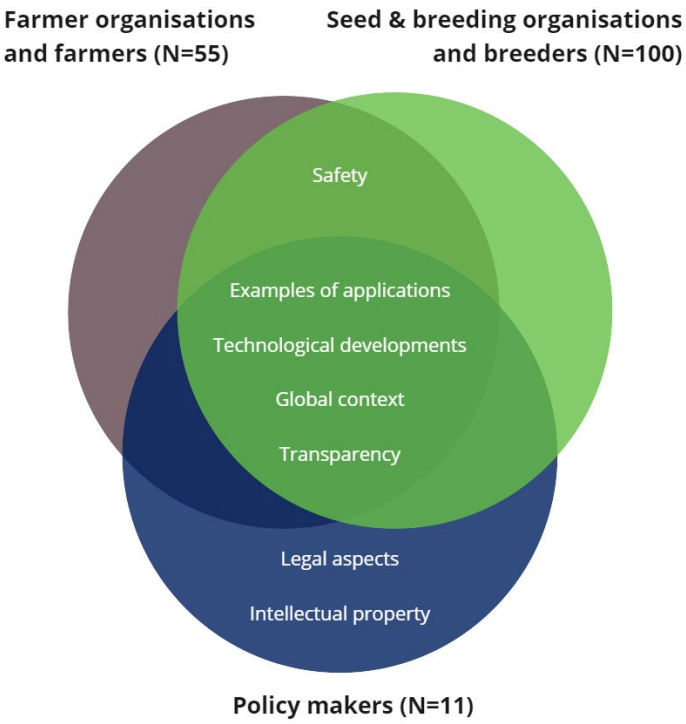

Figure 41. Comparison of aspects about gene editing in plants to address in future communication efforts by SHGs.

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7.5 *Conclusions*

Education providers and government authorities have a fundamental role to play in disseminating information as the survey results revealed that they are most trusted by farmers, breeders and policy makers. This is especially relevant in the context of communication about more sensitive topics such a gene editing in plants. Furthermore, opposing patterns of trust could be observed between specific SHGs like the farming community and the seed & plant breeding sector on the one hand and policy makers on the other hand.

Present communication topics of the three SHGs relate mainly to crop productivity. According to the survey results, the farming community and the seed & plant breeding sector communicate preferably about aspects that are most important to their profession (*e.g.*, safety), while **policy makers seem to communicate about a more diverse set of topics** including nutrition and tradition, which might resonate more with society. Interestingly, the survey results indicate that this is also relevant to **the farming community and the seed & plant breeding sector because they highlighted the need to address more diverse topics as well in future communication efforts.** This might be considered essential to better connect with society, build trust and create awareness of the benefits of agricultural innovations such as for example gene-edited plants.

Magazines, professional magazines, scientific journals and activities that facilitate personal interactions such as conferences are important to all three SHGs for sourcing information and communication purposes. In addition, websites are the only online sources consistently used by all SHGs, while the survey results hint that there are specific preferences among SHGs for social media. **It appears that policy makers prefer to communicate via many different social media platforms**, which suggests that social media is considered valuable to improve visibility and increase engagement with target audiences. However, age-, education- and country-specific trends in the preference of online communication sources could be observed according to demographic analysis of the survey results, suggesting that **communication strategies tailored to your target audience are essential to use social media as effective communication channels**.

When communicating about plant gene editing, the potential benefits was the most important aspect identified by the three SHGs, while the survey results suggest that **future communication efforts should address broader topics** including applications, technological developments, the global context and transparency. On the contrary, **policy makers appear to communicate in addition about research funding, mechanisms of plant gene editing, as well as potential risks** associated with this plant breeding innovation and indicated that future communication about **legal -and intellectual property aspects** will be important.

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10 ANNEXES

Annex 1

Funded by the Horizon 2020 Framework Programme of the European Union

Questionnaire on knowledge, experience and needs for communication on crop improvement and seeds in Europe

Dear participant,

The aim of the EU Horizon 2020-funded project CropBooster-P is to identify the main drivers and uncertainties crucial for future-proofing our food system and bioeconomy, and to develop plausible ways to enable more sustainable and resilient crop production.

We would like to assess with this survey what your knowledge, experience and needs are related to communication about crop improvement and seeds in Europe. Based on the results of the survey, this project aims to provide recommendations on effective communication strategies with different target groups.

By completing this survey, you are agreeing to have your results analysed as part of this project. Individual responses will be kept anonymous and will be used by the CropBooster-P team to help identify trends, good practices, gaps and needs on communication in Europe. After analysis, the anonymised survey data will be deposited into the publicly accessible repository DANS-EASY.

If you have any questions, please do not hesitate to contact us via secretariat@euroseeds.eu or secretariat@plantetp.eu. The results of the survey will be published on the Cropbooster-P website after analysis.

The survey will take up to 15 minutes to complete. Please note that questions indicated with '*' require an answer and your answers will only be sent to us after clicking on the green 'submit' button on the last page.

In case you complete this survey on your mobile phone or tablet, we recommend you to hold your screen in landscape orientation.

Please indicate the stakeholder group you categorize yourself with:

o Farmer – Farmer organization Please go to **page 2**.
o Seed – Breeding sector Please go to **page 3**.
o Policy maker Please go to **page 4**.

1. Background information

Step 1 of 6

1.1 Are you filling in this form on behalf of yourself or the organization you work for?
o Myself. Please go to **page 5**.
o The organization I work for. Please continue this page with **question 1.2**.

1.2 Which crops does your farmer organization deal with?
 Cereals
 Legumes
 Vegetables
 Sugar beets
 Potatoes
 Maize/sorghum
 Fodder plants/amenity grasses
 Oilseed crops
 Ornamentals
 Fruit crops
 All of the above
 Not applicable

1.3 In which country is your farmer organization active?
Please select:_____

Please go to **page 11**.

1. Background information

Step 1 of 6

1.1 Are you filling in this form on behalf of yourself or the organization you work for?
o Myself. Please go to **page 7**.
o The organization I work for. Please continue this page with **question 1.2**.

1.2 Which crops does the company or organization you work for deal with?
□ Cereals
□ Legumes
□ Vegetables
□ Sugar beets
□ Potatoes
□ Maize/sorghum
□ Fodder plants/amenity grasses
□ Oilseed crops
□ Ornamentals
□ Fruit crops
□ All of the above
□ Not applicable

1.3 Which of the following best describe the company or organization you work for?
□ Technology/Service provider
□ Plant breeding
□ Seed production
□ Seed treatment
□ Seed trading
□ Industry association or advocacy
□ Other:_____

1.4 Where is the company or organization you work for in general active?
o Domestic national market only (within the country where your company or organization is headquartered)
o Inside Europe only
o Internationally

1.5 What is the location of the headquarters of the company or organization you work for?
Please select:_____

1.6 What is the size of the company or organization (as regards annual turnover) you work for?
o Small (up to 50 Million EUR)
o Medium-sized (between 50 Million and 450 Million EUR)
o Large (more than 450 Million EUR)

Please go to **page 11**.

1. Background information

Step 1 of 6

1.1 Are you filling in this form on behalf of yourself or the organization you work for?
o Myself. Please go to **page 9**.
o The organization I work for. Please continue this page with **question 1.2**.

1.2 Which of the following best describes the governmental body you work for?
o European Commission
o European Parliament
o National Government
o National Parliament
o Regional Government
o Regional Parliament
o Other:_____

1.3 In which country is your governmental body active?
Please select:

Please go to **page 11**.

1. Background information

Step 1 of 6

1.2 Please specify your gender.
o Male
o Female
o Other
o Prefer not to say

1.3 What is your age range?
o below 25
o 25-34
o 35-44
o 45-54
o 55-64
o 65-74
o above 74

1.4 In which country do you work?
Please select:

1.5 What is your highest formal completed education level?
o Primary school
o Middle school
o Secondary school
o Post-secondary
o Bachelor's degree
o Master's degree
o PhD
o Other:_____

1.6 What is your highest completed level of agricultural education?
o Not applicable
o Practical experience on-farm
o Basic agricultural training (this includes a completed agricultural apprenticeship)
o Full agricultural training (two or more years of full-time higher education)
o University degree in agriculture/agronomy
o Other:_____

1.7 Is communication part of your professional tasks?
o Yes
o No

1.8 Which crops do you deal with?
□ Cereals
□ Legumes
□ Vegetables
□ Sugar beets
□ Potatoes
□ Maize/sorghum
□ Fodder plants/amenity grasses
□ Oilseed crops
□ Ornamentals
□ Fruit crops
□ All of the above
□ Not applicable

1.9 What size is your farm in total?
o 0 – 4,9 ha
o 5 – 99,9 ha
o 100 ha or over

1.10 Does your farm have any specific certifications or organizational affiliations, or are you e.g. a member of a specific agri-environmental scheme, such as Organic, LEAF, etc?
o Yes. Please continue this page with **question 1.11**.
o No. Please go to **page 11**.

1.11 Please specify the specific certifications or organizational affiliations or the specific agri-environmental scheme:_____

1. Background information

Step 1 of 6

1.2 Please specify your gender.
o Male
o Female
o Other
o Prefer not to say

1.3 What is your age range?
o below 25
o 25-34
o 35-44
o 45-54
o 55-64
o 65-74
o above 74

1.4 In which country do you work?
Please select:_____

1.5 What is your highest formal completed education level?
o Primary school
o Middle school
o Secondary school
o Post-secondary
o Bachelor's degree
o Master's degree
o PhD
o Other:_____

1.6 What is your highest completed level of agricultural education?
o Not applicable
o Practical experience on-farm
o Basic agricultural training (this includes a completed agricultural apprenticeship)
o Full agricultural training (two or more years of full-time higher education)
o University degree in agriculture/agronomy
o Other:_____

1.7 Is communication part of your professional tasks?
o Yes
o No

1.8 Which crops do you deal with?
□ Cereals
□ Legumes
□ Vegetables
□ Sugar beets
□ Potatoes
□ Maize/sorghum
□ Fodder plants/amenity grasses
□ Oilseed crops
□ Ornamentals
□ Fruit crops
□ All of the above
□ Not applicable

1.9 Which of the following best describe the company or organization you work for?
□ Technology/Service provider
□ Plant breeding
□ Seed production
□ Seed treatment
□ Seed trading
□ Industry association or advocacy
□ Other:_____

1.10 Where is the company or organization you work for in general active?
o Domestic national market only (within the country where your company or organization is headquartered)
o Inside Europe only
o Internationally

1.11 What is the location of the headquarters of the company or organization you work for?
Please select:_____

1.12 What is the size of the company or organization (as regards annual turnover) you work for?
o Small (up to 50 Million EUR)
o Medium-sized (between 50 Million and 450 Million EUR)
o Large (more than 450 Million EUR)

Please go to **page 11**.

1. Background information

Step 1 of 6

1.2 Please specify your gender.
o Male
o Female
o Other
o Prefer not to say

1.3 What is your age range?
o below 25
o 25-34
o 35-44
o 45-54
o 55-64
o 65-74
o above 74

1.4 In which country do you work?
Please select:

1.5 What is your highest formal completed education level?
o Primary school
o Middle school
o Secondary school
o Post-secondary
o Bachelor's degree
o Master's degree
o PhD
o Other:_____

1.6 What is your highest completed level of agricultural education?
o Not applicable
o Practical experience on-farm
o Basic agricultural training (this includes a completed agricultural apprenticeship)
o Full agricultural training (two or more years of full-time higher education)
o University degree in agriculture/agronomy
o Other:_____

1.7 Is communication part of your professional tasks?
o Yes
o No

1.8 Which of the following best describes the governmental body you work for?
o European Commission
o European Parliament. Please continue with **question 1.9**.
o National Government
o National Parliament
o Regional Government
o Regional Parliament
o Other:_____

Please go to **page 11**.

1.9 What is your nationality?
Please select:_____

Please go to **page 11**.

2. What is your general perception and knowledge on food production?

Step 2 of 6

2.1 Please indicate your degree of trust in the following organizations regarding information and communication about food production in Europe:

	Completely distrust	Distrust	Neither trust nor distrust	Trust	Completely trust
Education providers and academia	☐	☐	☐	☐	☐
Government agencies/authorities	☐	☐	☐	☐	☐
European Food Safety Agency (EFSA)	☐	☐	☐	☐	☐
Farmers and farmer organizations	☐	☐	☐	☐	☐
Seed/Plant breeding sector	☐	☐	☐	☐	☐
Agribusinesses and industry associations	☐	☐	☐	☐	☐
Retailers	☐	☐	☐	☐	☐
Environmental organizations	☐	☐	☐	☐	☐
Consumer organizations	☐	☐	☐	☐	☐
Media	☐	☐	☐	☐	☐

Plant breeding: the activity that deals with the development of new plant varieties with different desired characteristics.

Conventional breeding: breeding methods that enable breeders to produce and select plants with desired characteristics and that have been widely used for a long time (e.g. crossing and selection, such as marker-assisted selection, genomic selection or random mutagenesis, hybrid breeding).

New plant breeding methods: these precision breeding methods (e.g. gene editing) are new methods that allow more efficient and targeted breeding, as they allow the targeted generation of characteristics that in conventional breeding depend on less controllable and predictable. processes.

2.2 How do you self-assess your knowledge about plant breeding?

	Completely disagree	Mainly disagree	Do not disagree nor agree	Mainly agree	Completely agree
I understand what plant breeding is.	☐	☐	☐	☐	☐
I am interested in plant breeding.	☐	☐	☐	☐	☐
I understand the difference between conventional breeding and new plant breeding methods.	☐	☐	☐	☐	☐
I am interested in the difference between conventional breeding and new plant breeding methods).	☐	☐	☐	☐	☐

Please go to **page 13**.

3. What is your experience on communication about different aspects of food systems?

Step 3 of 6

3.1 On which topic do you have the most experience communicating? Only one option can be selected.

o Crop production. Please go to **page 14**.
o Crop improvement and breeding. Please go to **page 18**.
o Plant research. Please go to **page 22**.
o I do not communicate about these topics. Please go to **page 28**.

Crop production: includes practices and technologies for agriculture, ranging from sowing to general management practices (machinery, greenhouses, fertilization, crop protection) and harvesting.

Crop improvement and breeding: the activity that deals with the development of new plant varieties with different desired characteristics.

Plant research: the branch of science concerned with the study of plants and the scientific basis for the genetic improvement of crops.

3. What is your experience on communication about different aspects of food systems?

Step 3 of 6

3.2 Why do you engage with others in communication about crop production? The number of options to select is not limited.

 It is important for my business/job.
 It is important to stay informed about innovation(s).
 It is important to inform my target groups.
 It is important to know how crops are cultivated.
 It can provide solutions to more sustainable agriculture.
 Other:_____

3.3 About what crop characteristics do you mainly communicate? Maximum 3 options can be selected.

 None
 Adaptation to climate change
 Increased sustainability of crops
 Reduction of food loss
 Resistance to environmental stress
 Sufficient yields/harvests
 Increased pest and disease resistance
 Increased quality of crops
 Other:_____

3.4 About which crops do you mainly communicate? Maximum 3 options can be selected.

 None
 I do not focus on any crop specifically.
 Cereals
 Legumes
 Vegetables
 Sugar beets
 Potatoes
 Maize/sorghum
 Fodder plants/amenity grasses
 Oilseed crops
 Ornamentals
 Fruit crops
 Other:_____

3.5 How frequently do you use the following food values in your communication about crop production?

	Never	Seldom	Sometimes	Often	Almost always
Naturalness (extent to which food is produced without modern technologies)	□	□	□	□	□
Taste (extent to which consumption of food is appealing to the senses)	□	□	□	□	□
Price (the price that is paid for the food)	□	□	□	□	□
Safety (extent to which consumption of food will not cause illness)	□	□	□	□	□
Convenience (ease with which food is cooked and/or consumed)	□	□	□	□	□
Nutrition (amount and type of fat, protein, vitamins, etc.)	□	□	□	□	□
Tradition (preserving traditional consumption patterns)	□	□	□	□	□
Origin (where the food was grown or produced)	□	□	□	□	□
Fairness (the extent to which all parties involved in the production of food equally benefit)	□	□	□	□	□
Appearance (extent to which food looks appealing)	□	□	□	□	□
Environmental impact (effect of food production on the environment)	□	□	□	□	□

3.6 Can you provide an example of a communication relating to crop production which, in your experience was effective?

_____

_____

_____

Please go to **page 16**.

4. What is your opinion on communication about crop production?

Step 4 of 6

4.1 How frequently do you use information from these stakeholders in your communication about crop production?

	Never	Seldom	Sometimes	Often	Almost always
Education providers and academia	□	□	□	□	□
Government agencies/authorities	□	□	□	□	□
European Food Safety Agency (EFSA)	□	□	□	□	□
Farmers and farmer organizations	□	□	□	□	□
Seed/Plant breeding sector	□	□	□	□	□
Agribusinesses and industry associations	□	□	□	□	□
Retailers	□	□	□	□	□
Environmental organizations	□	□	□	□	□
Consumer organizations	□	□	□	□	□
Media	□	□	□	□	□

4.2 Which of the following channels do you use to learn about crop production? Maximum 5 options can be selected.

□ Radio
□ Television
□ Magazines
□ Printed newspapers
□ Scientific journals
□ Professional/technical magazines
□ Conferences/meetings/workshops/webinars
□ Websites
□ Forums/chats/blogs
□ Podcasts
□ Facebook
□ Twitter
□ LinkedIN
□ Youtube
□ Instagram
□ WhatsApp
□ Snapchat
□ Pinterest
□ TikTok
□ Other:_____

4.3 Which are your main target groups to communicate with about crop production? Maximum 3 options can be selected.

 Consumers
 Farmers
 Plant breeders
 Agribusinesses
 Retailers
 Policy makers
 Other:_____

4.4 Which of the following channels do you use to communicate with your main target groups about crop production? Maximum 5 options can be selected.

 Radio
 Television
 Magazines
 Printed newspapers
 Scientific journals
 Professional/technical magazines
 Conferences/meetings/workshops/webinars
 Websites
 Forums/chats/blogs
 Podcasts
 Facebook
 Twitter
 LinkedIN
 Youtube
 Instagram
 WhatsApp
 Snapchat
 Pinterest
 TikTok
 Other:_____

4.5 Why do you specifically use these channels to communicate about crop production? The number of options to select is not limited.

 I have professional support to use these channels.
 My target audience is mainly reached through these channels.
 I have easy access to these channels.
 These channels are low cost.
 Other:_____

4.6 Which of the following tools do you use to communicate about crop production? The number of options to select is not limited.

 Pictures
 Animated pictures (GIFs)
 Videos
 Text
 Other:_____

Please go to **page 26**.

3. What is your experience on communication about different aspects of food systems?

Step 3 of 6

3.2 Why do you engage with others in communication about crop improvement and breeding? The number of options to select is not limited.

☐ It is important for my business/job.
☐ It is important to stay informed about innovation(s).
☐ It is important to inform my target groups.
☐ It is important to know how new crop varieties are generated.
☐ It can provide solutions to more sustainable agriculture.
☐ Other:_____

3.3 About which of the following techniques of plant breeding do you communicate? The number of options to select is not limited.

☐ Methods in plant research (e.g. genome research)
☐ Plant breeding in general (i.e. crossing and selection)
☐ Hybrid breeding
☐ Mutagenesis breeding
☐ Precision breeding (e.g. gene editing)
☐ All of the above
☐ None
☐ Other:_____

3.4 About which of the following improvements of crops do you mainly communicate? Maximum 3 options can be selected.

☐ None
☐ Adaptation to climate change
☐ Increased sustainability of crops
☐ Reduction of food loss
☐ Resistance to environmental stress
☐ Sufficient yields/harvests
☐ Increased pest and disease resistance
☐ Increased quality of crops
☐ Other:_____

3.5 About which crops do you mainly communicate? Maximum 3 options can be selected.

☐ None
☐ I do not focus on any crop specifically.
☐ Cereals
☐ Legumes
☐ Vegetables
☐ Sugar beets
☐ Potatoes
☐ Maize/sorghum
☐ Fodder plants/amenity grasses
☐ Oilseed crops
☐ Ornamentals
☐ Fruit crops
☐ Other:_____

3.6 How frequently do you use the following food values in your communication about crop improvement and breeding?

	Never	Seldom	Sometimes	Often	Almost always
Naturalness (extent to which food is produced without modern technologies)	□	□	□	□	□
Taste (extent to which consumption of food is appealing to the senses)	□	□	□	□	□
Price (the price that is paid for the food)	□	□	□	□	□
Safety (extent to which consumption of food will not cause illness)	□	□	□	□	□
Convenience (ease with which food is cooked and/or consumed)	□	□	□	□	□
Nutrition (amount and type of fat, protein, vitamins, etc.)	□	□	□	□	□
Tradition (preserving traditional consumption patterns)	□	□	□	□	□
Origin (where the food was grown or produced)	□	□	□	□	□
Fairness (the extent to which all parties involved in the production of food equally benefit)	□	□	□	□	□
Appearance (extent to which food looks appealing)	□	□	□	□	□
Environmental impact (effect of food production on the environment)	□	□	□	□	□

3.7 Can you provide an example of a communication relating to crop improvement and breeding which, in your experience was effective?

_____

_____

_____

Please go to **page 20**.

4. What is your opinion on communication about crop improvement and breeding?

Step 4 of 6

4.1 How frequently do you use information from these stakeholders in your communication about crop improvement and breeding?

	Never	Seldom	Sometimes	Often	Almost always
Education providers and academia	□	□	□	□	□
Government agencies/authorities	□	□	□	□	□
European Food Safety Agency (EFSA)	□	□	□	□	□
Farmers and farmer organizations	□	□	□	□	□
Seed/Plant breeding sector	□	□	□	□	□
Agribusinesses and industry associations	□	□	□	□	□
Retailers	□	□	□	□	□
Environmental organizations	□	□	□	□	□
Consumer organizations	□	□	□	□	□
Media	□	□	□	□	□

4.2 Which of the following channels do you use to learn about crop improvement and breeding? Maximum 5 options can be selected.

□ Radio
□ Television
□ Magazines
□ Printed newspapers
□ Scientific journals
□ Professional/technical magazines
□ Conferences/meetings/workshops/webinars
□ Websites
□ Forums/chats/blogs
□ Podcasts
□ Facebook
□ Twitter
□ LinkedIN
□ Youtube
□ Instagram
□ WhatsApp
□ Snapchat
□ Pinterest
□ TikTok
□ Other:_____

4.3 Which are your main target groups to communicate with about crop improvement and breeding? Maximum 3 options can be selected.

 Consumers
 Farmers
 Plant breeders
 Agribusinesses
 Retailers
 Policy makers
 Other:_____

4.4 Which of the following channels do you use to communicate with your main target groups about crop improvement and breeding? Maximum 5 options can be selected.

 Radio
 Television
 Magazines
 Printed newspapers
 Scientific journals
 Professional/technical magazines
 Conferences/meetings/workshops/webinars
 Websites
 Forums/chats/blogs
 Podcasts
 Facebook
 Twitter
 LinkedIN
 Youtube
 Instagram
 WhatsApp
 Snapchat
 Pinterest
 TikTok
 Other:_____

4.5 Why do you specifically use these channels to communicate about crop improvement and breeding? The number of options to select is not limited.

 I have professional support to use these channels.
 My target audience is mainly reached through these channels.
 I have easy access to these channels.
 These channels are low cost.
 Other:_____

4.6 Which of the following tools do you use to communicate about crop improvement and breeding? The number of options to select is not limited.

 Pictures
 Animated pictures (GIFs)
 Videos
 Text
 Other:_____

Please go to **page 26**.

3. What is your experience on communication about different aspects of food systems?

Step 3 of 6

3.2 Why do you engage with others in communication about plant research? The number of options to select is not limited.

 It is important for my business/job.
 It is important to stay informed about innovation(s).
 It is important to inform my target groups.
 It is important to know how scientific findings are put to use in the creation of new crop varieties.
 It can provide solutions to more sustainable agriculture.
 Other:_____

3.3 About which of the following techniques of plant breeding do you communicate? The number of options to select is not limited.

 Methods in plant research (e.g. genome research)
 Plant breeding in general (i.e. crossing and selection)
 Hybrid breeding
 Mutagenesis breeding
 Precision breeding (e.g. gene editing)
 All of the above
 None
 Other:_____

3.4 About which of the following improvements of crops do you mainly communicate? Maximum 3 options can be selected.

 None
 Adaptation to climate change
 Increased sustainability of crops
 Reduction of food loss
 Resistance to environmental stress
 Sufficient yields/harvests
 Increased pest and disease resistance
 Increased quality of crops
 Other:_____

3.5 About which crops do you mainly communicate? Maximum 3 options can be selected.

 None
 I do not focus on any crop specifically.
 Cereals
 Legumes
 Vegetables
 Sugar beets
 Potatoes
 Maize/sorghum
 Fodder plants/amenity grasses
 Oilseed crops
 Ornamentals
 Fruit crops
 Other:_____

3.6 How frequently do you use the following food values in your communication about plant research?

	Never	Seldom	Sometimes	Often	Almost always
Naturalness (extent to which food is produced without modern technologies)	☐	☐	☐	☐	☐
Taste (extent to which consumption of food is appealing to the senses)	☐	☐	☐	☐	☐
Price (the price that is paid for the food)	☐	☐	☐	☐	☐
Safety (extent to which consumption of food will not cause illness)	☐	☐	☐	☐	☐
Convenience (ease with which food is cooked and/or consumed)	☐	☐	☐	☐	☐
Nutrition (amount and type of fat, protein, vitamins, etc.)	☐	☐	☐	☐	☐
Tradition (preserving traditional consumption patterns)	☐	☐	☐	☐	☐
Origin (where the food was grown or produced)	☐	☐	☐	☐	☐
Fairness (the extent to which all parties involved in the production of food equally benefit)	☐	☐	☐	☐	☐
Appearance (extent to which food looks appealing)	☐	☐	☐	☐	☐
Environmental impact (effect of food production on the environment)	☐	☐	☐	☐	☐

3.7 Can you provide an example of a communication relating to plant research which, in your experience was effective?

_____

_____

_____

Please go to **page 24**.

4. What is your opinion on communication about crop improvement and breeding?

Step 4 of 6

4.1 How frequently do you use information from these stakeholders in your communication about plant research?

	Never	Seldom	Sometimes	Often	Almost always
Education providers and academia	□	□	□	□	□
Government agencies/authorities	□	□	□	□	□
European Food Safety Agency (EFSA)	□	□	□	□	□
Farmers and farmer organizations	□	□	□	□	□
Seed/Plant breeding sector	□	□	□	□	□
Agribusinesses and industry associations	□	□	□	□	□
Retailers	□	□	□	□	□
Environmental organizations	□	□	□	□	□
Consumer organizations	□	□	□	□	□
Media	□	□	□	□	□

4.2 Which of the following channels do you use to learn about plant research? Maximum 5 options can be selected.

□ Radio
□ Television
□ Magazines
□ Printed newspapers
□ Scientific journals
□ Professional/technical magazines
□ Conferences/meetings/workshops/webinars
□ Websites
□ Forums/chats/blogs
□ Podcasts
□ Facebook
□ Twitter
□ LinkedIN
□ Youtube
□ Instagram
□ WhatsApp
□ Snapchat
□ Pinterest
□ TikTok
□ Other:_____

4.3 Which are your main target groups to communicate with about plant research? Maximum 3 options can be selected.

 Consumers
 Farmers
 Plant breeders
 Agribusinesses
 Retailers
 Policy makers
 Other:_____

4.4 Which of the following channels do you use to communicate with your main target groups about plant research? Maximum 5 options can be selected.

 Radio
 Television
 Magazines
 Printed newspapers
 Scientific journals
 Professional/technical magazines
 Conferences/meetings/workshops/webinars
 Websites
 Forums/chats/blogs
 Podcasts
 Facebook
 Twitter
 LinkedIN
 Youtube
 Instagram
 WhatsApp
 Snapchat
 Pinterest
 TikTok
 Other:_____

4.5 Why do you specifically use these channels to communicate about plant research? The number of options to select is not limited.

 I have professional support to use these channels.
 My target audience is mainly reached through these channels.
 I have easy access to these channels.
 These channels are low cost.
 Other:_____

4.6 Which of the following tools do you use to communicate about plant research? The number of options to select is not limited.

 Pictures
 Animated pictures (GIFs)
 Videos
 Text
 Other:_____

Please go to **page 26**.

5. What are your needs related to communication?

Step 5 of 6

5.1 What are limiting factors for you to communicate to others? The number of options to select is not limited.

☐ There are no limiting factors.
☐ Access to reliable internet connection.
☐ Time to dedicate to communication.
☐ Knowledge about my communication topic(s).
☐ Access to relevant content.
☐ Other:_____

5.2 How do you rate the importance of addressing the following aspects through communication efforts?

	Not important at all	Slightly important	Important	Very Important	Extremely important
Sustainability: production methods that respect planetary boundaries, benefit society and ensure financial viability.	☐	☐	☐	☐	☐
Safety: guarantees safe and nutritious food that is not contaminated by food-borne diseases/pathogens.	☐	☐	☐	☐	☐
Quality: linked to aspects such as food appearance, texture, flavour and nutrition.	☐	☐	☐	☐	☐
Nutritional value: is the measure of a well-balanced ratio of the essential nutrients in items of food or diet in relation to the nutrient requirements of their consumer.	☐	☐	☐	☐	☐
Food loss and waste: food that is not eaten and is lost/wasted throughout the food system, during production, processing, distribution, retail and consumption.	☐	☐	☐	☐	☐
Labelling: includes any written, printed or graphic matter that is present on the label, accompanies the food, or is displayed near the food, including for the purpose of promoting its sale or disposal.	☐	☐	☐	☐	☐

Origin: where the primary ingredients were produced.	□	□	□	□	□
Fair competition: refers to a free market in which all the players operate on a level playing field.	□	□	□	□	□
Fair trade: trade that is considered fair and reasonable from the point of view of producers.	□	□	□	□	□
Pricing: the price of a product in relation to affordability.	□	□	□	□	□

Please go to **page 30**.

3. What is your experience on communication about different aspects of food systems?

Step 3 of 6

3.2 Why do you not communicate about these topics? The number of options to select is not limited.

□ I am not interested in communication
□ I do not have time to dedicate on communication
□ I do not have access to reliable internet connection.
□ I need knowledge to communicate about these topics
□ Other: _____

3.3 Do you inform yourself about the following topics?

o Crop production. Please continue on this page with **question 3.4**
o Crop improvement and breeding. Please continue on this page with **question 3.4**
o Plant research. Please continue on this page with **question 3.4**
o I do not inform myself about these topics. Please go to **page 30**.

3.4 Which of the following channels do you use to inform yourself? Maximum 5 options can be selected.

□ Radio
□ Television
□ Magazines
□ Printed newspapers
□ Scientific journals
□ Professional/technical magazines
□ Conferences/meetings/workshops/webinars
□ Websites
□ Forums/chats/blogs
□ Podcasts
□ Facebook
□ Twitter
□ LinkedIN
□ Youtube
□ Instagram
□ WhatsApp
□ Snapchat
□ Pinterest
□ TikTok
□ Other:_____

3.5 How frequently do you inform yourself by the following stakeholders?

	Never	Seldom	Sometimes	Often	Almost always
Education providers and academia	□	□	□	□	□
Government agencies/authorities	□	□	□	□	□
European Food Safety Agency (EFSA)	□	□	□	□	□
Farmers and farmer organizations	□	□	□	□	□
Seed/Plant breeding sector	□	□	□	□	□
Agribusinesses and industry associations	□	□	□	□	□
Retailers	□	□	□	□	□
Environmental organizations	□	□	□	□	□
Consumer organizations	□	□	□	□	□
Media	□	□	□	□	□

3.6 Which of the following tools do you prefer to use to inform yourself? The number of options to select is not limited.

□ Pictures
□ Animated pictures (GIFs)
□ Videos
□ Text
□ Other:_____

Please go to **page 30**.

6. What is your experience and opinion on gene editing in plants?

Step 6 of 6

6.1 Are you familiar with gene editing in plants?
o Yes
o No

6.2 Do you communicate about gene editing in plants?
o Yes. Please continue with **question 6.3**.
o No. Please continue with **question 6.5**.

6.3 Which are your main target groups to communicate with about gene editing in plants? Maximum 3 options can be selected.
 Consumers
 Farmers
 Plant breeders
 Agribusinesses
 Retailers
 Policy makers
 Other:_____

6.4 What specific topics are most important to you when communicating about gene editing in plants? Maximum 3 options can be selected.
 Mechanisms of gene editing in plants
 Examples of the applications of gene editing in plants
 Comparisons of gene editing and conventional breeding methods
 Potential risks associated with gene editing in plants
 Potential benefits associated with gene editing in plants
 Connections between everyday life of target group and gene editing in plants
 Expertise and experiences of research institute/firm that is using gene editing in plants
 Funding for research on gene editing in plants
 Other: _____

6.5 What are the main limiting factors for you to communicate about gene editing in plants? Maximum 3 options can be selected.
 No need/interest to communicate about gene editing in plants
 There are no limiting factors
 Lack of experience to communicate about gene editing in plants
 Access to trustworthy information about gene editing in plants
 Access to information in laymen's terms about gene editing in plants
 Lack of examples of gene editing in plants
 Lack of knowledge about gene editing in plants
 Lack of easily comprehensible visualisations of gene editing in plants
 Other: _____

6.6 How frequently do you inform yourself by the following stakeholders on gene editing in plants?

	Never	Seldom	Sometimes	Often	Almost always
Education providers and academia	□	□	□	□	□
Government agencies/authorities	□	□	□	□	□
European Food Safety Agency (EFSA)	□	□	□	□	□
Farmers and farmer organizations	□	□	□	□	□
Seed/Plant breeding sector	□	□	□	□	□
Agribusinesses and industry associations	□	□	□	□	□
Retailers	□	□	□	□	□
Environmental organizations	□	□	□	□	□
Consumer organizations	□	□	□	□	□
Media	□	□	□	□	□

6.7 Which of the following channels do you use to learn about gene editing in plants? Maximum 5 options can be selected.

□ Radio
□ Television
□ Magazines
□ Printed newspapers
□ Scientific journals
□ Professional/technical magazines
□ Conferences/meetings/workshops/webinars
□ Websites
□ Forums/chats/blogs
□ Podcasts
□ Facebook
□ Twitter
□ LinkedIN
□ Youtube
□ Instagram
□ WhatsApp
□ Snapchat
□ Pinterest
□ TikTok
□ Other:_____

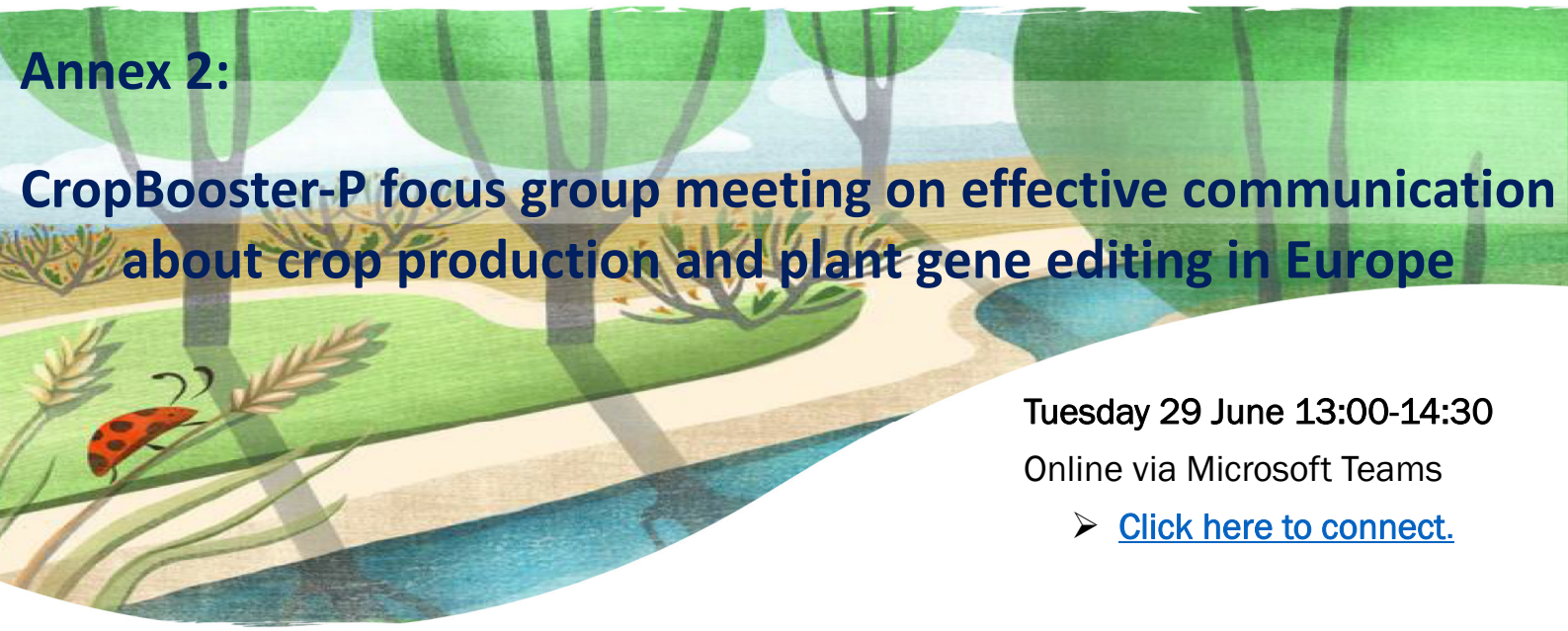
6.8 Which of the following aspects do you regard as important for communicating about gene editing in plants in the future?

	Not important at all	Slightly important	Important	Very Important	Extremely important
Technological developments: innovations related to the application of gene editing in plants.	☐	☐	☐	☐	☐
Examples of applications	☐	☐	☐	☐	☐
Safety: environmental and/or food safety risk assessment of applications of gene editing in plants.	☐	☐	☐	☐	☐
Legal aspects: legal status of applications of gene editing in plants.	☐	☐	☐	☐	☐
Intellectual property: intellectual property protection for applications of gene editing in plants.	☐	☐	☐	☐	☐
Transparency: public access to information about applications of gene editing in plants.	☐	☐	☐	☐	☐
Global context: international agreements related to applications of gene editing in plants.	☐	☐	☐	☐	☐

Is there anything more you would like to share?

_____
_____
_____

Thank you for taking the time to complete this survey.



Annex 2:

CropBooster-P focus group meeting on effective communication about crop production and plant gene editing in Europe

Tuesday 29 June 13:00-14:30

Online via Microsoft Teams

➢ Click here to connect.

Aim

In this online focus group meeting we aim to develop insight and comprehension in the values, needs and expectations from the farming community, seed & breeding sector and EU policy makers related to communication about crop production and plant gene editing in Europe.

Agenda

13:00	**Tour de table**
13:10	**Introduction to the CropBooster project and presentation of the key results from the online survey** Nick Vangheluwe, *Research project assistant at Plant ETP and Euroseeds*
13:20	**Discussion of the identified trends in the survey results and exchange of communication experience** Stakeholder representatives from the farming community, seed & breeding sector and EU policy bodies
14:20	**Concluding remarks**

Additional notes

- The focus group meeting will be recorded for further research. The recording will be deleted after analysis.
- You do not need to download Microsoft Teams to use the link; you can access the meeting directly through your web browser.
- Please contact Nick Vangheluwe in case you have any questions: Nick.Vangheluwe@plantetp.eu or +32472686890

CropBooster-P

Euroseeds
Embracing Nature

Plants for the Future
European Technology Platform

Introduction to the survey results

The aim of the EU Horizon 2020-funded project CropBooster-P is to identify the main drivers and uncertainties crucial for future-proofing our food system and to facilitate the transition to more sustainable and resilient crop production in ways that is acceptable for society.

Improving public awareness & trust and ensuring a full understanding & uptake of novel technologies related to crop production and nutritional quality will be essential. That is why we aim to identify the challenges that can be solved by communication means but currently hamper an efficient communication.

We conducted an online survey to assess values, experiences and expectations being associated with crop production/improvement and plant gene editing in Europe for the following three stakeholder groups: (1) the farming community, (2) the seed & breeding sector and (3) EU policy makers. We will discuss in the focus group meeting the identified trends based on the analysis of the survey results:

- The European Food Safety Agency (EFSA), the farming community, the seed & breeding sector and academia are most trusted by the three stakeholder groups regarding information and communication about food production. Agribusinesses and industry associations are most distrusted by policy makers.

- Information from the farming community, the seed & breeding sector and academia as well as agribusinesses and industry associations are frequently used in communication about crop production/improvement by the three stakeholder groups. However, policy makers preferentially engage with academia, environmental & consumer organizations and EFSA, to inform themselves about gene editing in plants.

- Farmers are the main target group of the three stakeholder groups to communicate with about crop production and crop improvement.

- The most preferred crop to communicate about by the three stakeholder groups is cereal. In addition, policy makers communicate preferentially about legumes, ornamentals and fruit crops.

- The farming community and the seed & breeding sector prefer (professional) magazines, websites and conferences & meetings to communicate about crop production/improvement, while policy makers prefer radio, conferences & meetings and social media. The preferred social media platform of the three stakeholder groups is Facebook followed by Twitter.

- Safety and environmental impact are the most frequently used food choice motives* in the communication about food production by the farming community and the seed & breeding sector, while nutrition is most frequently used by policy makers.

  * Safety: extent to which consumption of food will not cause illness.
  Environmental impact: effect of food production on the environment.
  Nutrition: amount and type of fat, protein, vitamins, etc.

- In future communication, the three stakeholder groups indicate that safety, examples & technological developments of gene editing in plants need to be addressed. However, safety (defined in the survey as: "environmental and/or food safety risk assessment of applications of gene editing in plants") is of low importance for policy makers in future communication.

In the focus group meeting, the following questions will be addressed to stakeholder representatives from the farming community, seed & breeding sector and EU policy bodies:

- Do you expect/agree with the identified trend?
- Do you think this result is representative for your stakeholder group?
- Do you have an explanation for this result?
- Which follow-up question(s) do you have?

Based on the results of the survey and the feedback during the focus group meeting, we aim to provide recommendations on effective communication strategies with different target groups to improve public awareness and to ensure a better understanding of novel technologies for crop production & improvement in Europe to facilitate the transition to more sustainable and resilient crop production.

Annex 3

Online focus group meeting

Effective communication about crop production and plant gene editing in Europe

29/06/21 13:00 – 14:30

Nick Vangheluwe (Plant ETP/Euroseeds)

Plants for the Future
European Technology Platform

Euroseeds
Embracing Nature

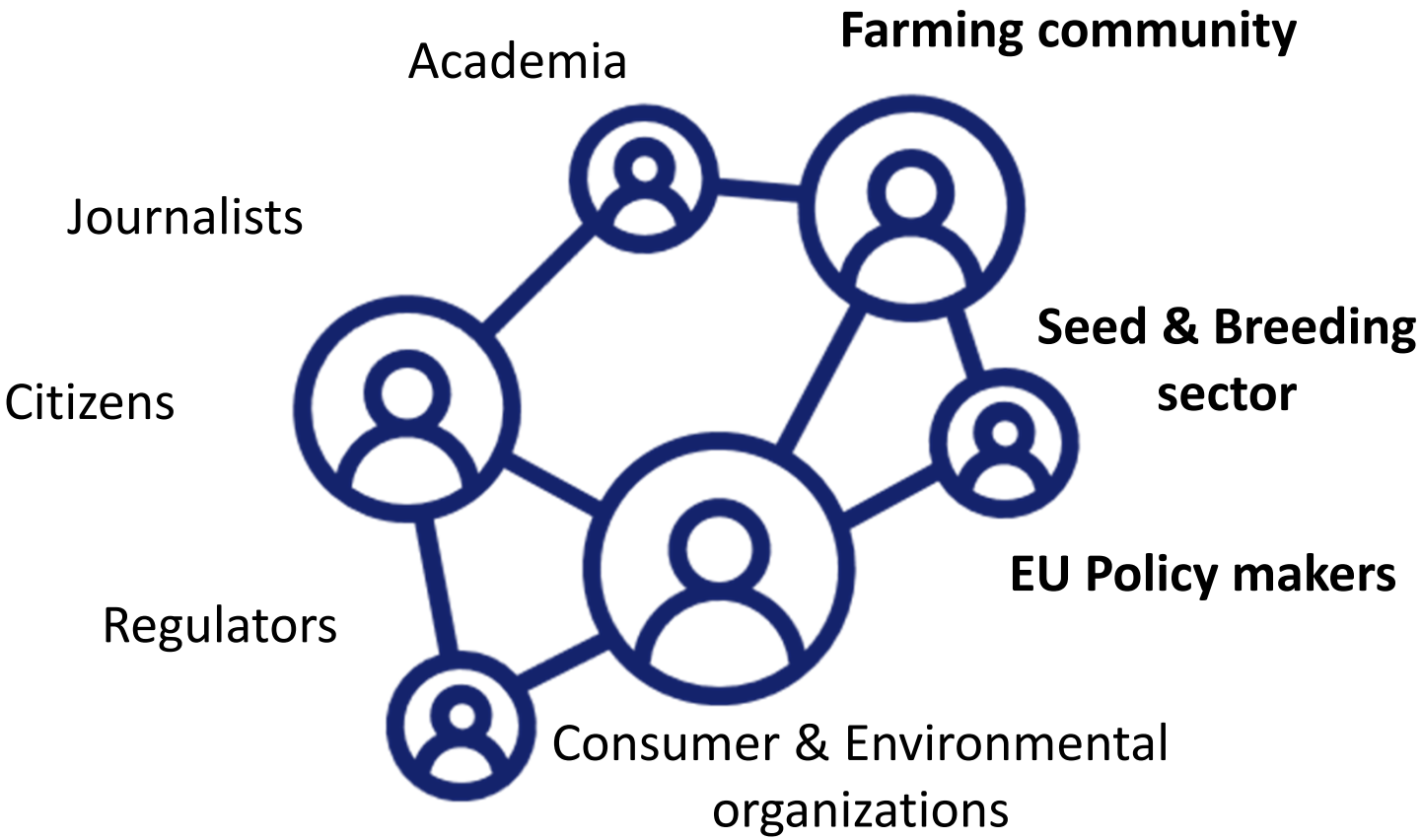
CropBooster-P

CropBooster project: a roadmap to achieve sufficient and sustainable food production for the future

Environmental, policy and societal challenges

THIS PROJECT IS FUNDED BY THE **EUROPEAN UNION HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME** UNDER GRANT AGREEMENT 817690

Aim is to develop a communication strategy to improve public awareness and full understanding of innovation



We received 166 responses to our online survey

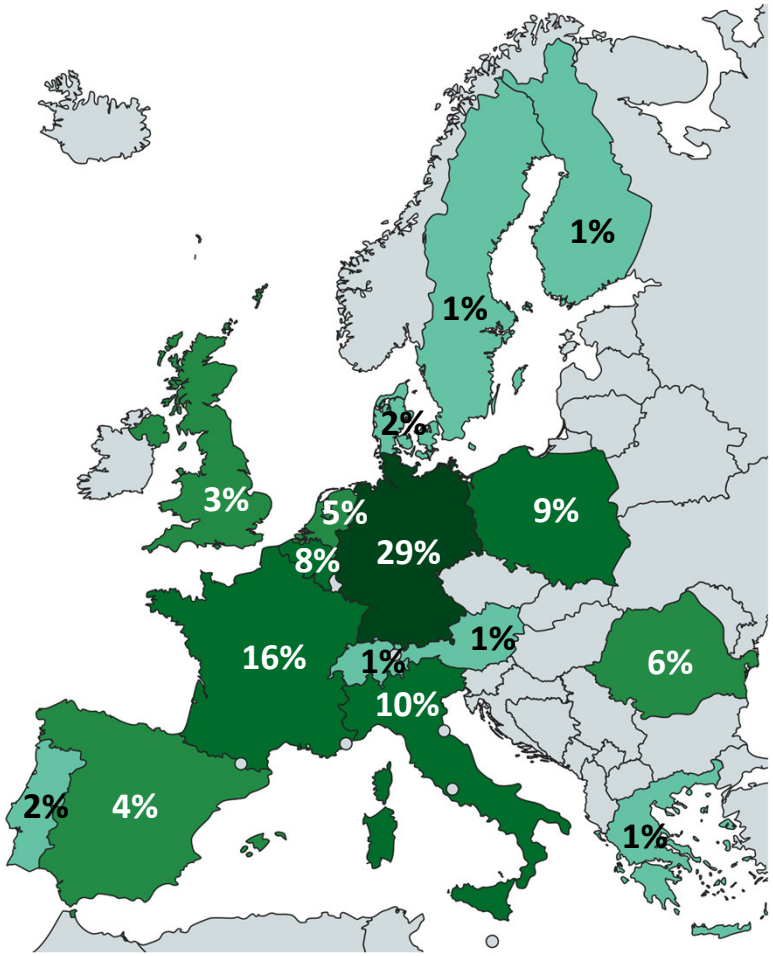
Farming community (N=55)

Seed & Breeding sector (N=100)

Policy makers (N=11)

Individual responses

Responses on behalf of an organization



Background info on the survey respondents:

Farming community: 75% communicate about crop production

Seed & Breeding sector: 60% communicate about crop improvement and 20% about crop production

Policy makers:

(45% communicate)

- European Parliament (N=4)
- European Commission (N=2)
- European agency (N=1)
- Political education & consultancy (N=1)
- National Government, PL (N=1)
- Regional Parliament, DE (N=1)
- Regional Government, BE (N=1)

Information from agribusinesses & industry associations is frequently used in communication about crops

Use info

Farming community

Farmers and farmer organizations

Seed/Plant breeding sector

Agribusinesses and industry associations

Government agencies/authorities

European Food Safety Agency (EFSA)

Education providers and academia

Media

Retailers

Environmental organizations

Consumer organizations

Seed & breeding sector

Seed/Plant breeding sector

Education providers and academia

Agribusinesses and industry associations

Government agencies/authorities

Farmers and farmer organizations

European Food Safety Agency (EFSA)

Media

Environmental organizations

Consumer organizations

Retailers

Policy makers

Farmers and farmer organizations

Education providers and academia

Agribusinesses and industry associations

Government agencies/authorities

Seed/Plant breeding sector

Environmental organizations

Consumer organizations

Media

European Food Safety Agency (EFSA)

Retailers

Policy makers prefer information from environmental & consumer organizations about plant gene editing

Use info

Farming community

Seed/Plant breeding sector

Farmers and farmer organizations

Education providers and academia

Agribusinesses and industry associations

Government agencies/authorities

European Food Safety Agency (EFSA)

Media

Environmental organizations

Consumer organizations

Retailers

Seed & breeding sector

Seed/Plant breeding sector

Education providers and academia

Agribusinesses and industry associations

Government agencies/authorities

Media

Farmers and farmer organizations

European Food Safety Agency (EFSA)

Environmental organizations

Consumer organizations

Retailers

Policy makers

Education providers and academia

Environmental organizations

Consumer organizations

European Food Safety Agency (EFSA)

Farmers and farmer organizations

Government agencies/authorities

Seed/Plant breeding sector

Media

Agribusinesses and industry associations

Retailers

Policy makers distrust agribusinesses & industry associations regarding info about food production

Trust

Farming community

European Food Safety Agency (EFSA)
Farmers and farmer organizations
Seed/Plant breeding sector
Education providers and academia
Government agencies/authorities
Agribusinesses and industry associations
Consumer organizations
Retailers
Environmental organizations
Media

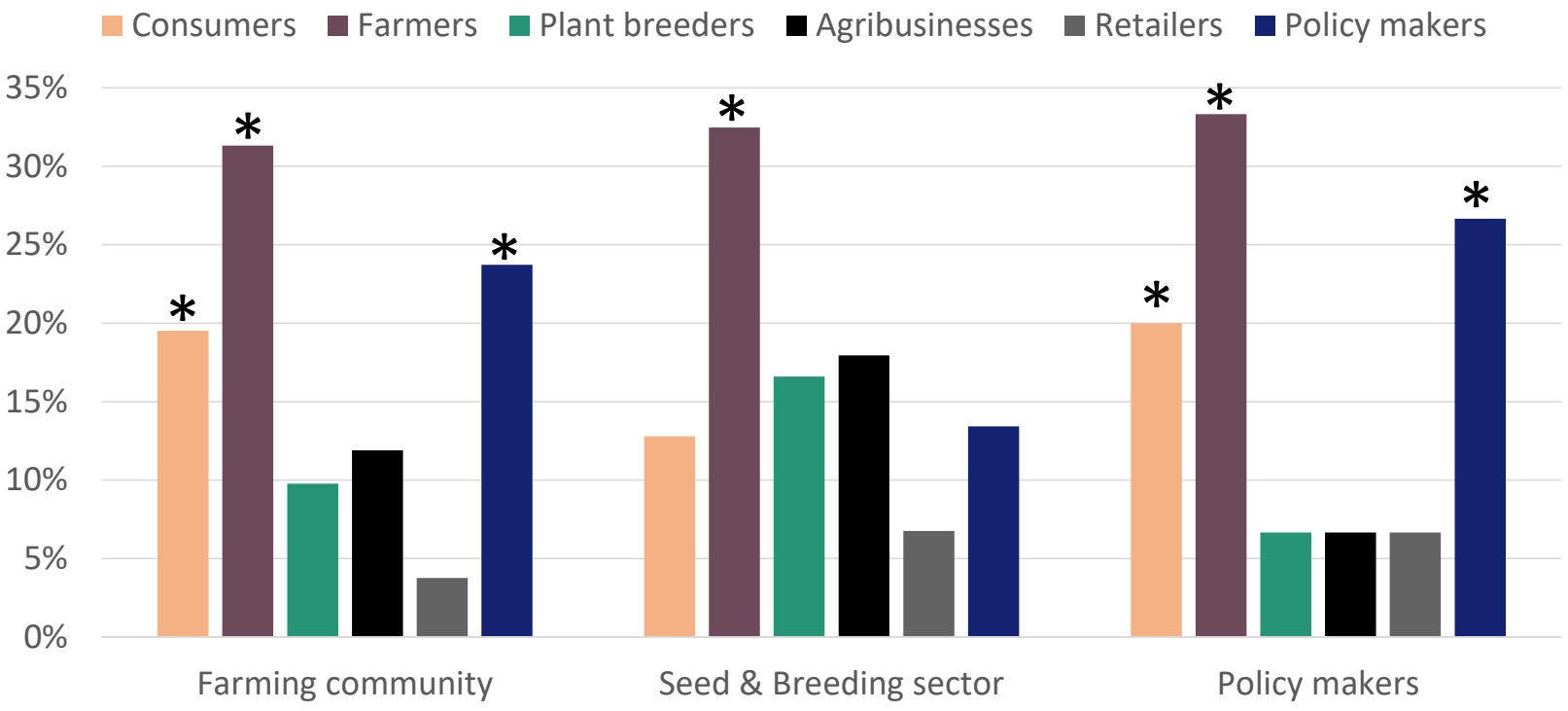
Seed & breeding sector

Seed/Plant breeding sector
European Food Safety Agency (EFSA)
Education providers and academia
Agribusinesses and industry associations
Farmers and farmer organizations
Government agencies/authorities
Retailers
Consumer organizations
Environmental organizations
Media

Policy makers

Government agencies/authorities
European Food Safety Agency (EFSA)
Education providers and academia
Farmers and farmer organizations
Seed/Plant breeding sector
Environmental organizations
Consumer organizations
Media
Retailers
Agribusinesses and industry associations

Farmers are the main target group of the three stakeholder groups to communicate with



Conferences, meetings and workshops are the most preferred activity to communicate

Preferred channel

Stakeholder groups have different preferences for food choice motives in communication

Preferred option

Farming community

Safety
Environmental impact
Origin
Price
Fairness
Nutrition
Taste
Tradition
Appearance
Convenience
Naturalness

Seed & breeding sector

Environmental impact
Safety
Nutrition
Origin
Price
Taste
Fairness
Naturalness
Convenience
Tradition
Appearance

Policy makers

Nutrition
Origin
Fairness
Price
Tradition
Environmental impact
Taste
Safety
Naturalness
Appearance
Convenience

Safety, examples & technological developments of gene editing in plants need to be addressed in future communication

Importance

Farming community

Safety

Examples of applications

Technological developments

Global context

Transparency

Legal aspects

Intellectual property

Seed & breeding sector

Examples of applications

Safety

Transparency

Technological developments

Global context

Intellectual property

Legal aspects

Policy makers

Examples of applications

Technological developments

Legal aspects

Global context

Intellectual property

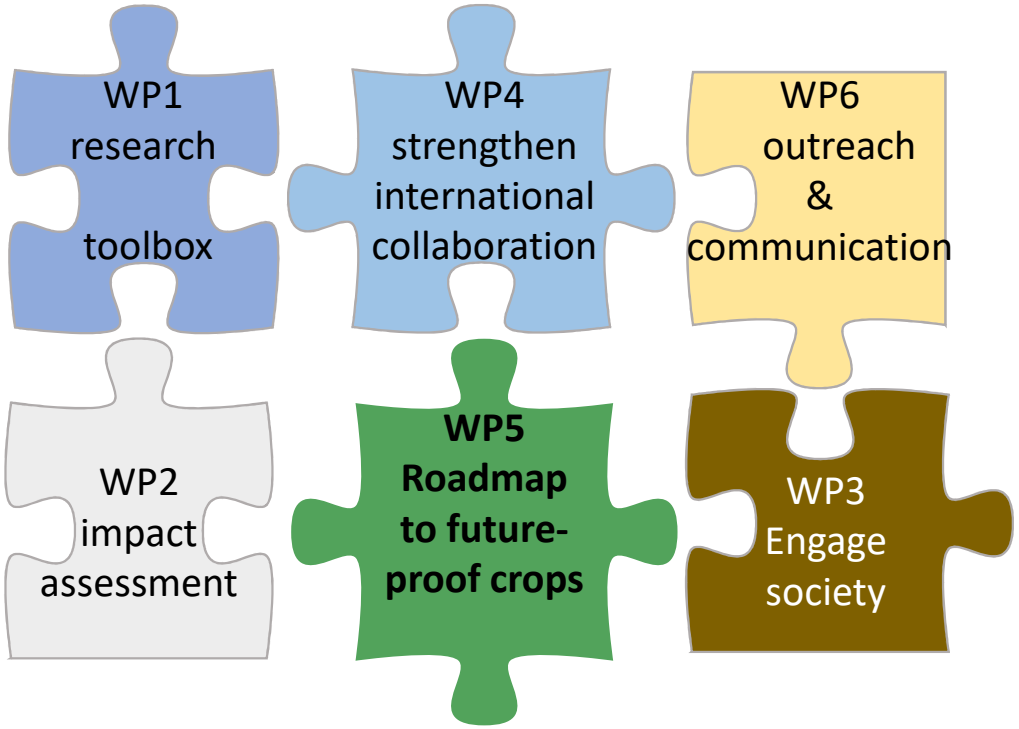
Transparency

Safety

Questions that are going to be addressed to you during the focus group meeting:

- Do you agree with the identified differences between stakeholder groups?
- Do you think this result is representative for your stakeholder group?
- Do you have an explanation for this result?
- Which follow-up question(s) do you have?

Provide recommendations on effective communication strategies with different target groups



How would you prioritize the different actors?
Is this representative for your stakeholder group?

Use info

Farming community

Seed/Plant breeding sector

Farmers and farmer organizations

Education providers and academia

Agribusinesses and industry associations

Government agencies/authorities

European Food Safety Agency (EFSA)

Media

Environmental organizations

Consumer organizations

Retailers

Seed & breeding sector

Seed/Plant breeding sector

Education providers and academia

Agribusinesses and industry associations

Government agencies/authorities

Media

Farmers and farmer organizations

European Food Safety Agency (EFSA)

Environmental organizations

Consumer organizations

Retailers

Policy makers

Education providers and academia

Environmental organizations

Consumer organizations

European Food Safety Agency (EFSA)

Farmers and farmer organizations

Government agencies/authorities

Seed/Plant breeding sector

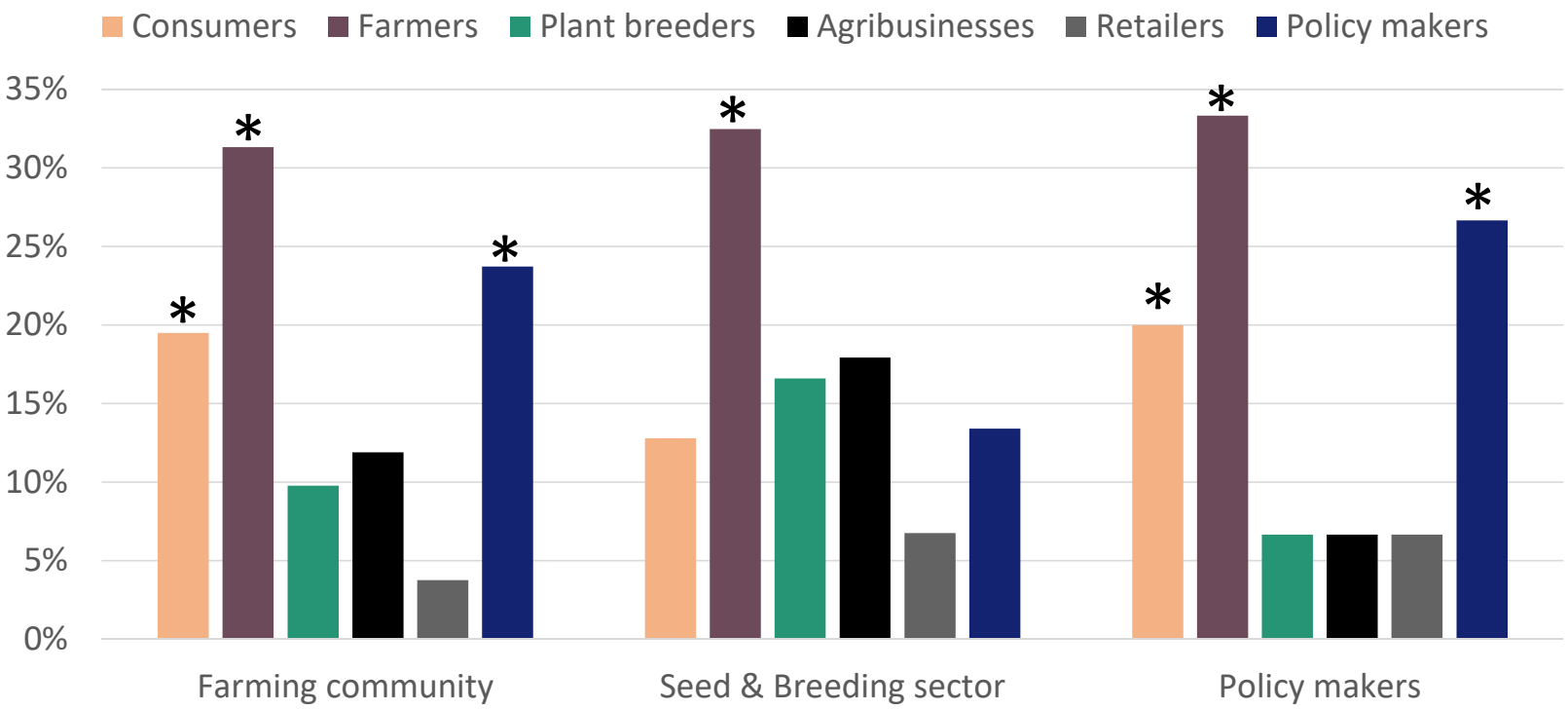
Media

Agribusinesses and industry associations

Retailers

13:20 - 14:40

Why are farmers the main target group? What is the relevance of social media?



13:40 - 14:00

Which food choice motive do you prefer?
Is this representative for your stakeholder group?

Preferred option

Farming community

Safety
Environmental impact
Origin
Price
Fairness
Nutrition
Taste
Tradition
Appearance
Convenience
Naturalness

Seed & breeding sector

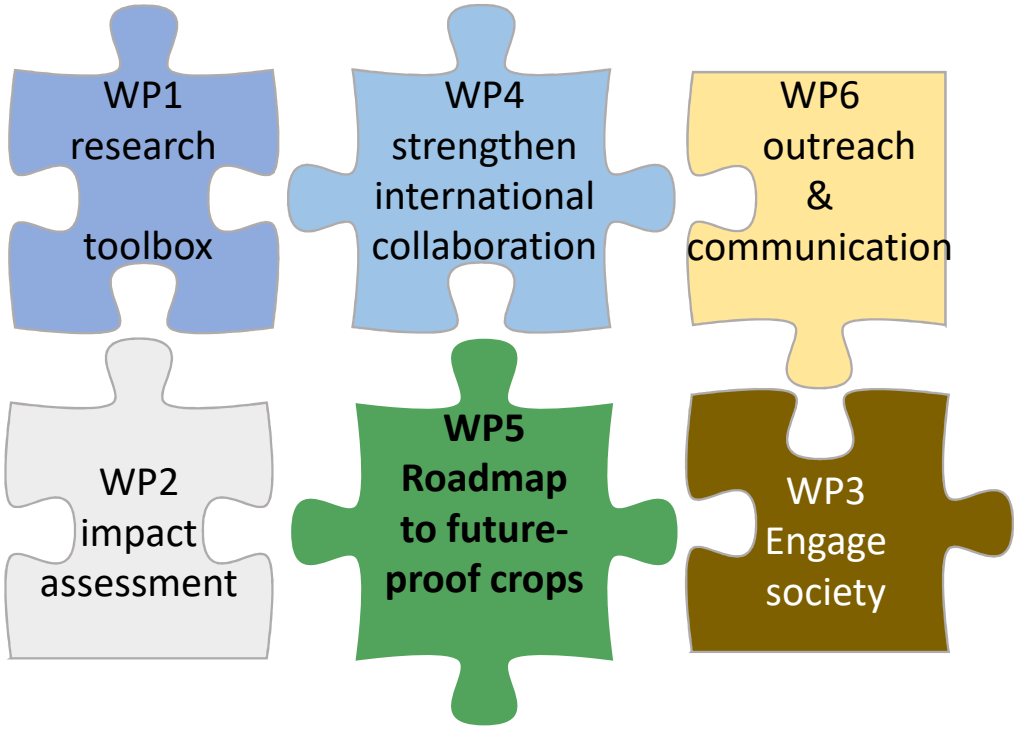
Environmental impact
Safety
Nutrition
Origin
Price
Taste
Fairness
Naturalness
Convenience
Tradition
Appearance

Policy makers

Nutrition
Origin
Fairness
Price
Tradition
Environmental impact
Taste
Safety
Naturalness
Appearance
Convenience

14:00 - 14:20

Future steps in the CropBooster project




Thank you
CropBooster-P

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CropBooster-P

Annex 4. Survey results

Farmers, plant breeders and policy maker's communication activities linked to plant research, crop production & improvement and plant gene editing in Europe

Authors: Nick Vangheluwe (Plant ETP & Euroseeds), Amrit Nanda (Plant ETP) and Petra Jorasch (Euroseeds)

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*SHG: stakeholder group

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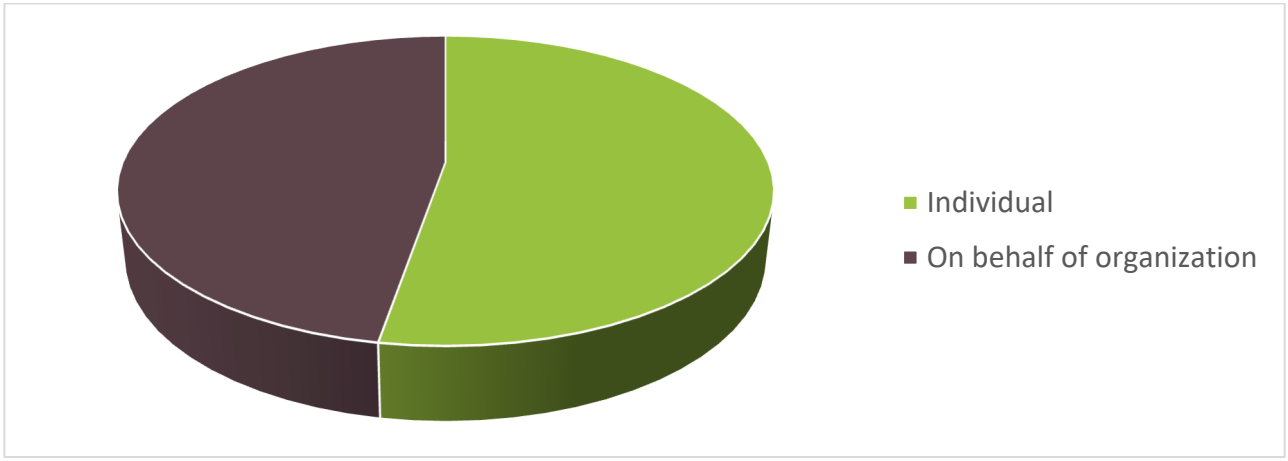
1 FARM-LEVEL SURVEY RESULTS

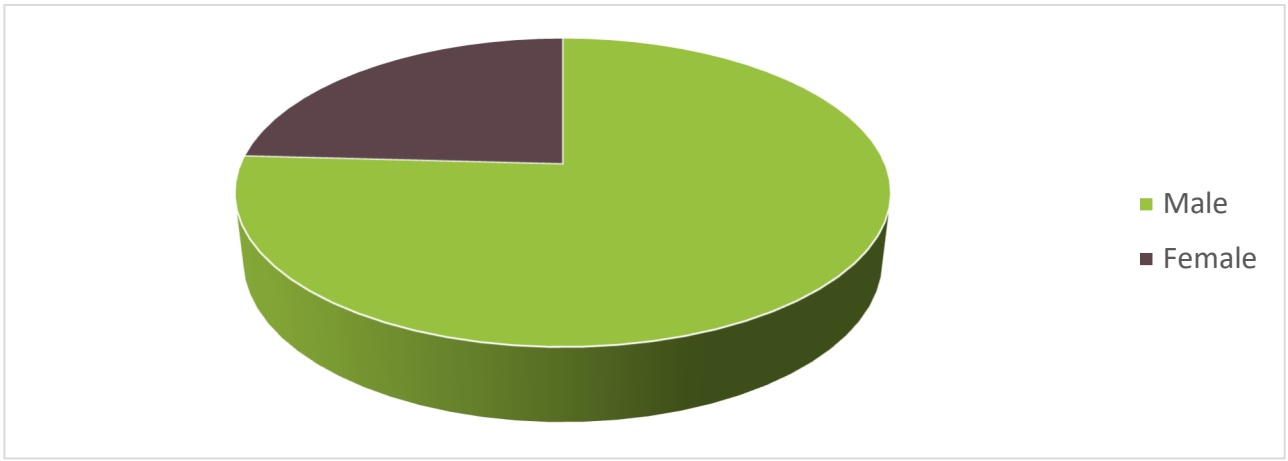
1.1 *Description of the survey sample*

Q1.1 Are you filling in this form on behalf of yourself or the organization your work for? N=55



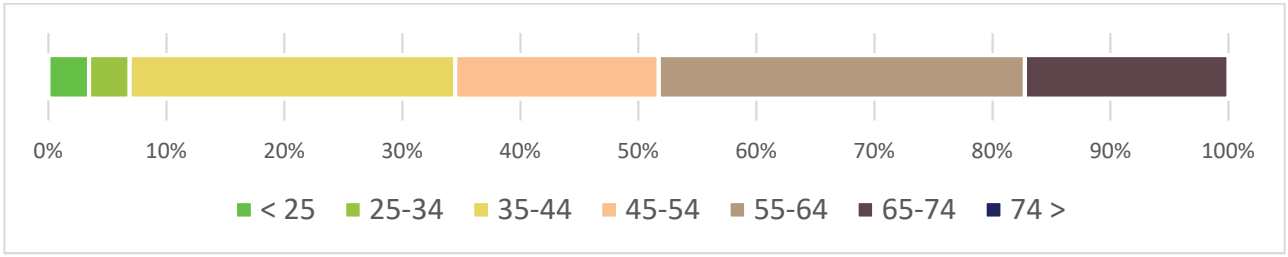
The number of responses is nearly equally divided between participants that answered on behalf of themselves and on behalf of the farmer organization they work for.

Q1.2 Please specify your gender. N=29



Approximately 75% of the farmers are male.

Q1.3 What is your age range? N=29



The age range of the farmers is predominantly between 35-44 and 55-64 years old.

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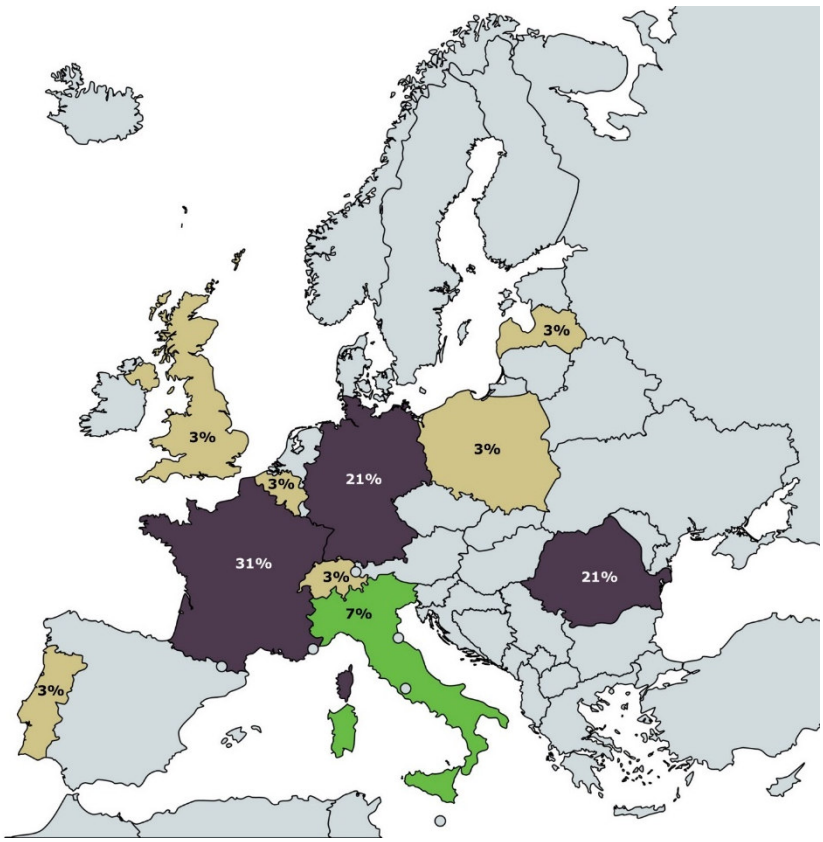
Q1.4a In which country do you work? (Individual responses) N=29



Individual responses are primarily from France, Germany, Romania, and Italy. Country distribution of the survey responses is color-coded: above 15% is indicated in brown, between 5% and 15% is indicated in green and below 5% is indicated in light brown.

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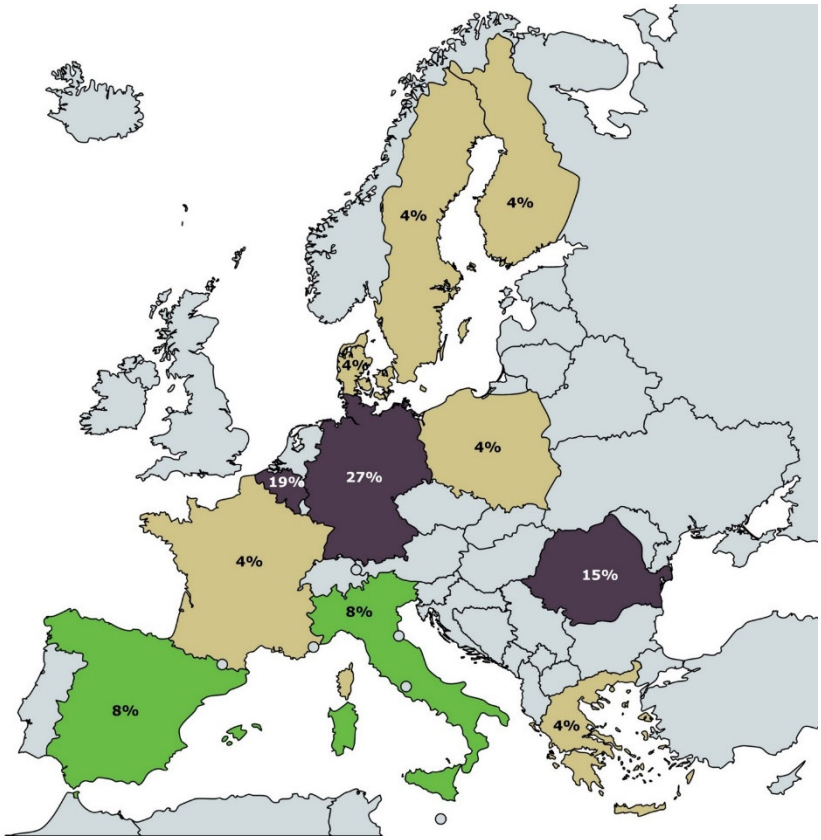
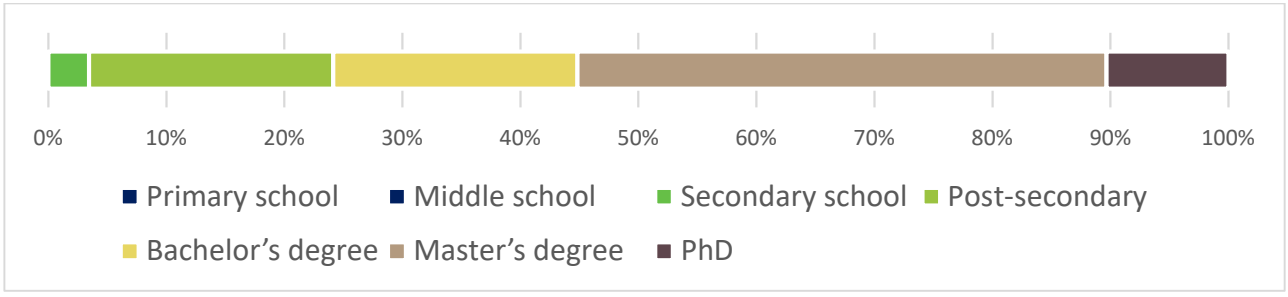
Q1.4b In which country is your farmer organization active? N=26



Responses on behalf of farmer organizations are primarily from Germany, Belgium, Romania, Italy, and Spain. Country distribution of the survey responses is color-coded: above 15% is indicated in brown, between 5% and 15% is indicated in green and below 5% is indicated in light brown.

Q1.5 What is your highest formal completed education level? N=29



Approximately 75% of the farmers have at least a Bachelor's degree.

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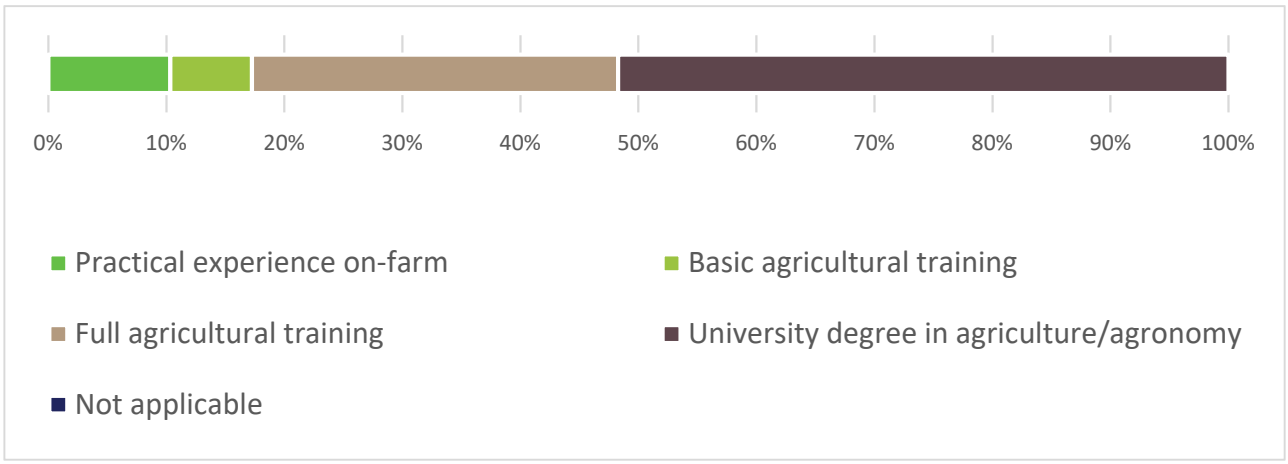
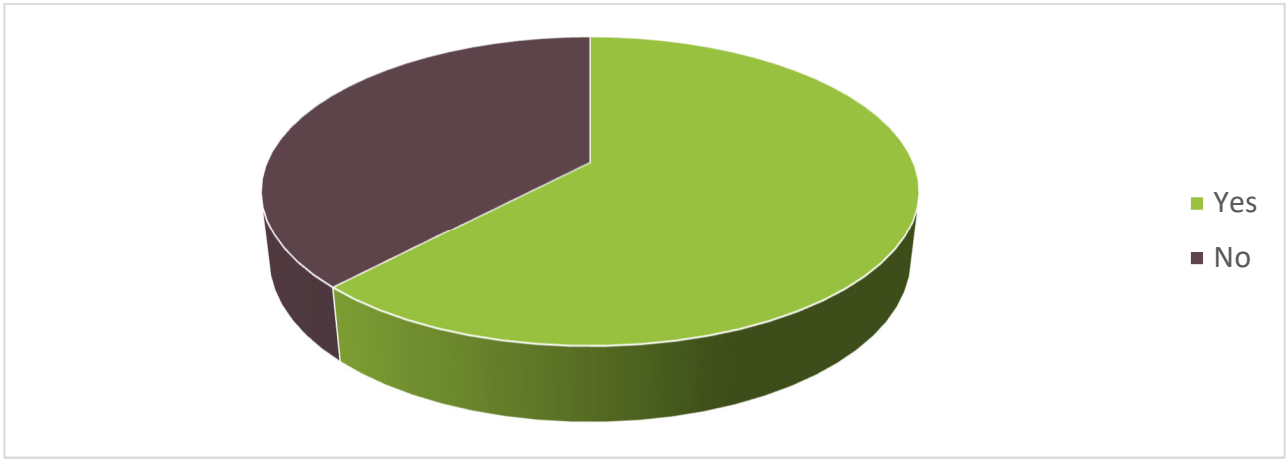
Q1.6 What is your highest completed level of agricultural education? N=29



Nearly half of the farmers have a university degree in agriculture/agronomy.

Q1.7 Is communication part of your professional tasks? N=29



A total of 62% of the farmers indicated that communication is part of their professional tasks.

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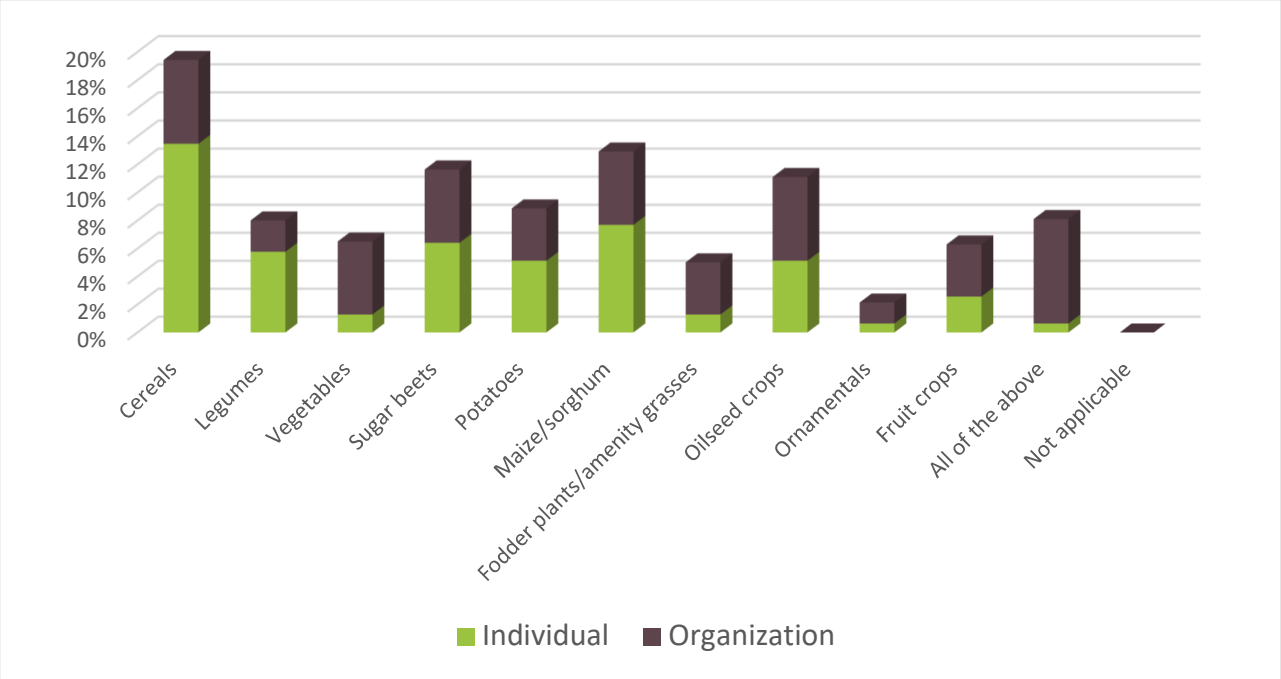
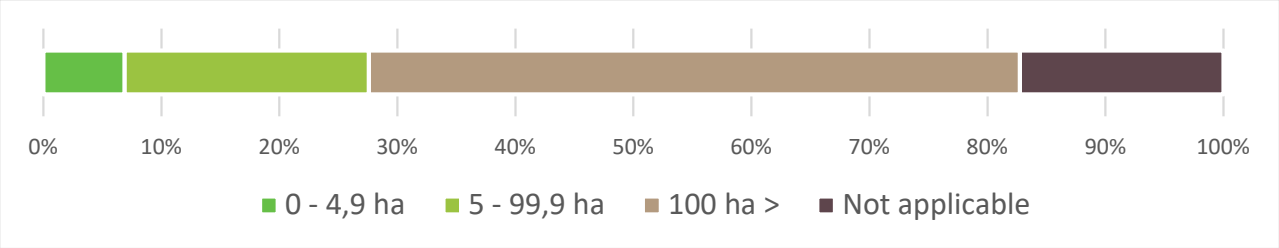
Q1.8 Which crops do you deal with? Or which crops does your farmer organization deal with? N=55



Farmers are mainly dealing with cereals and to a lesser extent with maize/sorghum, sugar beets, legumes, potatoes, and oilseed crops, while farmer organizations are mainly dealing with all the enlisted crops.

Q1.9 What size is your farm in total? N=29



Nearly half of the farmers work on a farm with a size of 100 hectares or more.

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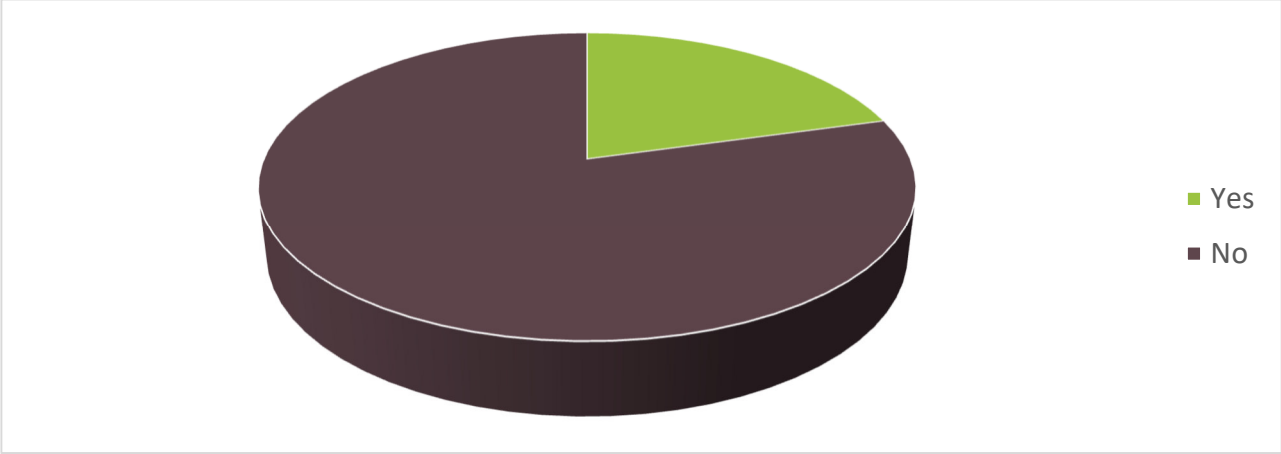
Q1.10 Does your farm have any specific certifications or organizational affiliations or are you a member of specific agri-environmental scheme such as Organic, LEAF etc.? N=29



A total of 21% of the farmers have a farm with a specific certification, organizational affiliation or is a member of a specific agri-environmental scheme. More specifically:

Environmental schemes:

- Higher Level Stewardship: farmers to undertake environmental management schemes which offer "significant benefits" to high-priority areas in United Kingdom.

- Pakiet ekologiczny in Poland

- Certificare ecologica in Romania

- HVE (2/3): Haute Valeur Environnementale (2 participants from France)

Specific certifications:

- Vegaplan: the Vegaplan Standard is a normative document which assures the quality of primary crop products (2 participants from France)

- GLOBALGAP: a trademark and set of standards for good agricultural practices (2 participants from France)

1.2 *General perception and knowledge of the SHG*

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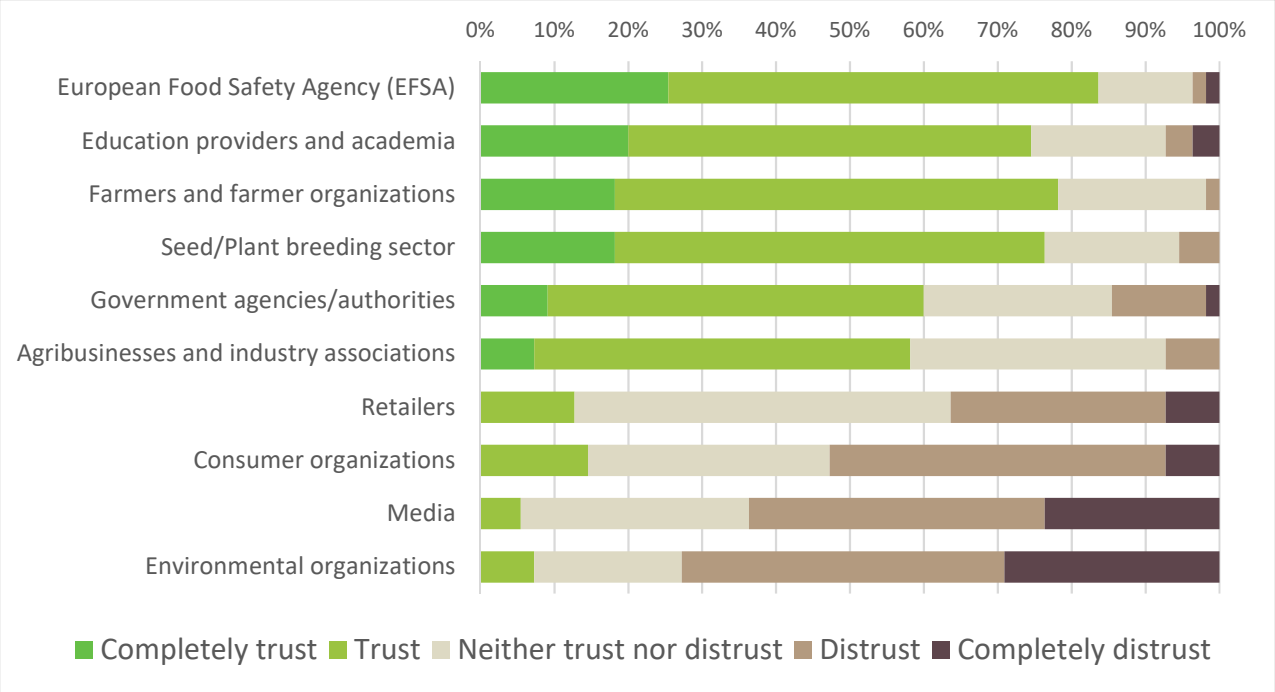
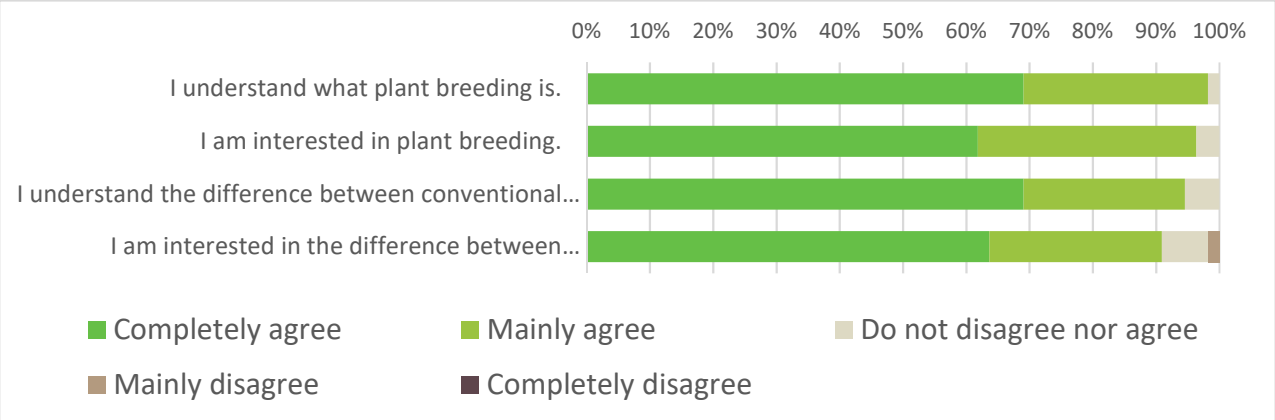
Q2.1 Please indicate your degree of trust in the following organizations regarding information and communication about food production in Europe. N=55



EFSA, education providers and academia, farmers and farmer organizations, seed/plant breeding sector, government agencies/authorities, and agribusinesses and industry associations have a median response of "trust" regarding the degree of trust of farmers and farmer organizations in information and communication about food production in Europe. Retailers have a median response of "neither trust nor distrust" and environmental organizations, media, and consumer organizations have a median response of "distrust".

Q2.2 How do you self-assess your knowledge about plant breeding? N=55



At least 90% of the farmers and farmer organizations completely agree or mainly agree with the statement that they understand what plant breeding is as well as what the difference is between conventional and new plant breeding methods.

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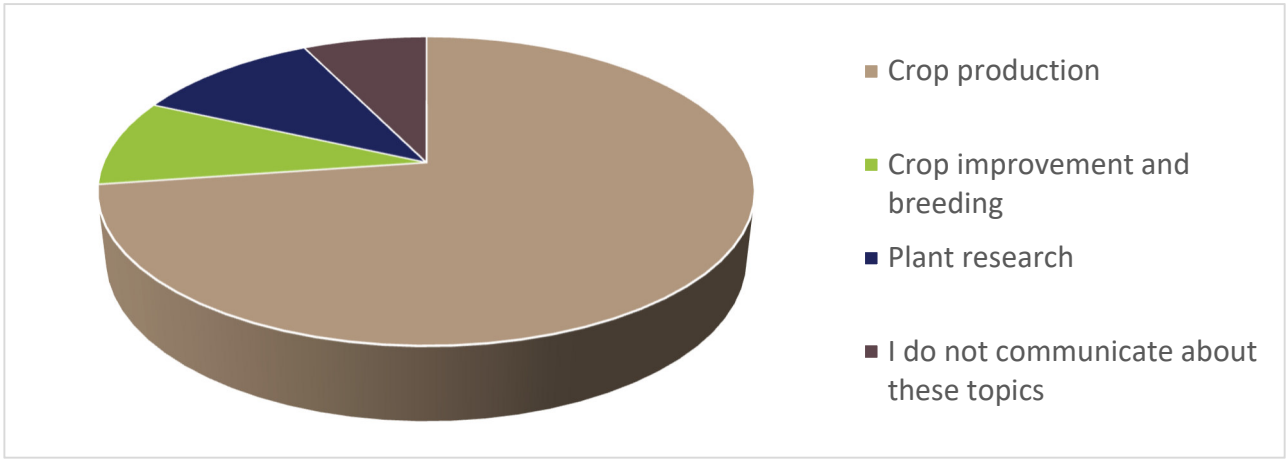
1.3 *Experience, opinion and needs of the SHG related to communication about different aspects of food systems*

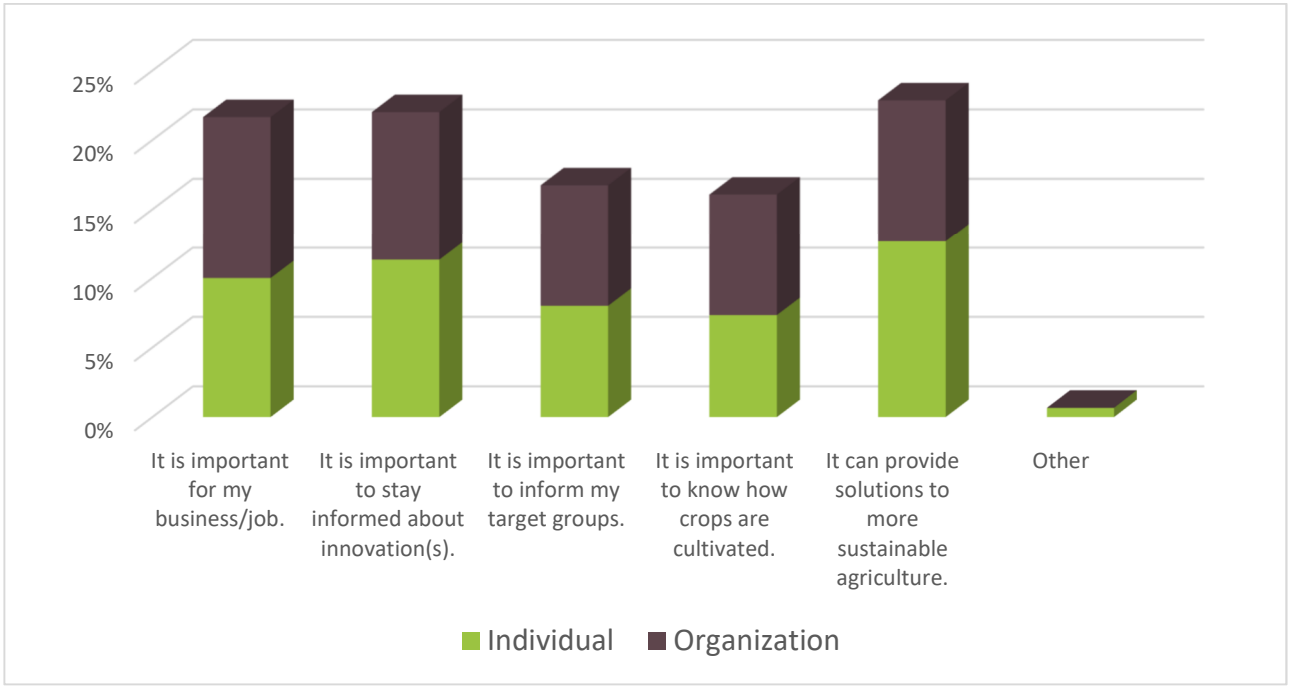
1.3.1 EXPERIENCE OF THE SHG ON ONGOING COMMUNICATION ACTIVITIES

Q3.1 On which topic do you have the most experience communicating? N=55



Nearly three-quarters of the farmers and farmer organizations have most experience in communication about crop production.

Q3.2 Why do you engage with others in communication about plant research, crop improvement and breeding or crop production? N=51



Farmers and farmer organizations indicated that they engage with others in communication about plant research, crop improvement and breeding or crop production because: "it is important for my business/job", "it is important to stay informed about innovation(s)", and "it can provide solutions to more sustainable agriculture".

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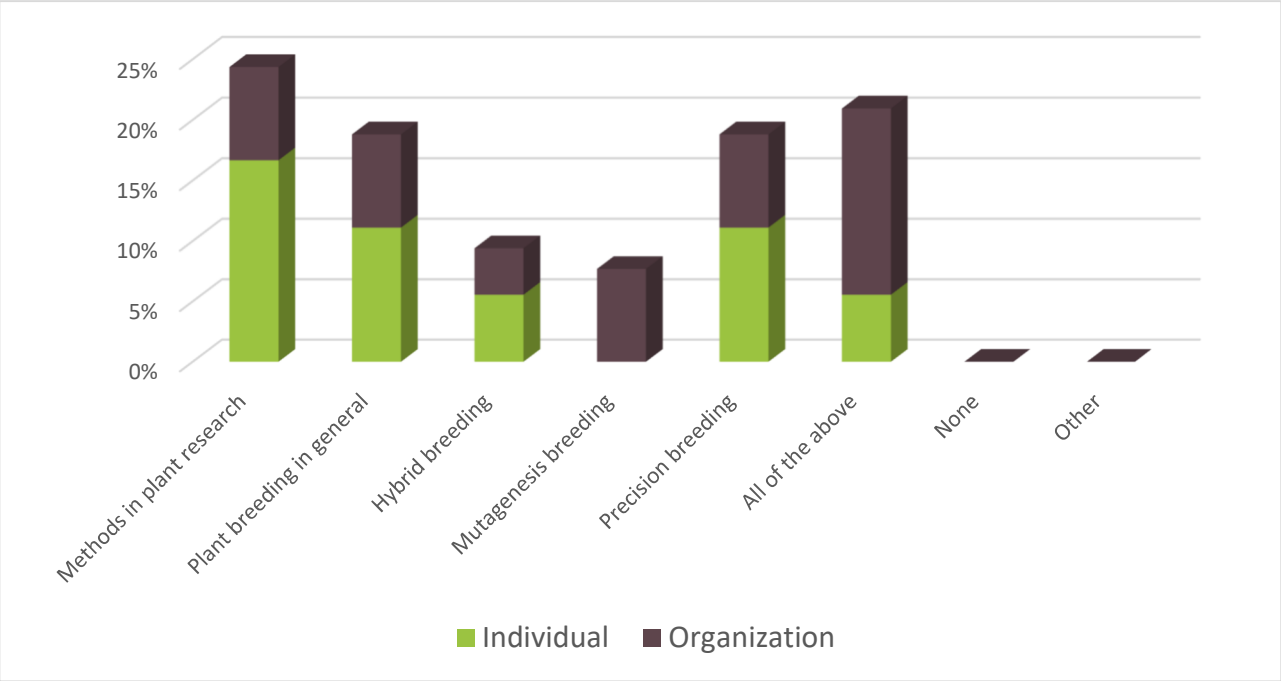
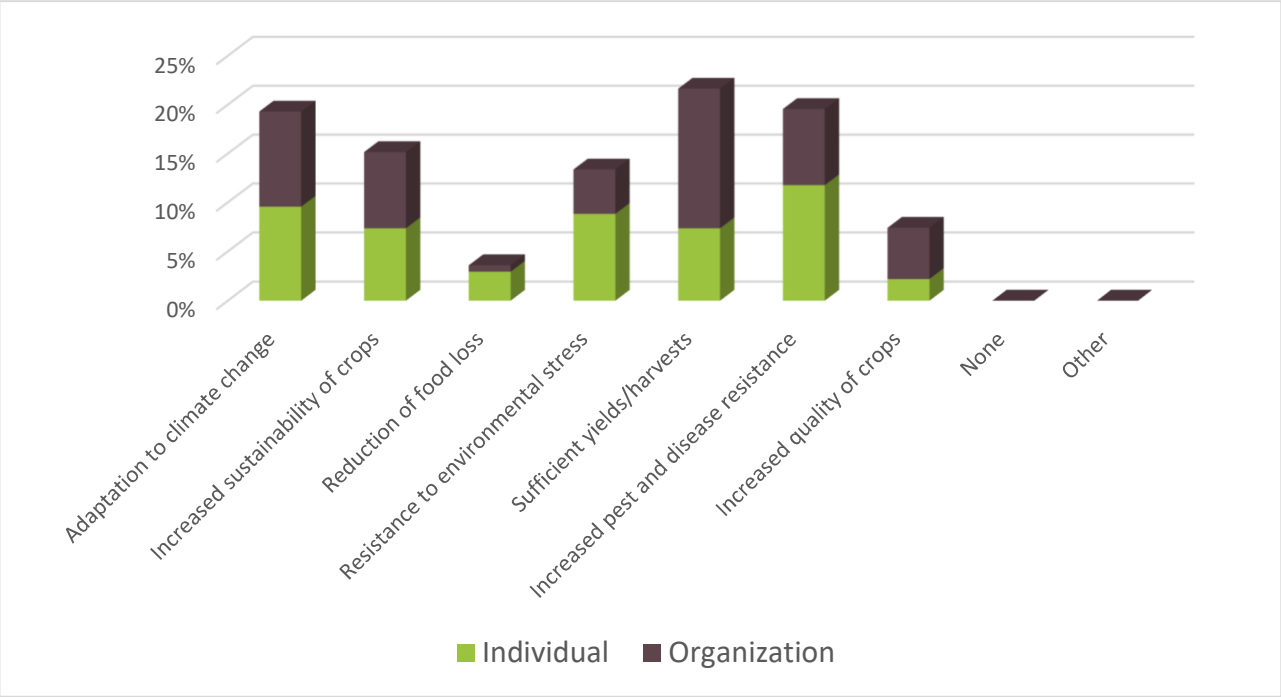
Q3.3 About which of the following techniques of plant breeding do you communicate? N=51



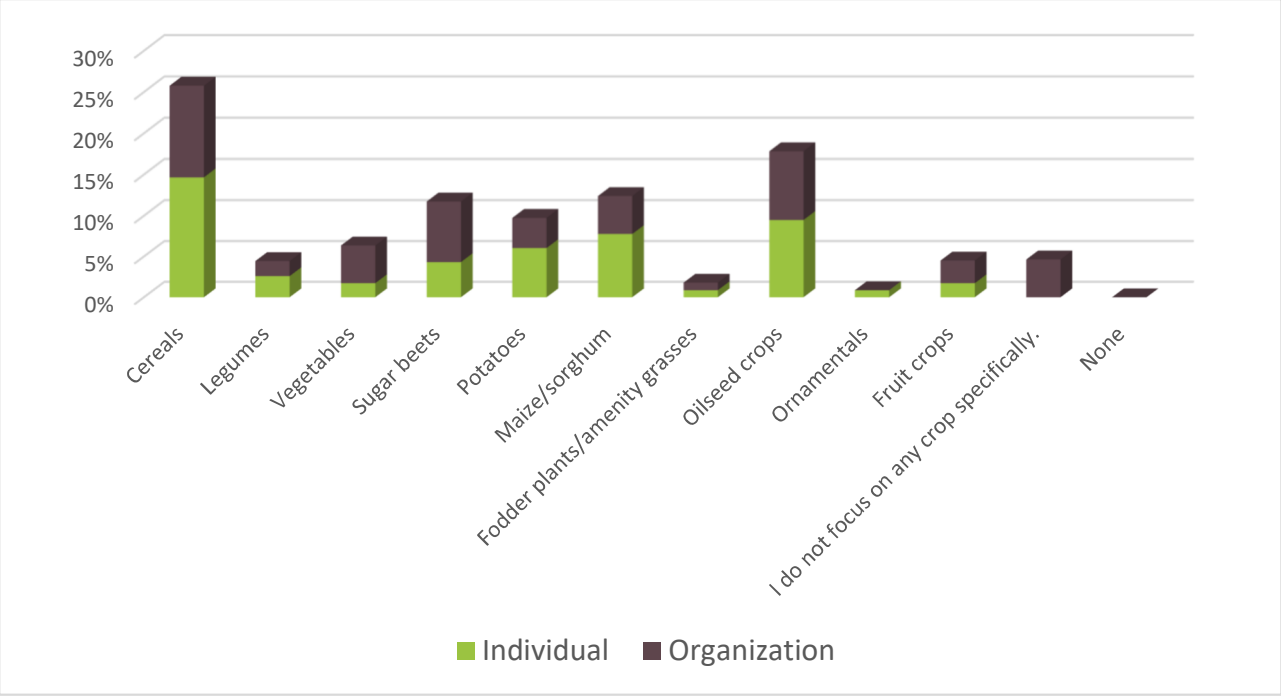
Farmers communicate mainly about methods in plant research, and to a lesser extent about plant breeding in general, and precision breeding, while farmer organizations communicate mainly about all the enlisted plant breeding techiques. Farmers did not choose the option mutagenesis breeding.

Q3.4 About what crop characteristics do you mainly communicate? N=51



Farmers communicate mainly about the crop characteristic "increased pest and disease resistance", and to a lesser extent about "adaptation to climate change", "resistance to environmental stress", "sufficient yields/harvests", and "increased sustainability of crops", while farmer organizations communicate mainly about "sufficient yields/harvests" and to a lesser extent about "adaptation to climate change", "increased sustainability of crops", and "increased pest and disease resistance".

Q3.5 About which crops do you mainly communicate? N=51



Farmers communicate mainly about cereals and to a lesser extent about oilseed crops,

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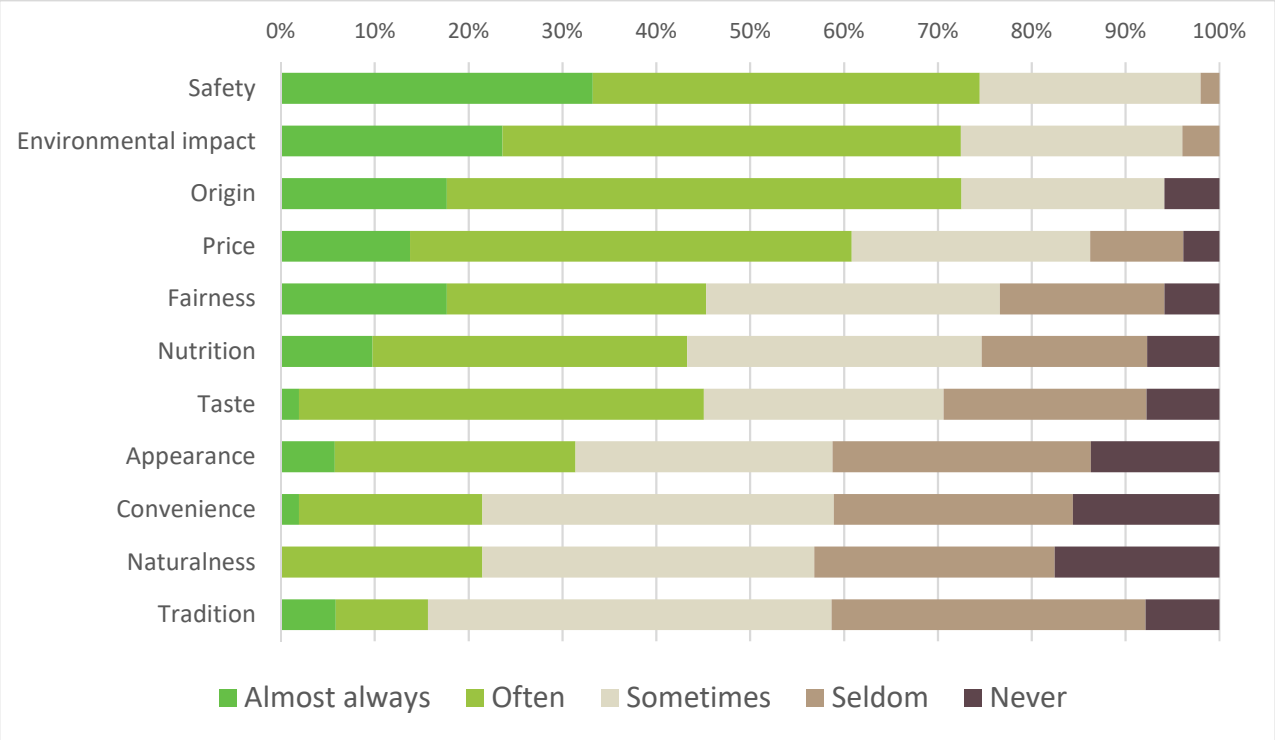
maize/sorghum, and potatoes. Farmer organizations communicate mainly about cereals, and to a lesser extent about oilseed crops, and sugar beets.

Q3.6 How frequently do you use the following food values in your communication about plant research, crop improvement and breeding or crop production? N=51



When farmers and farmer organizations were asked how frequently they use food values in their communication about plant research, crop improvement and breeding or crop production, the values: safety, environmental impact, origin, and price have a median response of "often", while the values: fairness, nutrition, taste, appearance, convenience, naturalness, and tradition have a median response of "sometimes". In addition, safety has a response of "extremely important" in the first Quartile.

Q3.7 Can you provide an example of a communication relating to plant research, crop improvement and breeding or crop production which, in your experience was effective? N=51

Wordcloud based on frequency of key words describing the respondent's answers:

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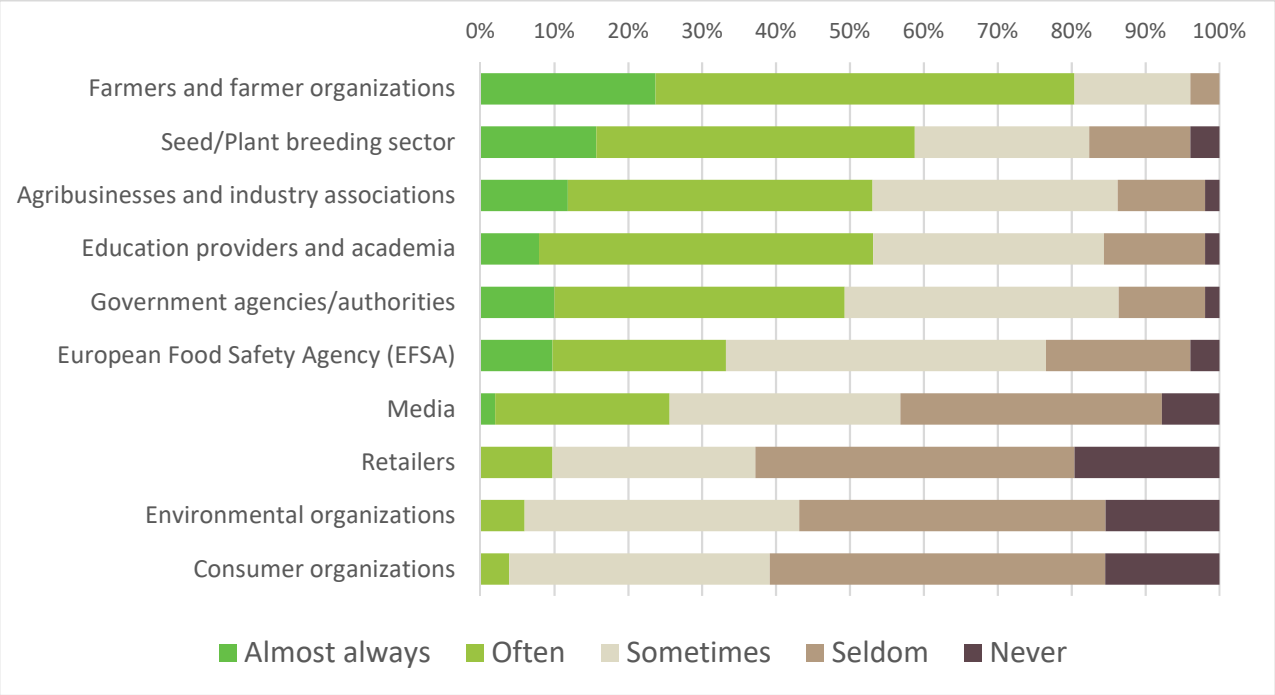
1.3.2 OPINION OF THE SHG ON ONGOING COMMUNICATION ACTIVITIES

Q4.1 How frequently do you use information from these stakeholders in your communication about plant research, crop improvement and breeding or crop production? N=51



When farmers and farmer organizations were asked how frequently they use information from various stakeholders in their communication about plant research, crop improvement and breeding or crop production, the stakeholders: farmers and farmer organizations, seed/plant breeding sector, agribusinesses and industry associations, education providers and academia have a median response of "often", while the stakeholders: government agencies/authorities, EFSA and, media have a median response of "sometimes", and the stakeholders: consumer organizations, environmental organizations, and retailers have a median response of "seldom".

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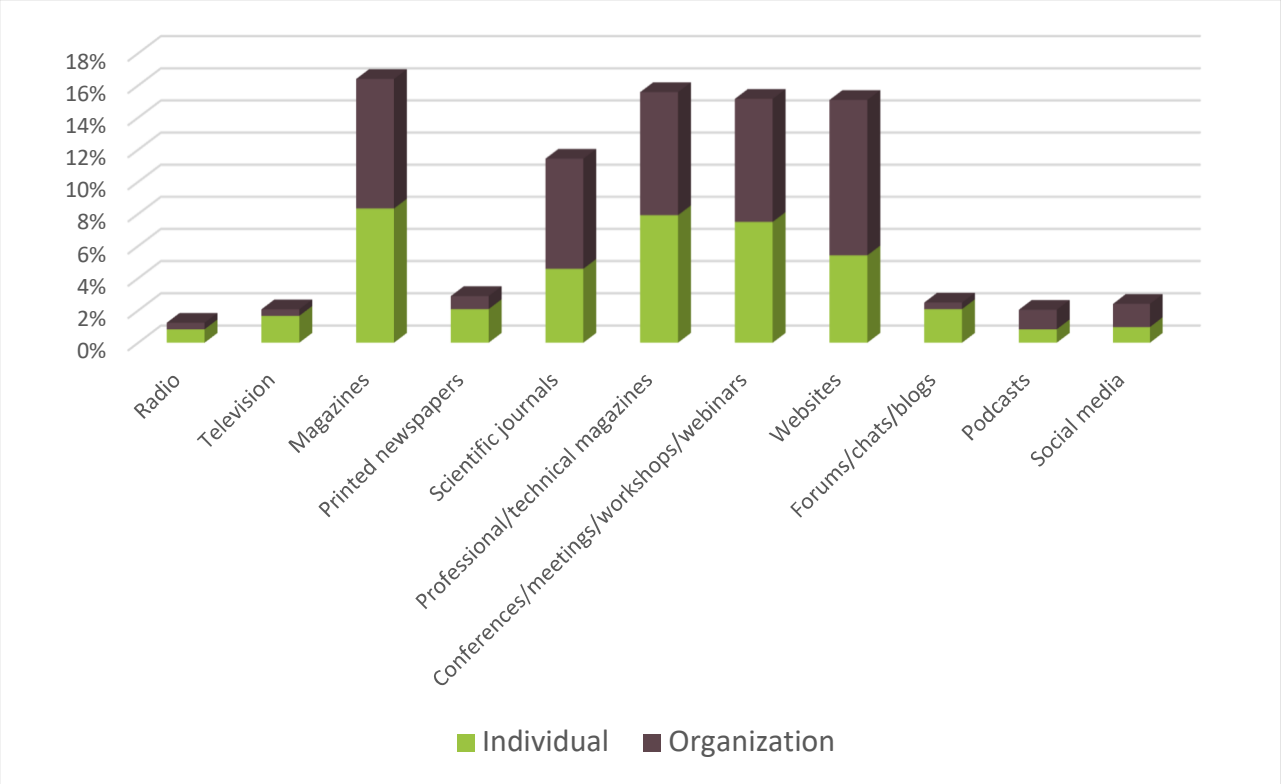
Q4.2 Which of the following channels do you use to learn about plant research, crop improvement and breeding or crop production? N=51



Farmers and farmer organizations use primarily the channels: (professional/technical) magazines, conferences/meetings/workshops/webinars, websites, and scientific journals to learn more about plant research, crop improvement and breeding or crop production.

	Radio	Television	Magazines	Printed newspapers	Scientific journals	Professional/technical magazines	Conferences/meetings/workshops/webinars	Websites	Forums/chats/blogs	Podcasts
≤44 years N=10	13%	**25%**	13%	**13%**	38%	**63%**	**63%**	50%	**13%**	13%
>45 years N=19	6%	**11%**	17%	**22%**	44%	**78%**	**72%**	50%	**22%**	6%

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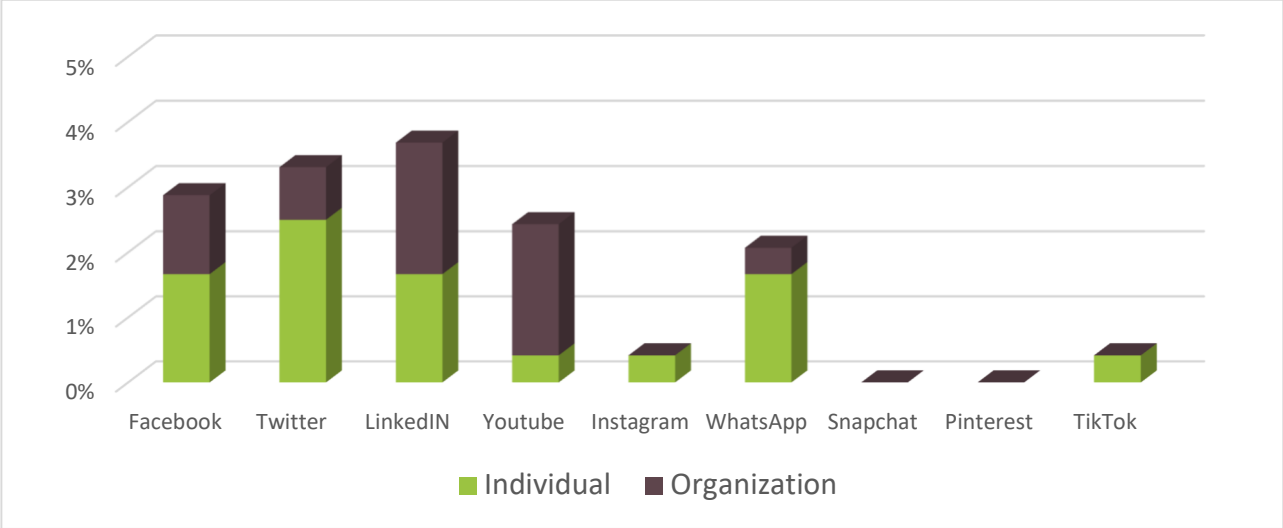
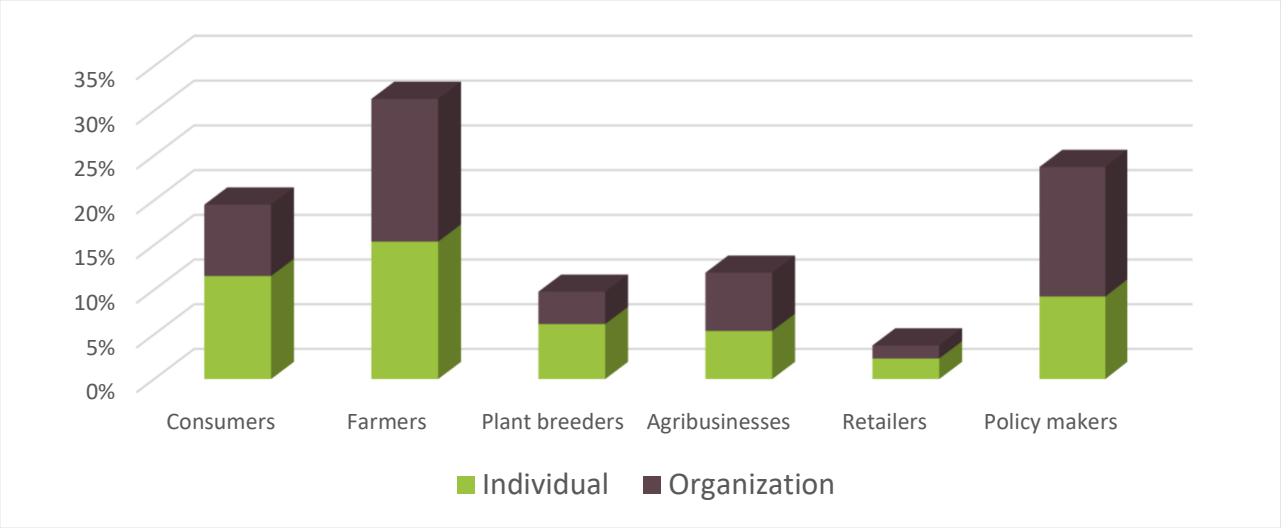


No significant results. Threshold is 5,26%.

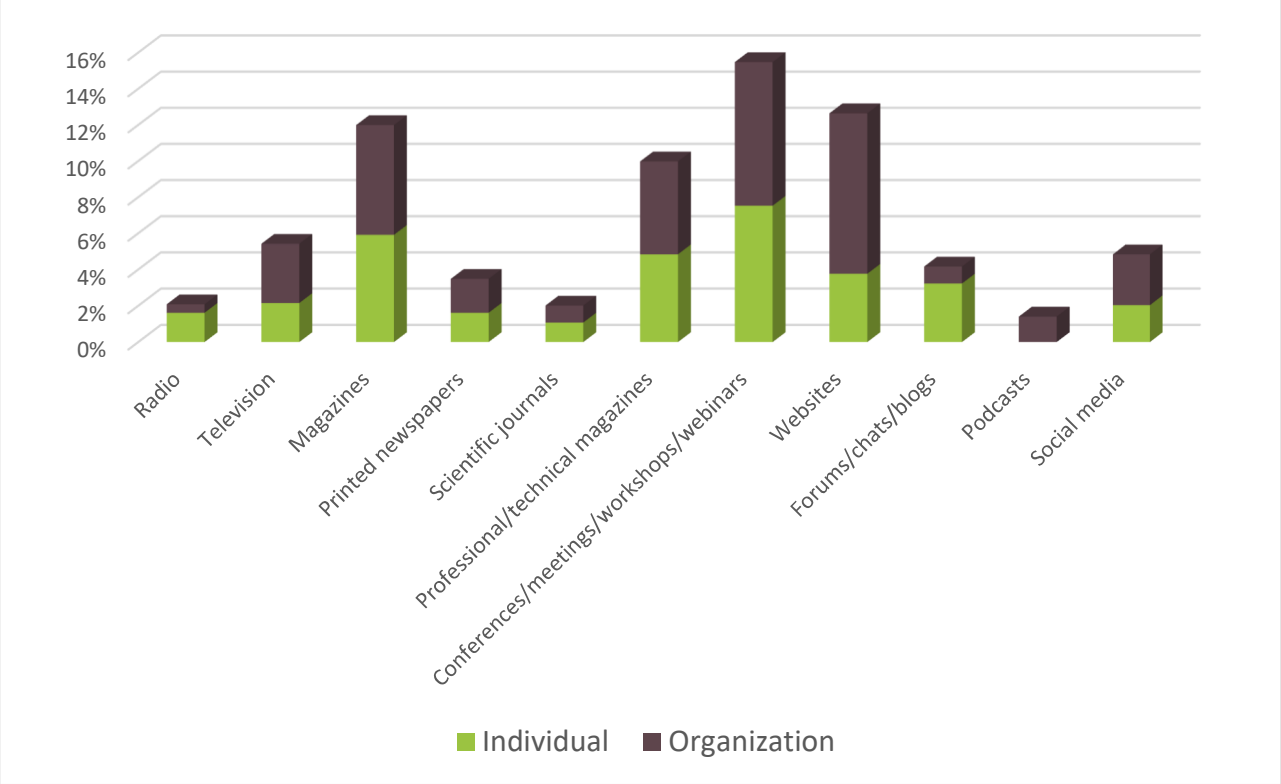
	Facebook	Twitter	LinkedIN	Youtube	Instagram	WhatsApp	Snapchat	Pinterest	TikTok	
≤44 years N=10	**25%**	25%	13%	0%	**13%**	13%	0%	0%	**13%**	
>45 years N=19	**11%**	22%	17%	6%	**0%**	17%	0%	0%	**0%**	

Q4.3 Which are your main target groups to communicate with about plant research, crop improvement and breeding or crop production? N=51



The main target groups of farmers and farmer organizations to communicate with about plant research, crop improvement and breeding or crop production are farmers, policy makers, and consumers.

Q4.4 Which of the following channels do you use to communicate with your main target groups about plant research, crop improvement and breeding or crop production? N=51



Farmers and farmer organizations use primarily the channels: conferences/meetings/ workshops/webinars, websites and (professional/technical) magazines to communicate with their target groups about plant research, crop improvement and breeding or crop production.

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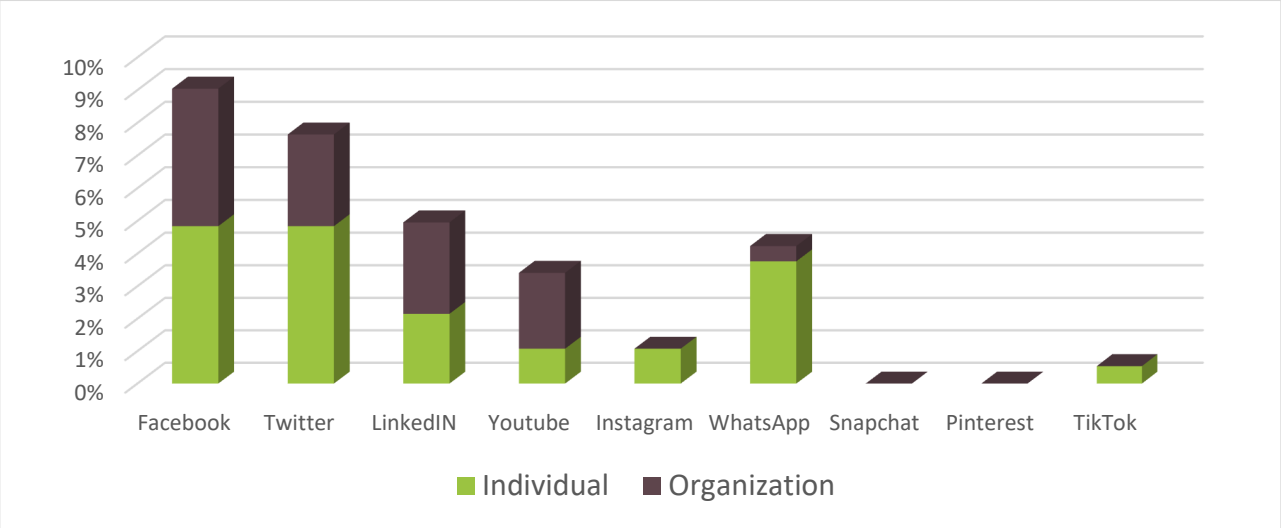
	Radio	Television	Magazines	Printed newspapers	Scientific journals	Professional/technical magazines	Conferences/meetings/ workshops/webinars	Websites	Forums/chats/blogs	Podcasts
≤44 years N=10	**0%**	13%	0%	**25%**	0%	**13%**	50%	25%	**13%**	0%
>45 years N=19	**17%**	17%	6%	**6%**	11%	**44%**	56%	28%	**28%**	0%



Farmers and farmer organizations use primarily the social media platforms: Facebook and Twitter to communicate with their target groups about plant research, crop improvement and breeding or crop production.

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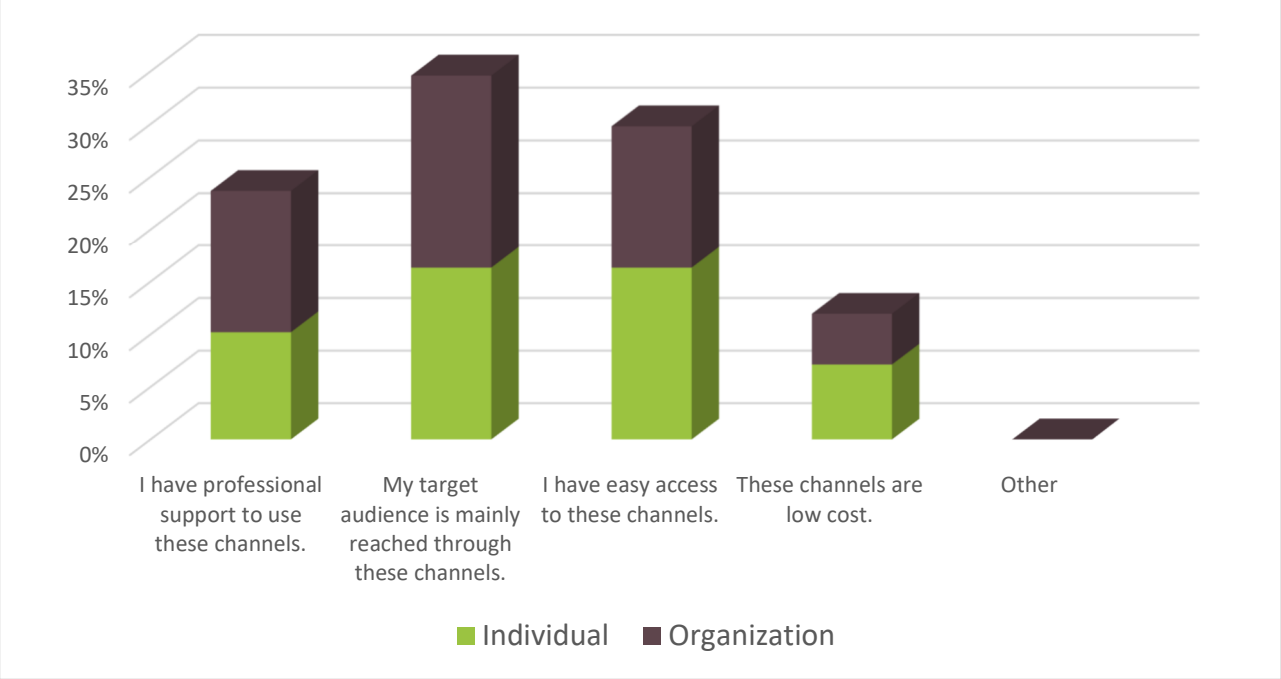
	Facebook	Twitter	LinkedIN	Youtube	Instagram	WhatsApp	Snapchat	Pinterest	TikTok	
≤44 years N=10	38%	**25%**	**0%**	**13%**	**13%**	**38%**	0%	0%	**13%**	
>45 years N=19	33%	**39%**	**22%**	**6%**	**6%**	**22%**	0%	0%	**0%**	

Q4.5 Why do you specifically use these channels to communicate about plant research, crop improvement and breeding or crop production? N=51



Farmers and farmer organizations specifically use certain channels to communicate about plant research, crop improvement and breeding or crop production because "their target audience is mainly reached through these channels", and "they have easy access to these channels".

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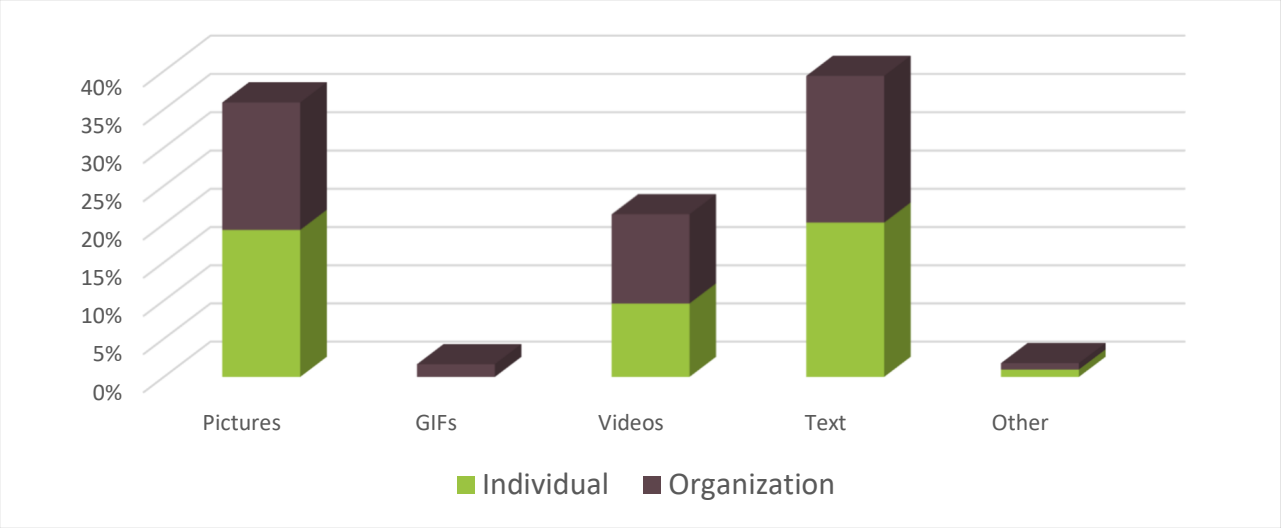
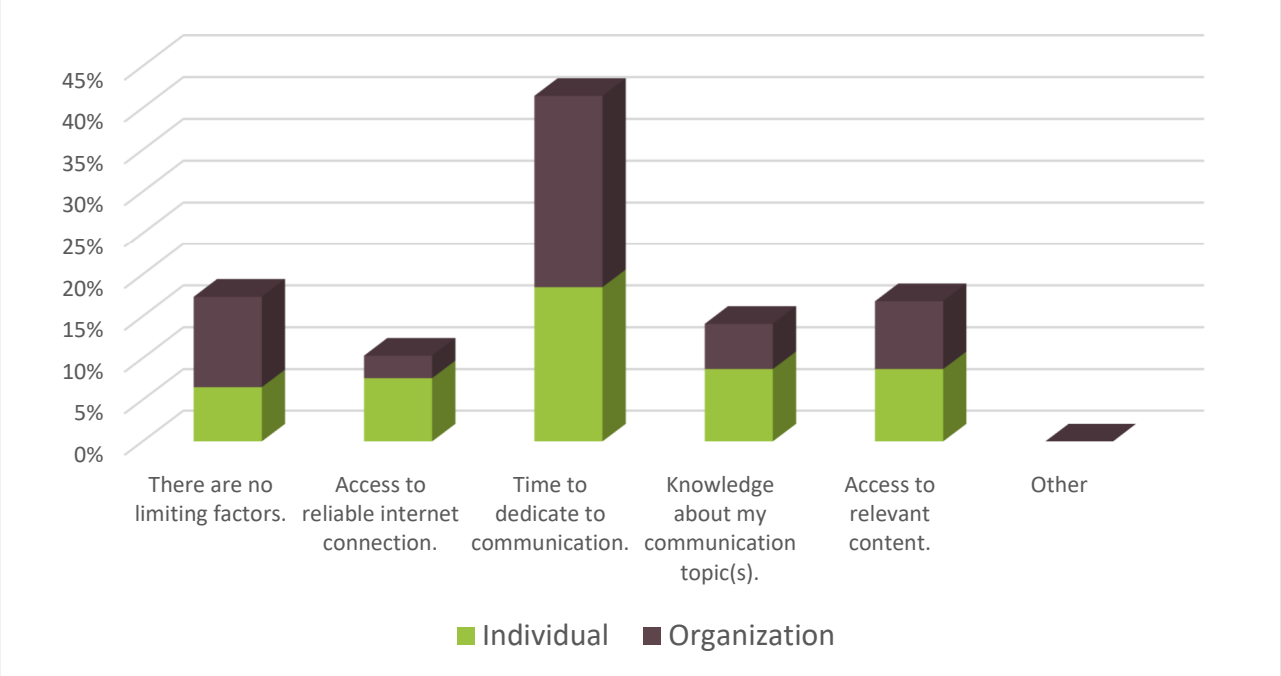
Q4.6 Which of the following tools do you use to communicate about plant research, crop improvement and breeding or crop production? N=51



Farmers and farmer organizations most frequently use text and pictures to communicate about plant research, crop improvement and breeding or crop production.

1.3.3 NEEDS OF THE SHG RELATED TO ONGOING COMMUNICATION ACTIVITIES

Q5.1 What are limiting factors for you to communicate to others? N=51



Farmers and farmer organizations their main limiting factor to communicate to others is time to dedicate to communication.

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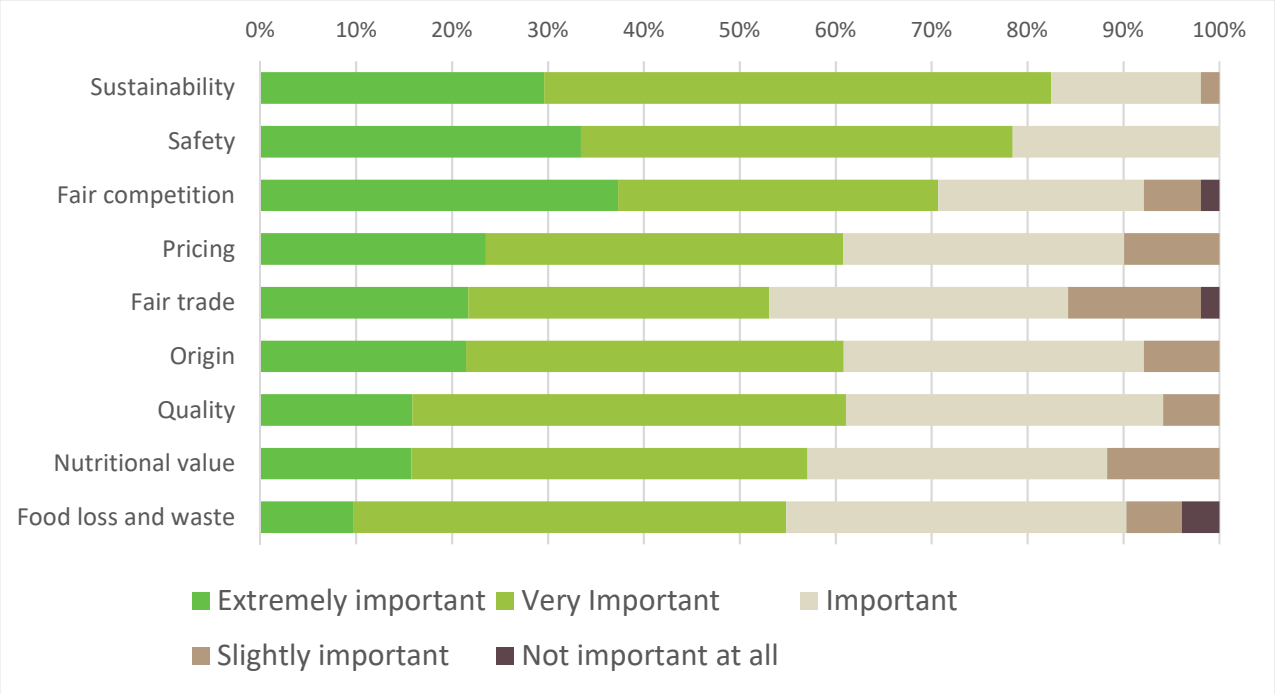
Q5.2 How do you rate the importance of addressing the following aspects through communication efforts? N=51



All options have a median response of "very important" regarding their importance in communication efforts by farmers and farmer organizations. In addition, the options: sustainability, safety and fair competition have a response of "extremely important" in the first Quartile.

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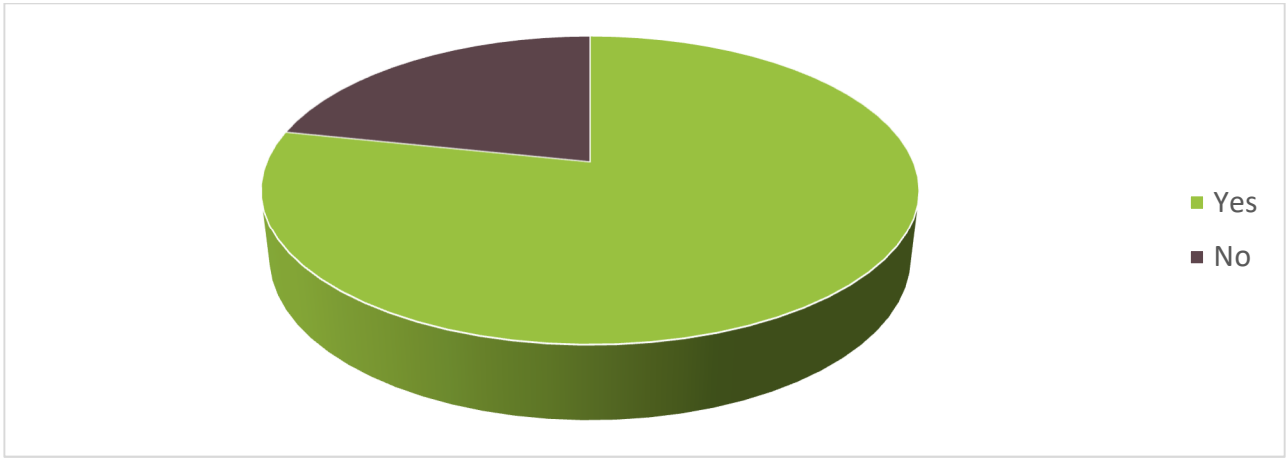
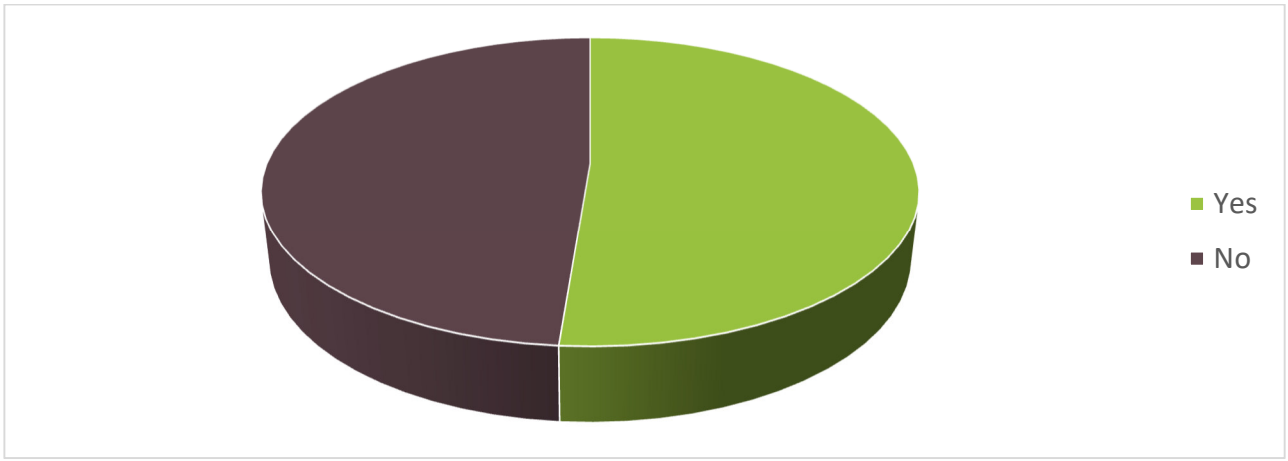
1.4 *Experience and needs of the SHG related to communication about gene editing in plants*

Q6.1 Are you familiar with gene editing in plants? N=55



A total of 78% of the farmers and farmer organizations indicated that they are familiar with gene editing in plants.

Q6.2 Do you communicate about gene editing in plants? N=55



Nearly half of the farmers and farmer organizations indicated that they communicate about gene editing in plants.

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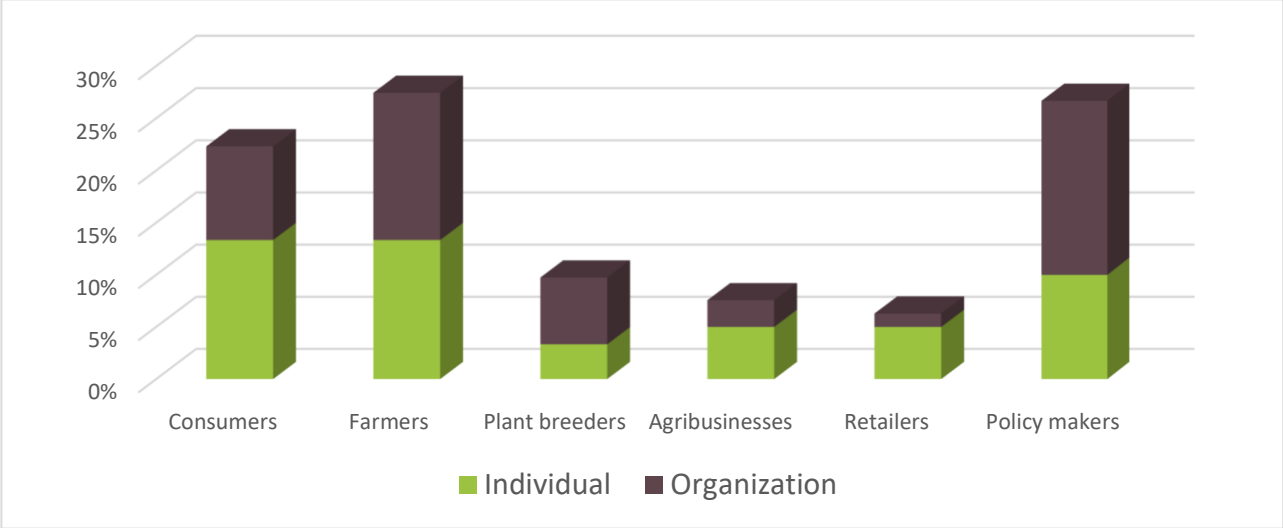
Q6.3 Which are your main target groups to communicate with about gene editing in plants? N=28



The main target groups of farmers and farmer organizations to communicate with about gene editing in plants are farmers, policy makers, and consumers.

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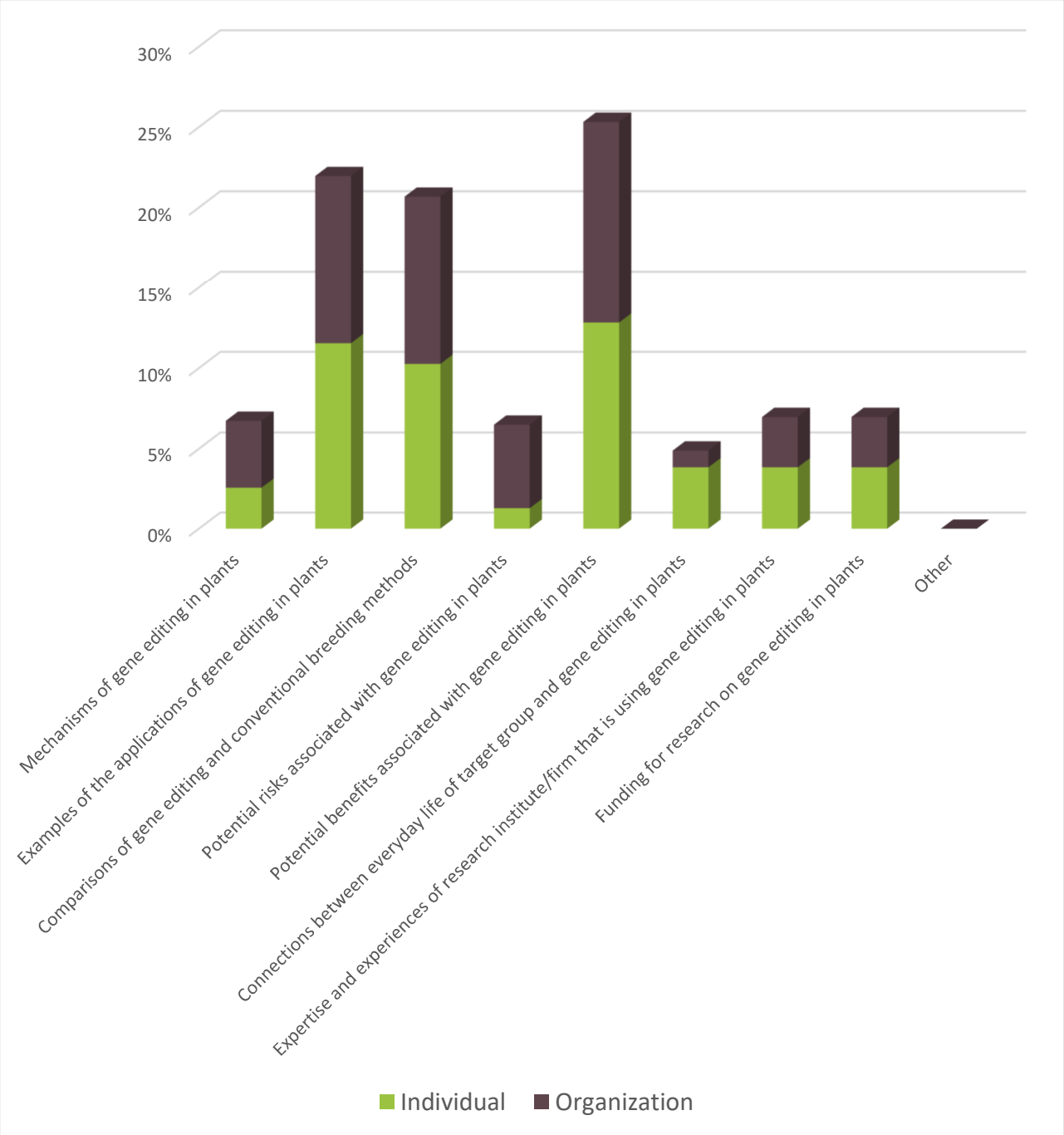
Q6.4 What specific topics are most important to you when communicating about gene editing in plants? N=28



Farmers and farmer organizations indicated that "potential benefits associated with gene editing in plants", "examples of the applications of gene editing in plants" and "comparisons of gene editing and conventional breeding methods" are the most important topics when communicating about gene editing in plants.

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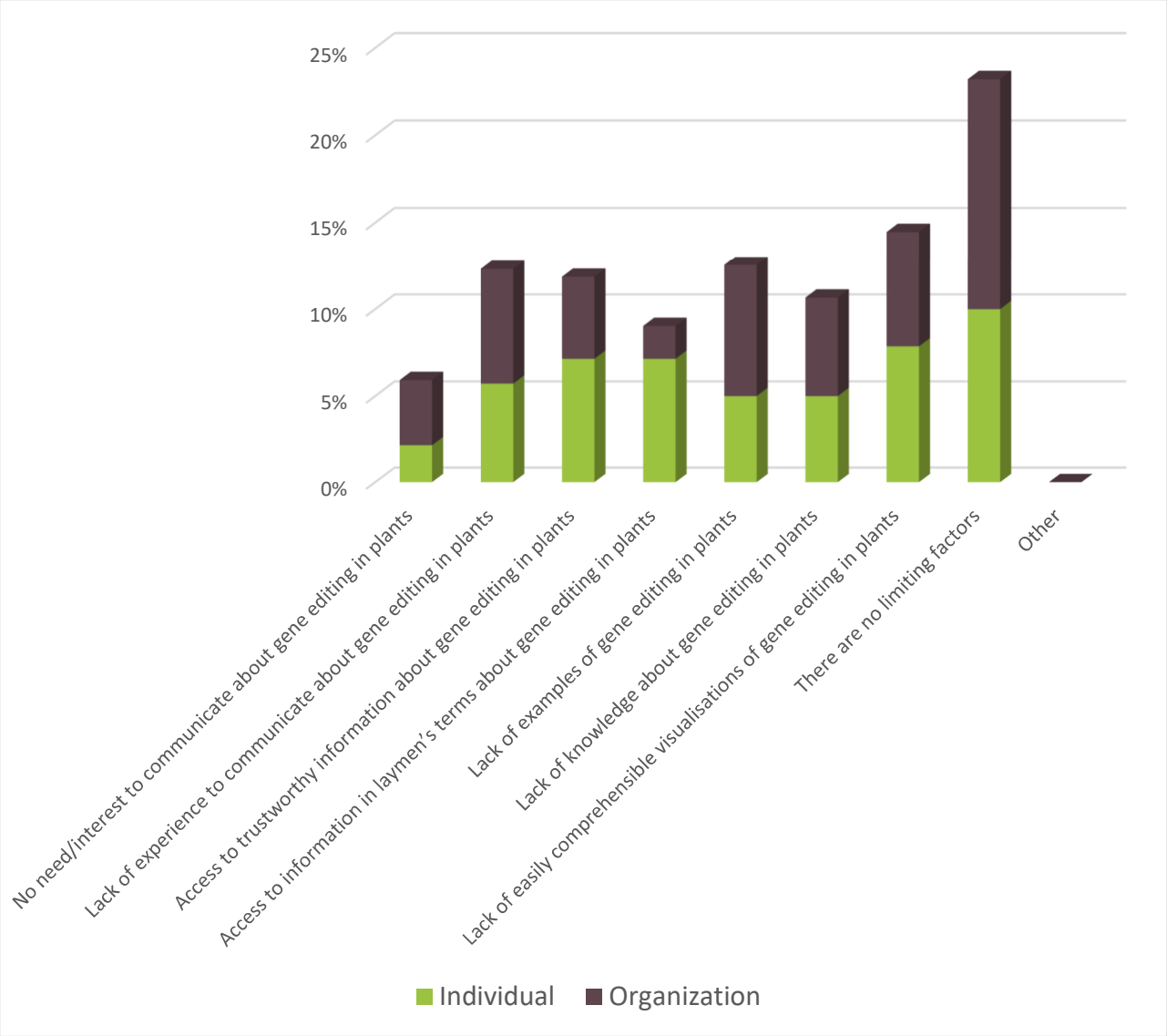
Q6.5 What are the main limiting factors for you to communicate about gene editing in plants? N=55



There are no main limiting factors for farmers and farmer organizations to communicate about gene editing in plants. To a lesser extent "Lack of easily comprehensible visualisations of gene editing in plants", and "Lack of examples of gene editing in plants" were indicated as limiting factors.

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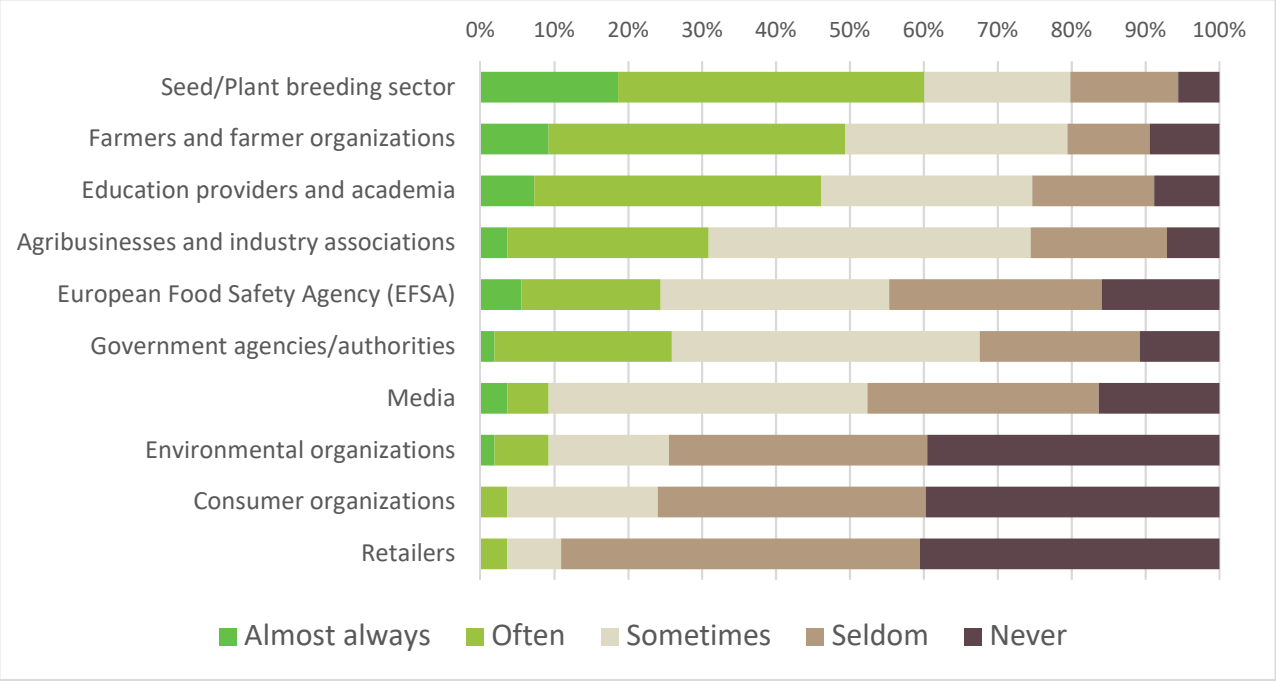
Q6.6 How frequently do you inform yourself by engaging with the following stakeholders on gene editing in plants? N=55



Seed/plant breeding sector has a median response of "often" regarding how frequently farmers and farmer organizations engage with various stakeholders to inform themselves on gene editing in plants. Farmer and farmer organizations, education providers and academia, agribusinesses and industry associations, EFSA, government agencies and authorities, and media have a median response of "sometimes" and retailers, consumer organizations, and environmental organizations have a median response of "seldom".

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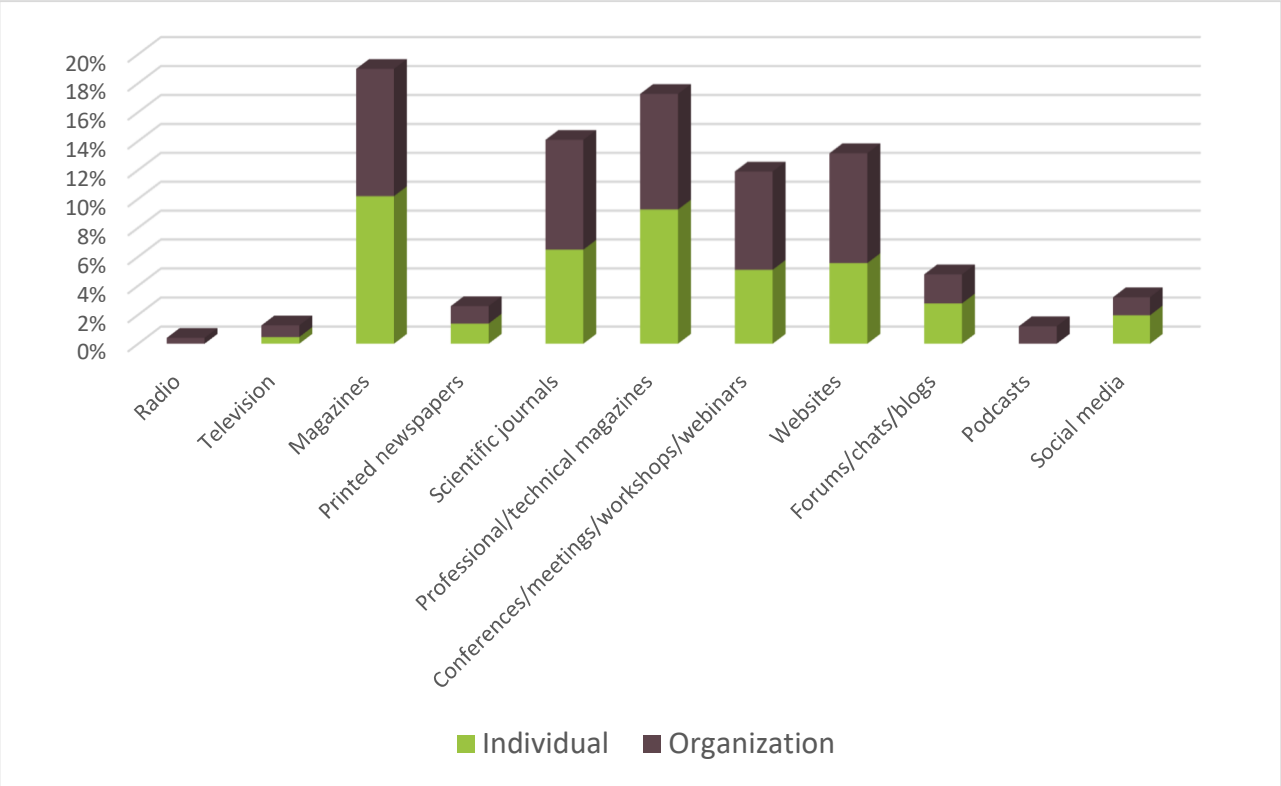
Q6.7 Which of the following channels do you use to learn about gene editing in plants? N=55



Farmers and farmer organizations use primarily the channels: (professional/technical) magazines, scientific journals, websites and conferences/meetings/workshops/webinars to learn more about gene editing in plants.

	Radio	Television	Magazines	Printed newspapers	Scientific journals	Professional/technical magazines	Conferences/meetings/workshops/webinars	Websites	Forums/chats/blogs	Podcasts
≤44 years N=10	0%	**10%**	**0%**	10%	**20%**	**60%**	**30%**	**30%**	20%	0%
>45 years N=19	0%	**0%**	**16%**	11%	**63%**	**74%**	**42%**	**47%**	21%	0%

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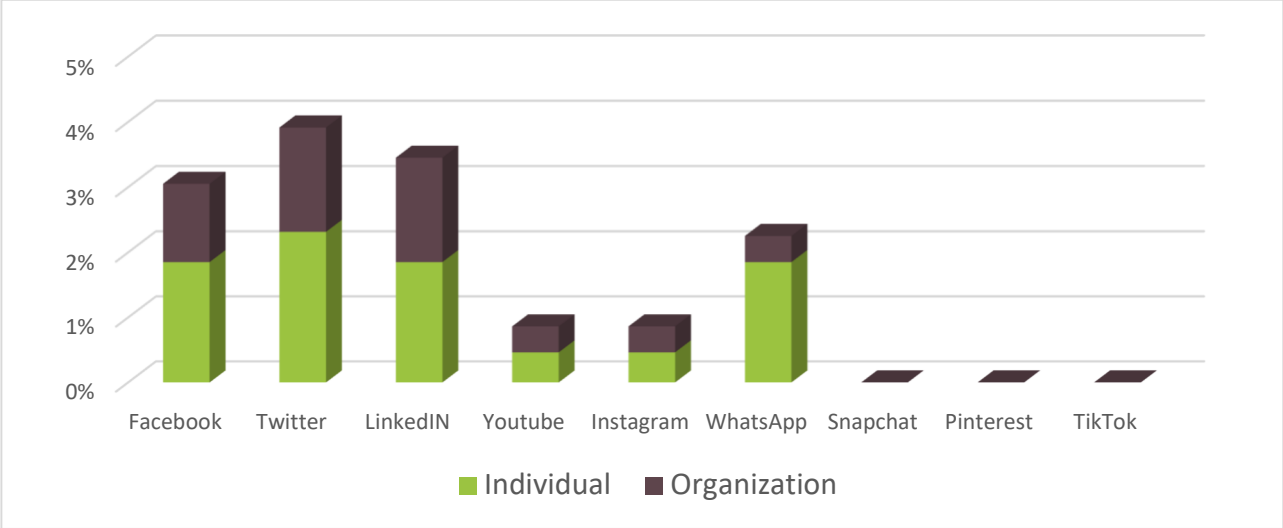

No significant results. Threshold is 5,26%.

	Facebook	Twitter	LinkedIN	Youtube	Instagram	WhatsApp	Snapchat	Pinterest	TikTok	
≤44 years N=10	**30%**	20%	0%	10%	10%	**20%**	0%	0%	0%	
>45 years N=19	**5%**	16%	21%	0%	0%	**11%**	0%	0%	0%	

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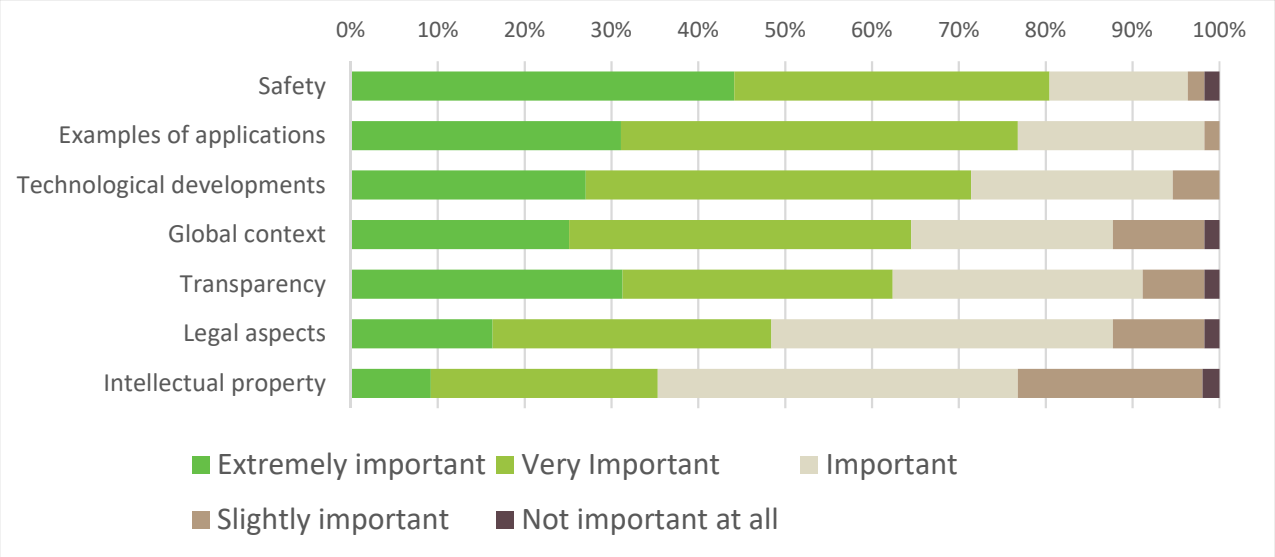
Q6.8 Which of the following aspects do you regard as important for communicating about gene editing in plants in the future? N=55



The majority of options have a median response of "very important" (and "extremely important in the first Quartile) regarding their importance in future communication about gene editing in plants by farmers and farmer organizations. Legal aspects and intellectual property have a median response of "important".

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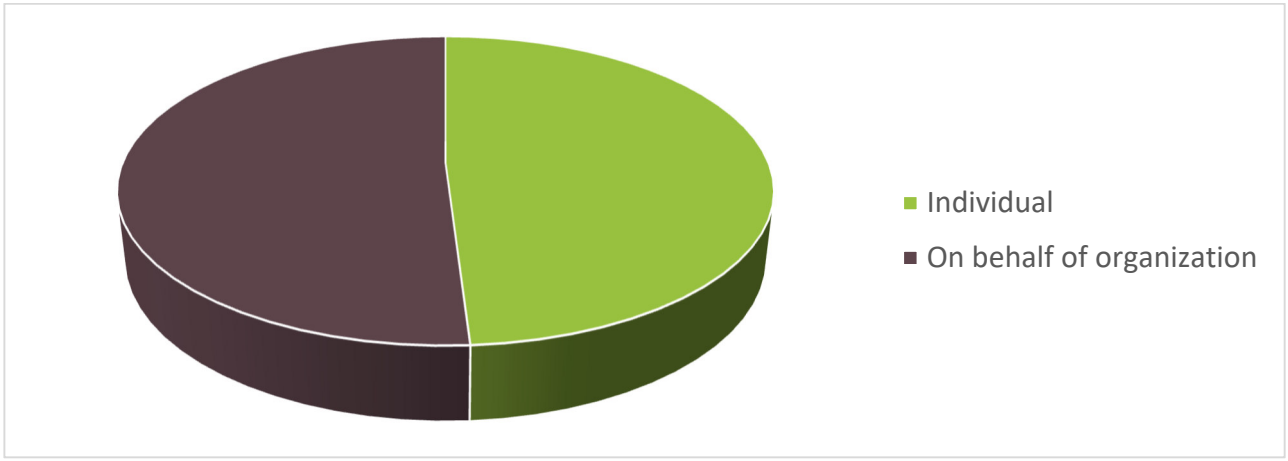
2 BREEDERS AND SEED & PLANT BREEDING ORGANISATION SURVEY RESULTS

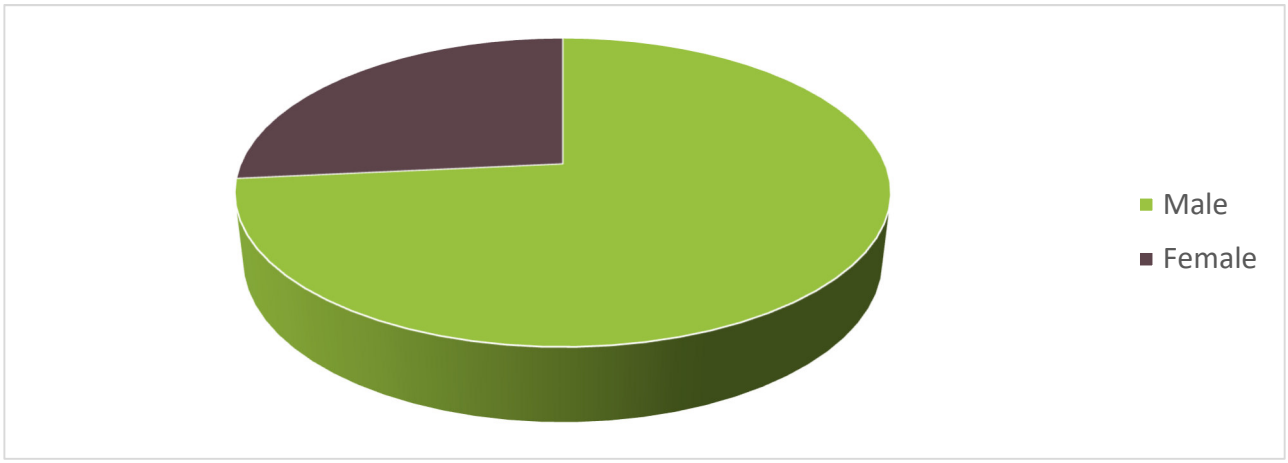
2.1 *Description of the survey sample*

Q1.1 Are you filling in this form on behalf of yourself or the organization your work for? N=100



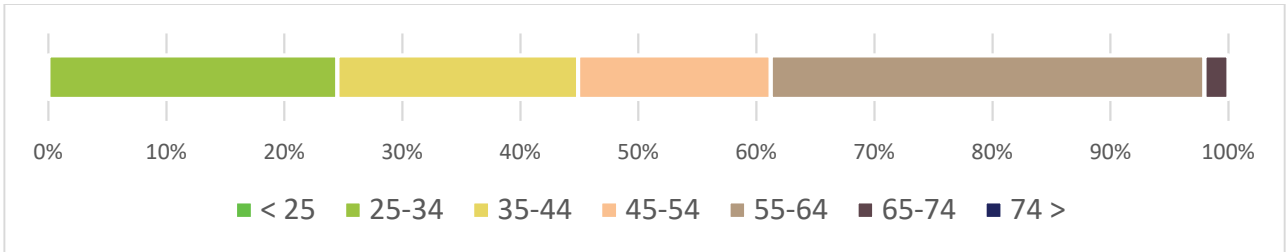
The number of responses is nearly equally divided between participants that answered on behalf of themselves and on behalf of the organization in the seed & breeding sector they work for.

Q1.2 Please specify your gender. N=49



Approximately 73% of the participants are male.

Q1.3 What is your age range? N=49



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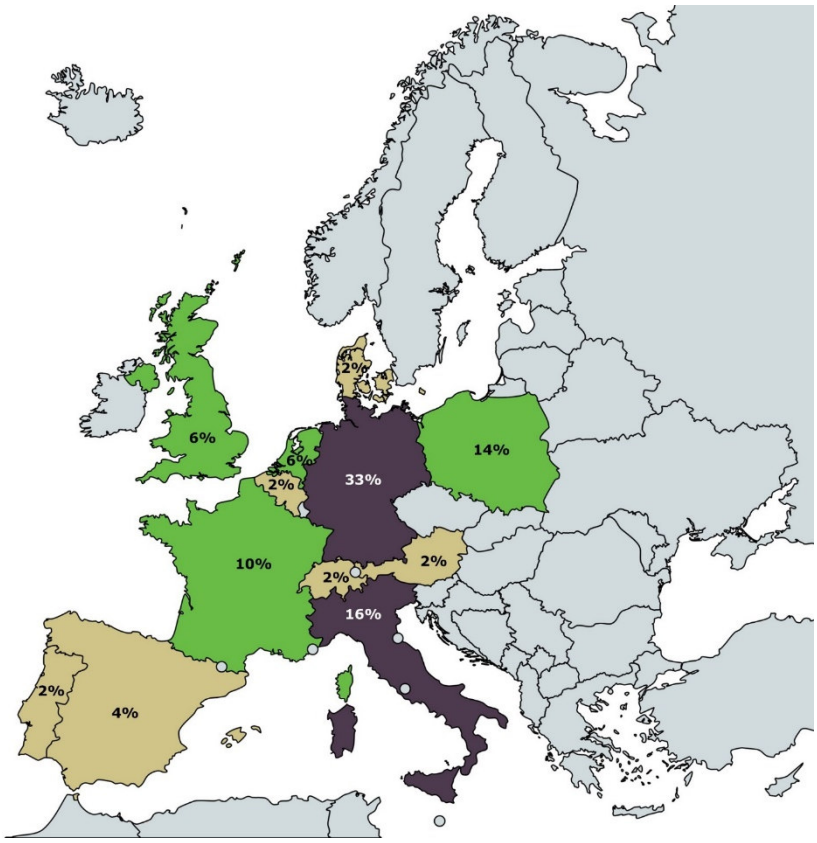
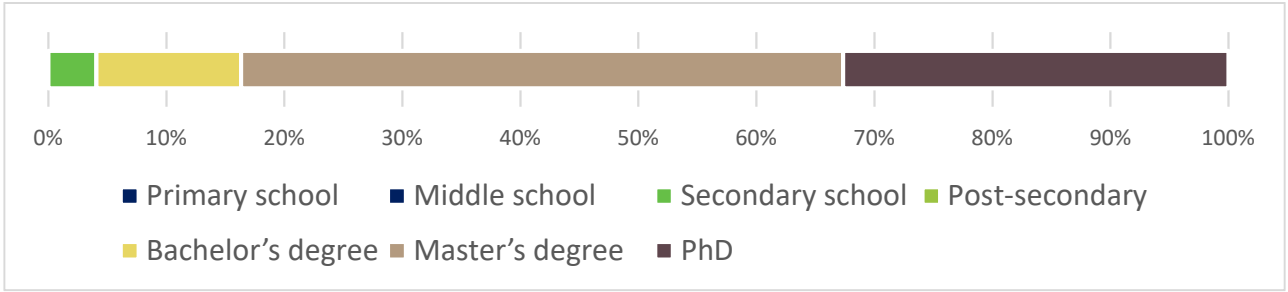
The age range of the participants is predominantly between 25-44 and 55-64 years old.

Q1.4 In which country do you work? (Individual responses) N=49



Individual responses are primarily from Germany, Italy, Poland, France, The Netherlands and UK. Country distribution of the survey responses is color-coded: above 15% is indicated in brown, between 5% and 15% is indicated in green and below 5% is indicated in light brown.

Q1.5 What is your highest formal completed education level? N=49



Approximately 95% of the participants have at least a Bachelor's degree.

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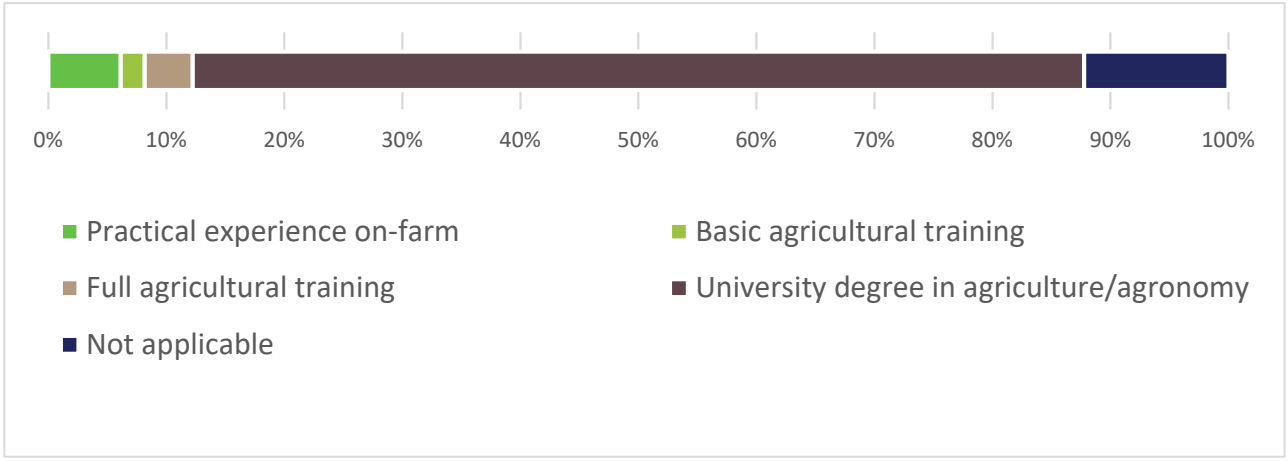
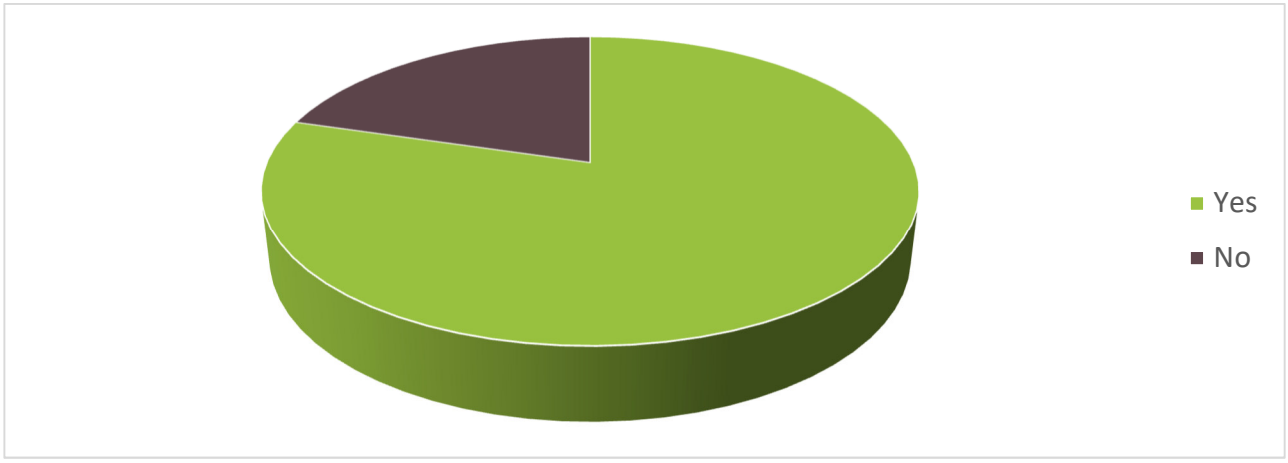
Q1.6 What is your highest completed level of agricultural education? N=49



Nearly three-quarters of the participants have a university degree in agriculture/agronomy.

Q1.7 Is communication part of your professional tasks? N=49



A total of 80% of the participants indicated that communication is part of their professional tasks.

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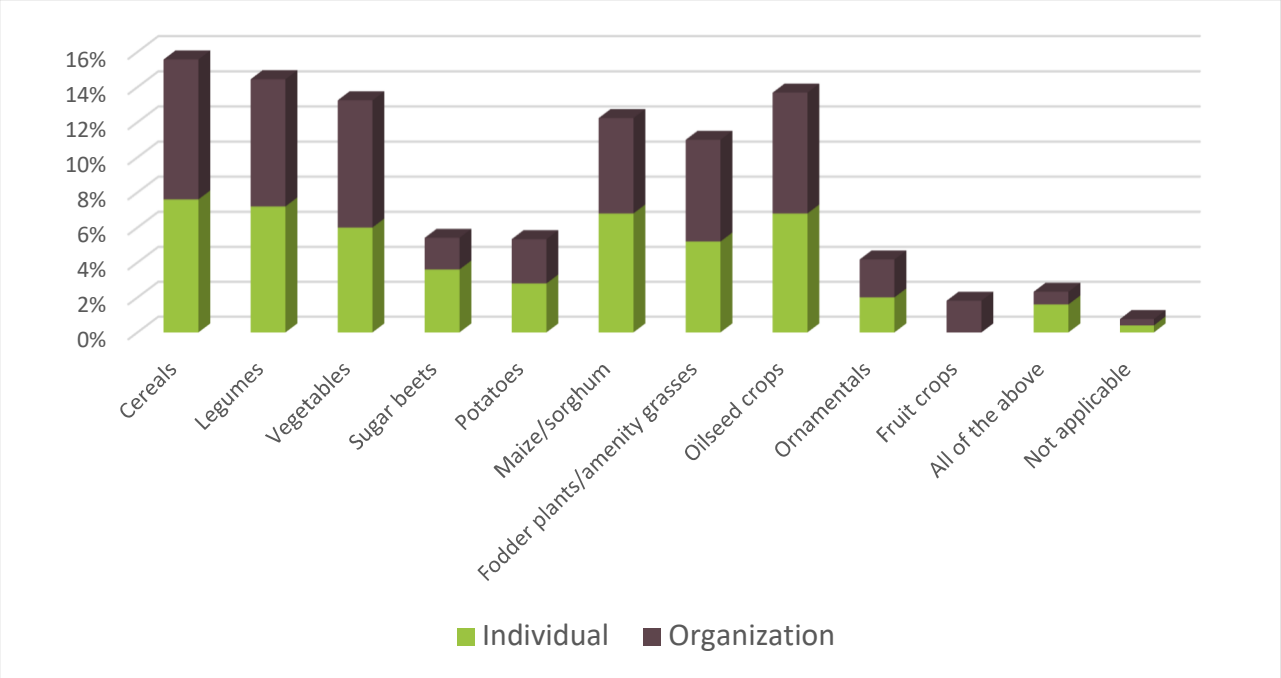
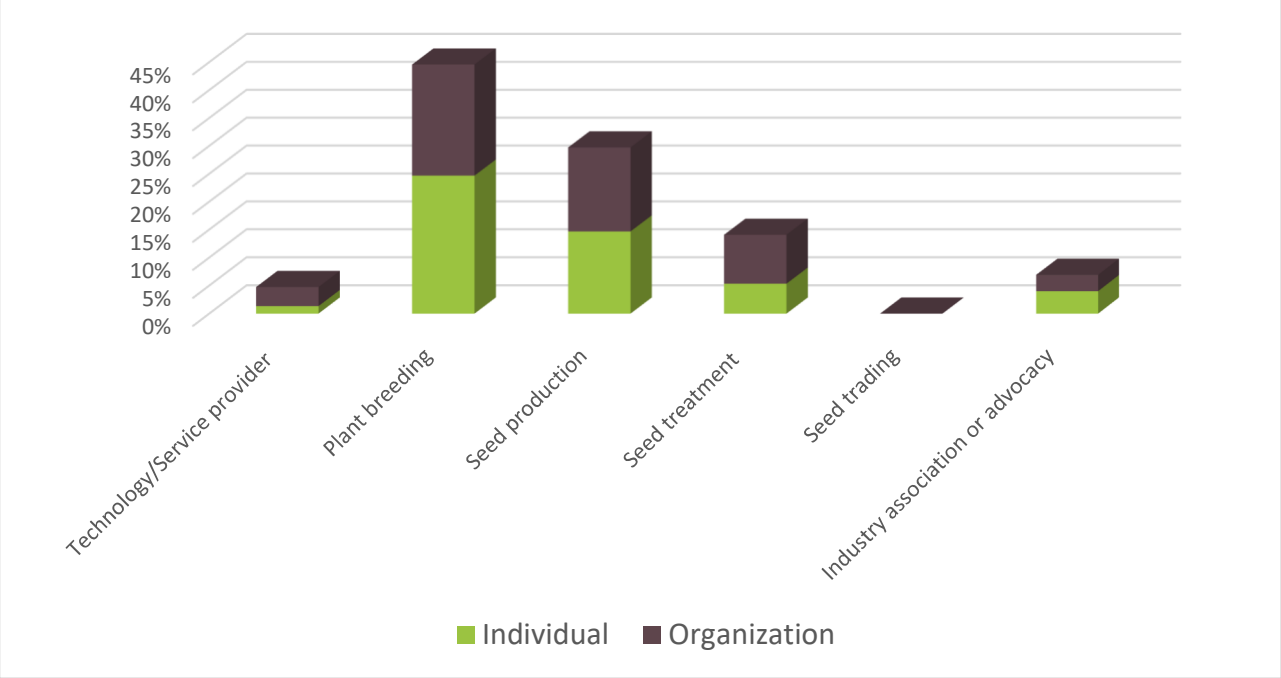
Q1.8 Which crops do you deal with? Or which crops does the company or organization you work for deal with? N=100



Participants are mainly dealing with cereals, legumes, oilseed crops, vegetables, maize/sorghum and fodder plants/amenity grasses.

Q1.9 Which of the following best describes the company or organization you work for? N=100



Participants are primarily active in plant breeding and seed production.

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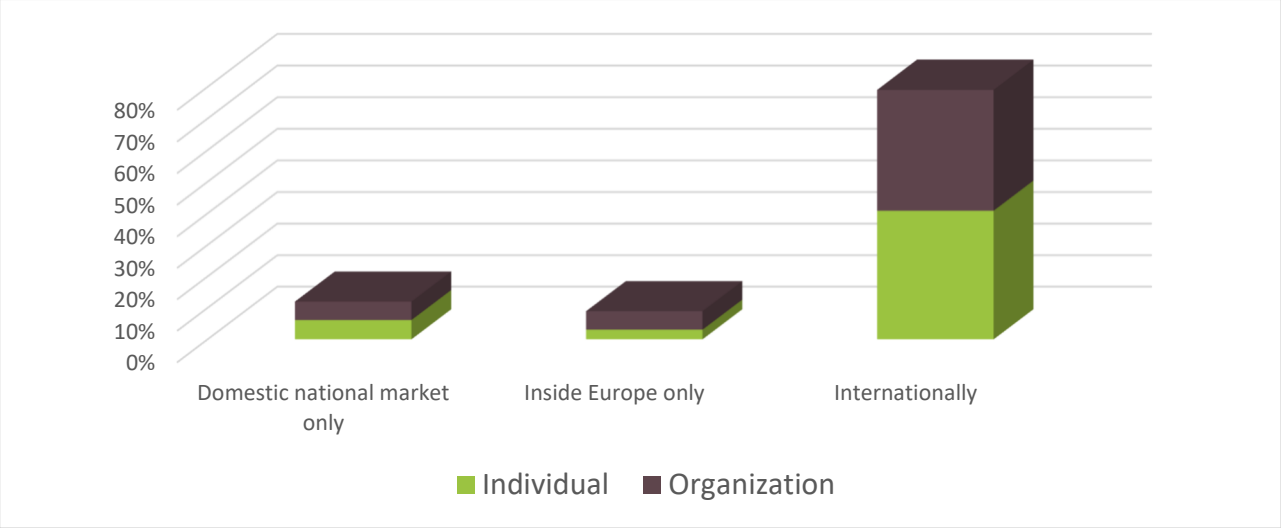
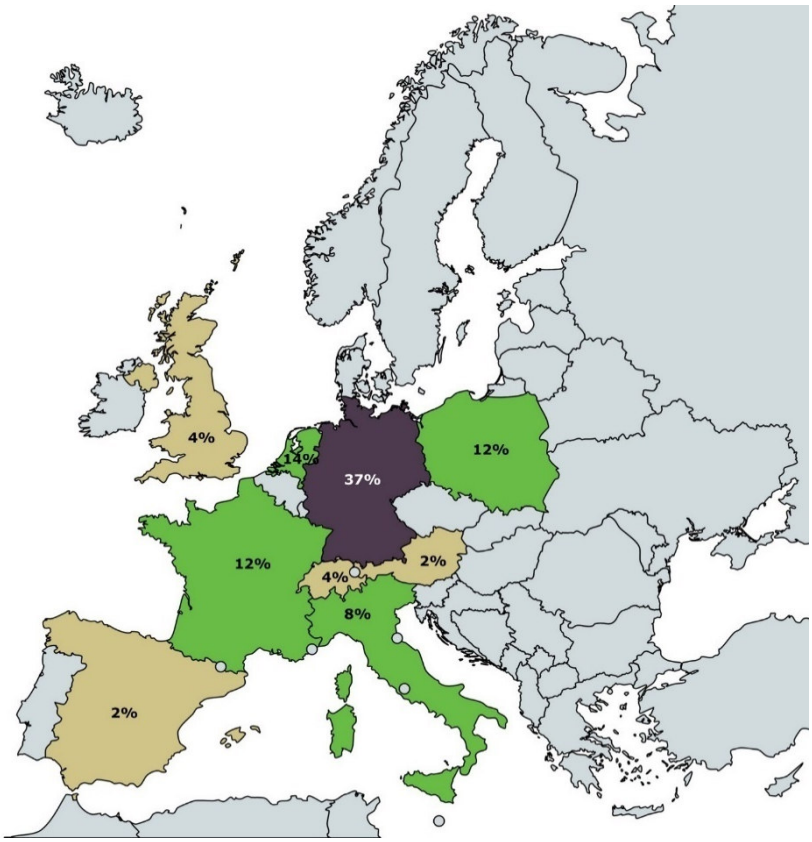
Q1.10 Where is the company or organization you work for in general active? N=100



Nearly three-quarters of the participants work in a company or organization that is internationally active.

Q1.11a What is the location of the headquarter of the company or organization you work for? (Individual responses) N=49



Individual responses are primarily from participants in a company or organization where the location of the headquarter is in Germany, The Netherlands, France, Poland and Italy. Country distribution of the survey responses is color-coded: above 15% is indicated in brown, between 5% and 15% is indicated in green and below 5% is indicated in light brown.

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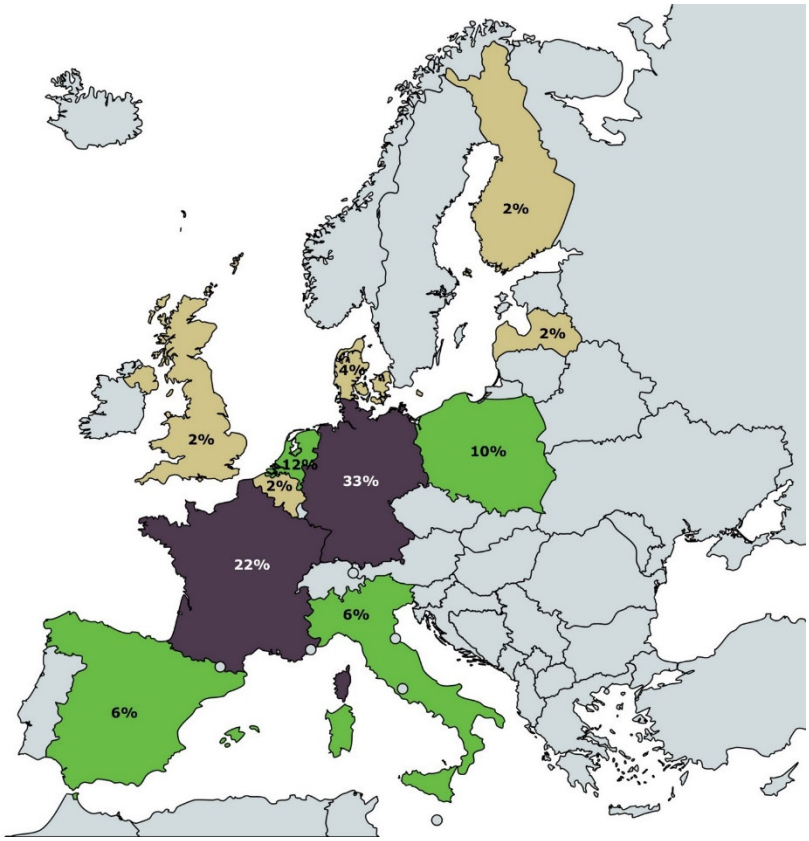
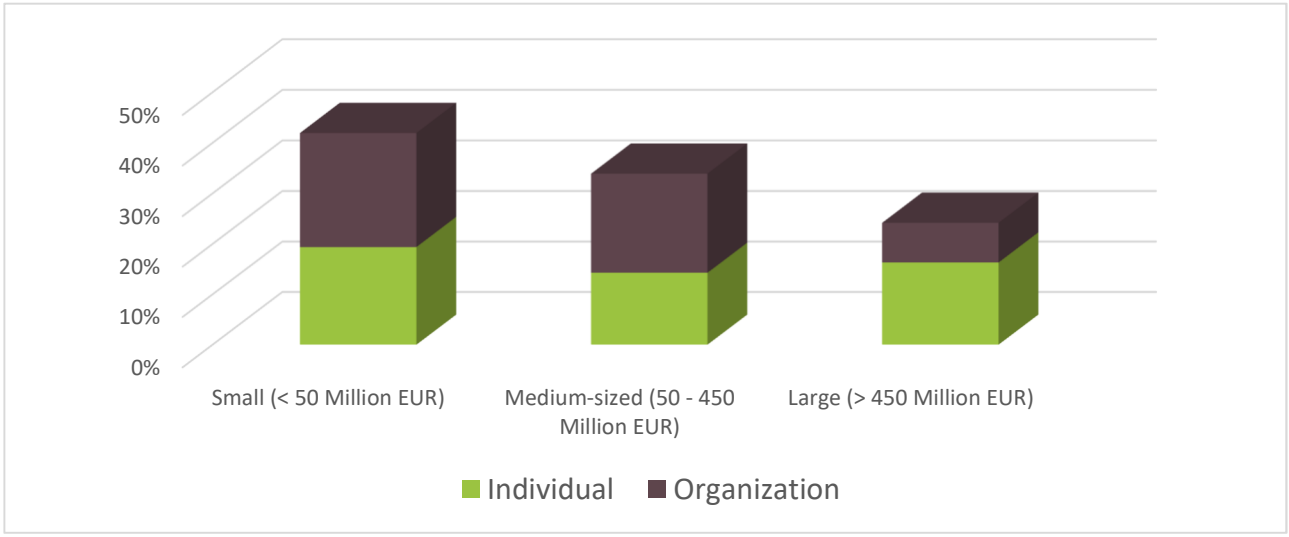
Q1.11b What is the location of the headquarter of the company or organization you work for? (Responses on behalf of organization) N=51



Responses on behalf of organizations in the seed & breeding sector are primarily from participants in a company or organization where the location of the headquarter is in Germany, France, The Netherlands, Poland, Italy and Spain. Country distribution of the survey responses is color-coded: above 15% is indicated in brown, between 5% and 15% is indicated in green and below 5% is indicated in light brown.

Q1.12 What is the size of the company or organization (as regards annual turnover) you work for? N=100



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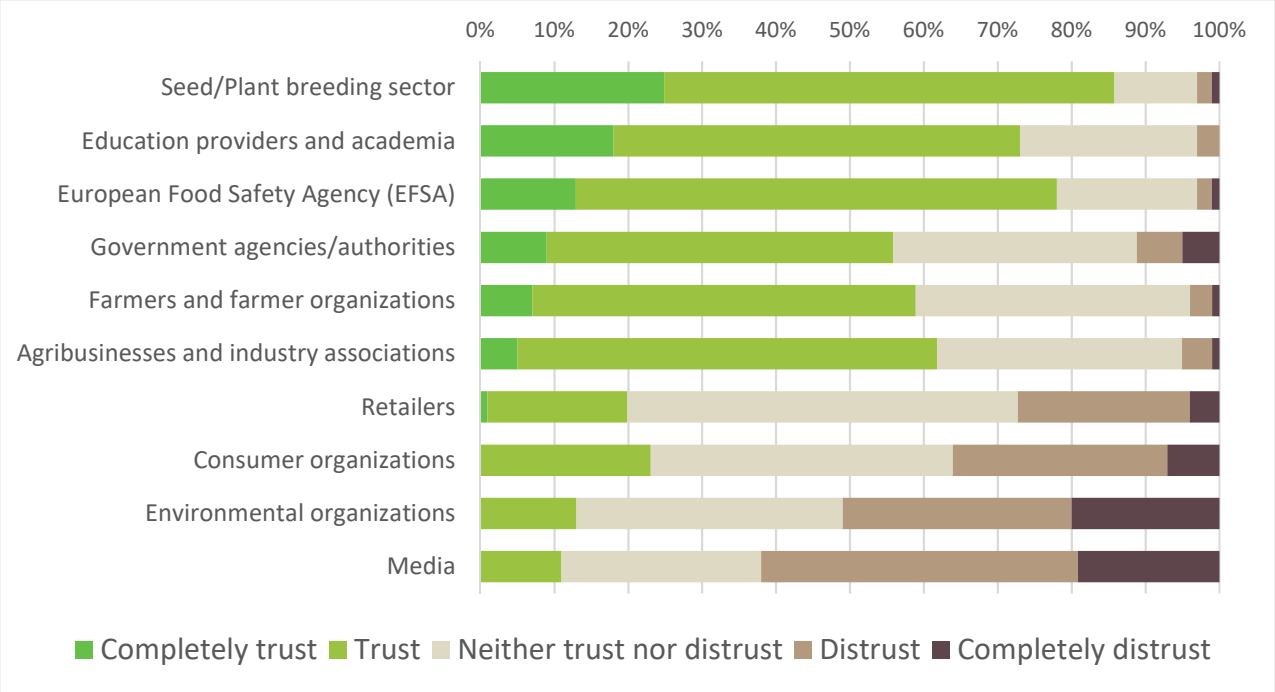
Participants work respectively for approximately 45%, 35% and 20% at small, medium-sized and large companies.

2.2 *General perception and knowledge of the SHG*

Q2.1 Please indicate your degree of trust in the following organizations regarding information and communication about food production in Europe. N=100



The seed/plant breeding sector, education providers and academia, EFSA, government agencies/authorities, farmers and farmer organizations, and agribusinesses and industry associations have a median response of "trust" regarding the degree of trust of the seed & breeding sector in information and communication about food production in Europe. Retailers, and consumer organizations have a median response of "neither trust nor distrust", and media, and environmental organizations have a median response of "distrust".

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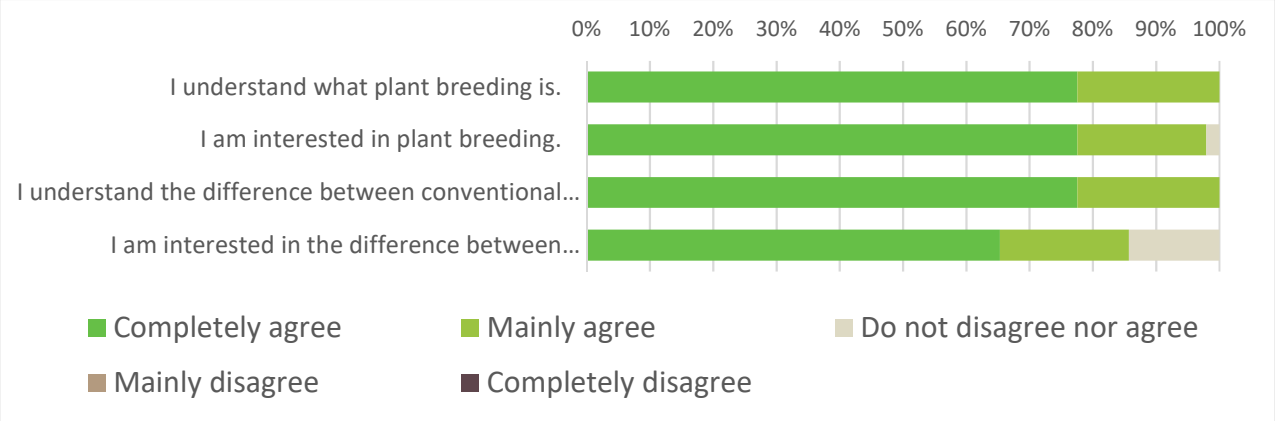
Q2.2 How do you self-assess your knowledge about plant breeding? N=100

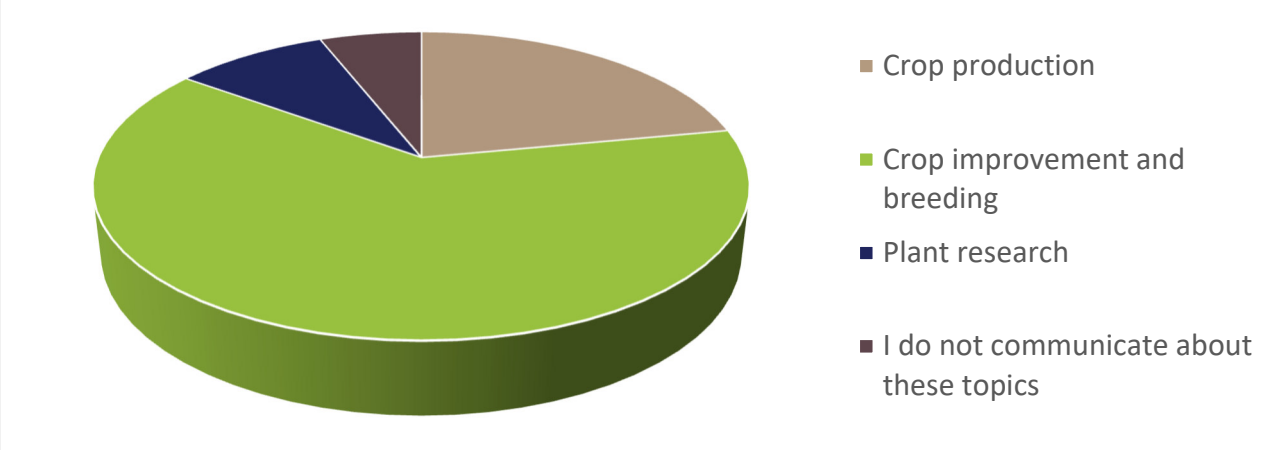


At least 97% of the seed & breeding sector completely agrees or mainly agrees with the statement that they understand what plant breeding is as well as what the difference is between conventional and new plant breeding methods.

2.3 *Experience, opinion and needs of the SHG related to communication about different aspects of food systems*

2.3.1 EXPERIENCE OF THE SHG ON ONGOING COMMUNICATION ACTIVITIES

Q3.1 On which topic do you have the most experience communicating? N=100



A total of 63% of the seed & breeding sector has most experience in communication about crop improvement and breeding and 22% has most experience in crop production.

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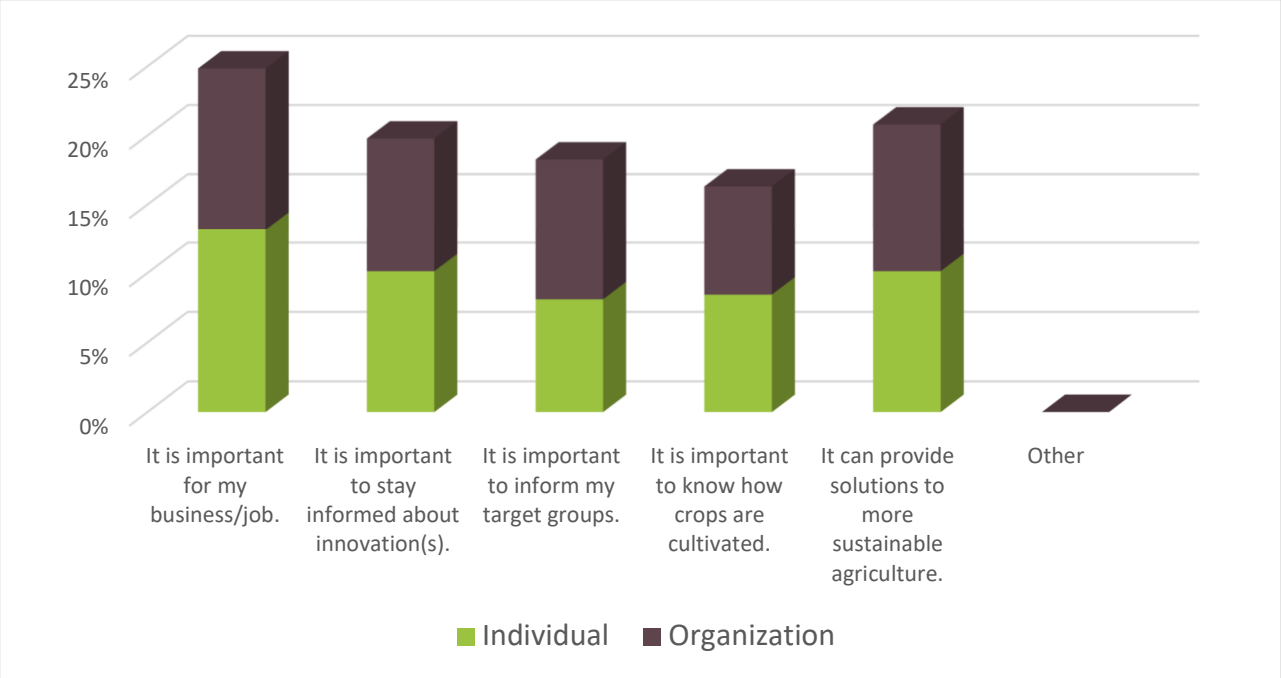
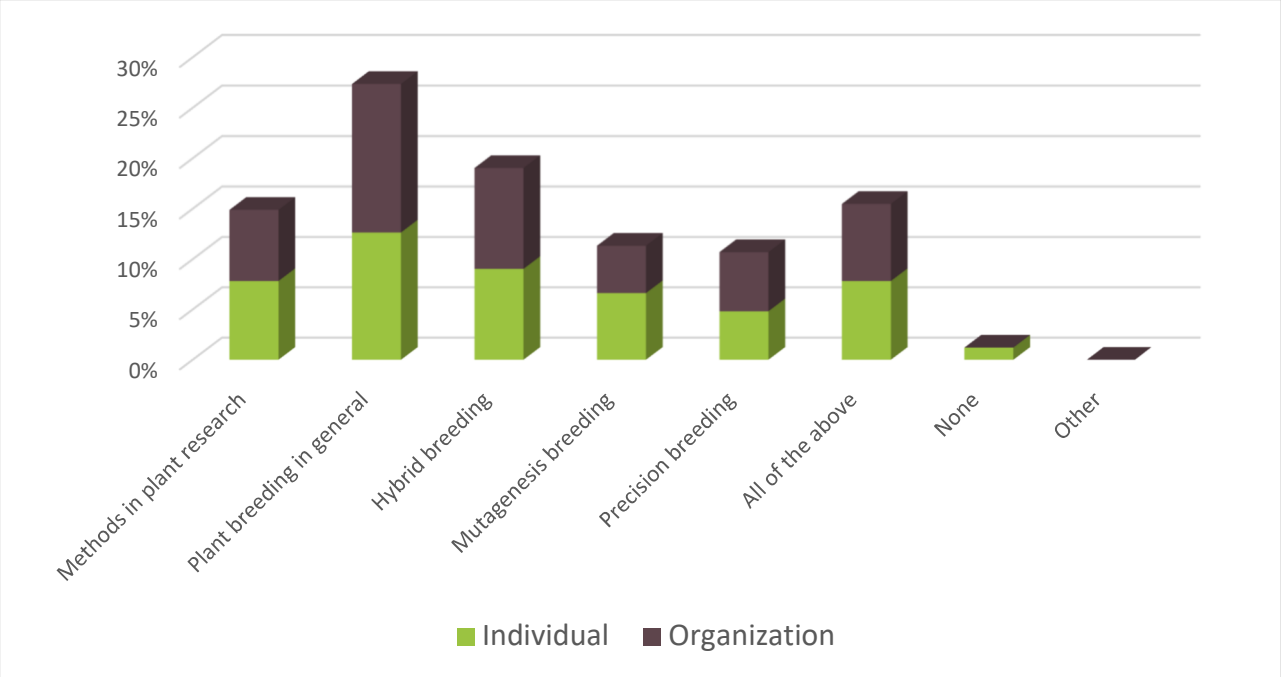
Q3.2 Why do you engage with others in communication about plant research, crop improvement and breeding or crop production? N=94



The seed & breeding sector indicated that they engage with others in communication about plant research, crop improvement and breeding or crop production because: "it is important for my business/job", and "it can provide solutions to more sustainable agriculture".

Q3.3 About which of the following techniques of plant breeding do you communicate? N=94



The seed & breeding sector mainly communicates about plant breeding in general, and hybrid breeding.

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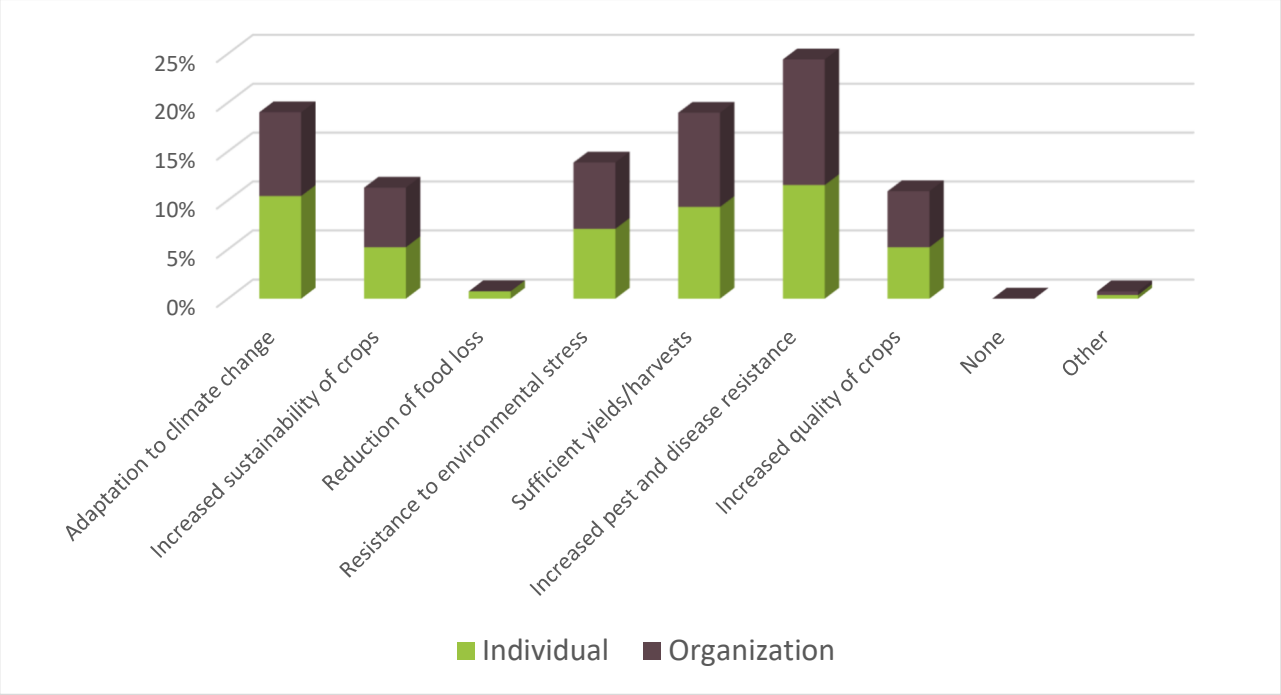
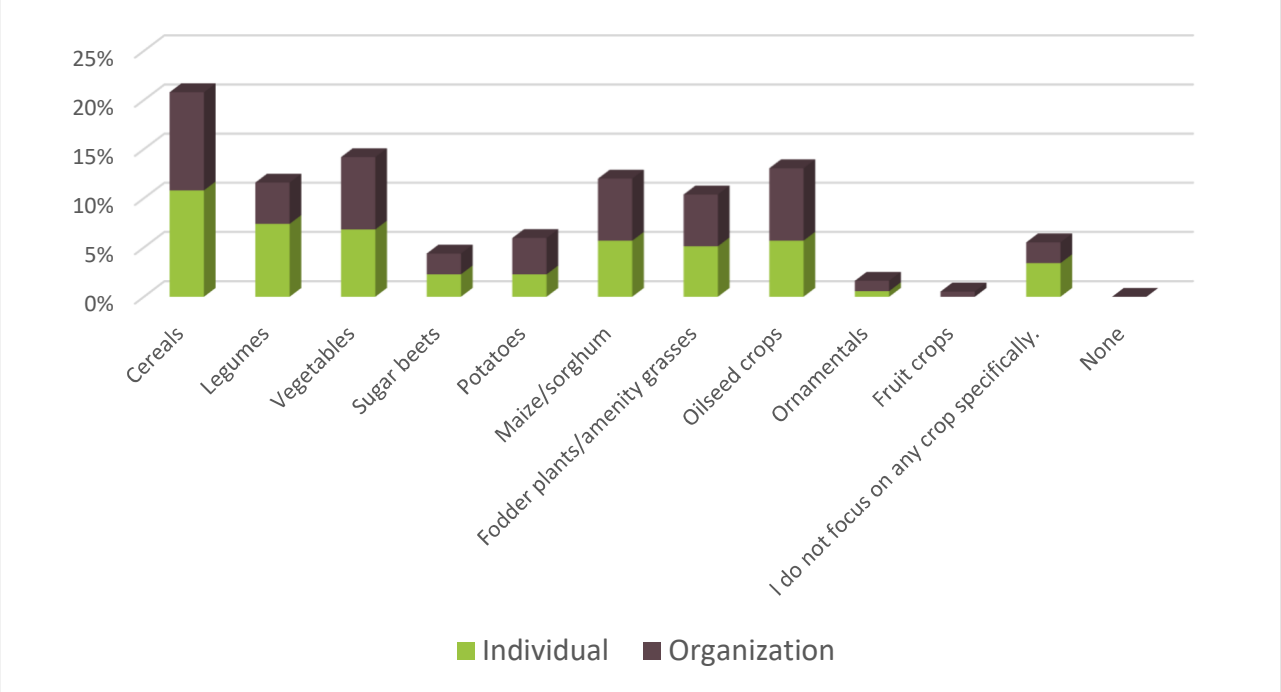
Q3.4 About what crop characteristics do you mainly communicate? N=94



The seed & breeding sector communicates mainly about the crop characteristic "increased pest and disease resistance", and to a lesser extent about "sufficient yields/harvests", and "adaptation to climate change".

Q3.5 About which crops do you mainly communicate? N=94



The seed & breeding sector communicates mainly about cereals, and to a lesser extent about vegetables, oilseed crops, maize/sorghum, legumes, and fodder plants/amenity grasses.

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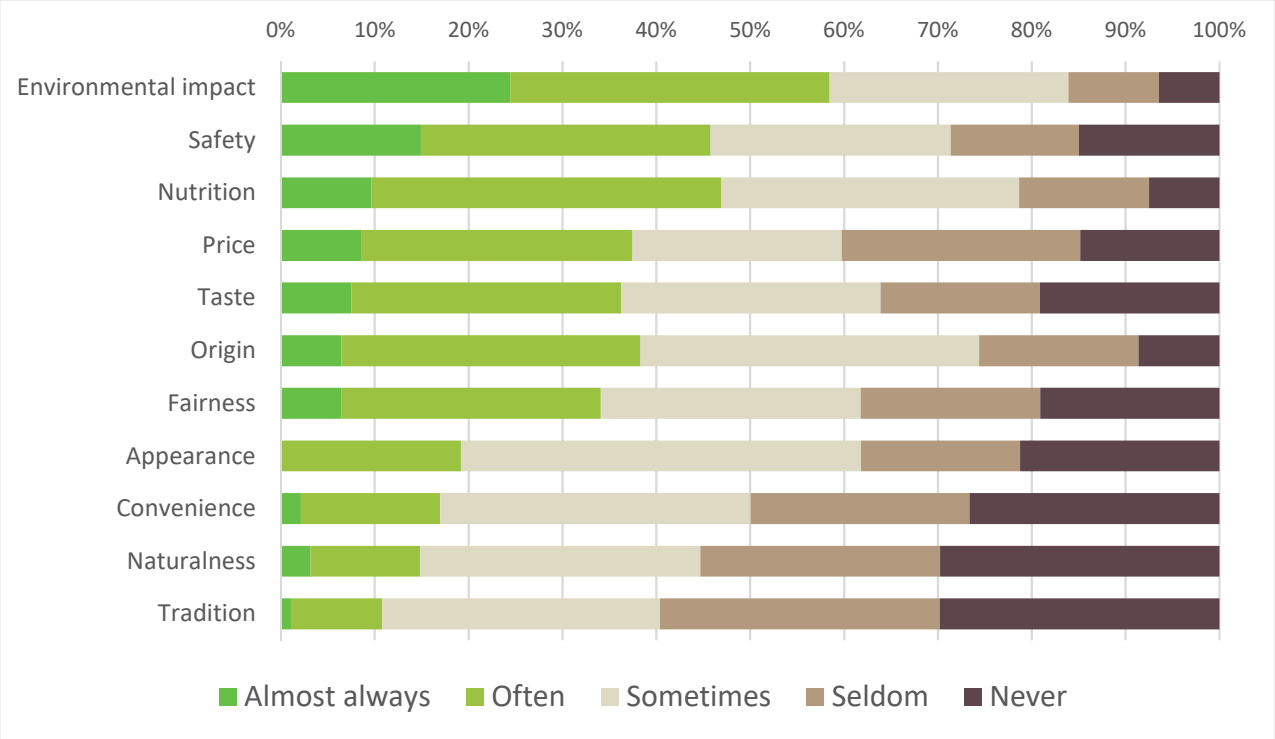
Q3.6 How frequently do you use the following food values in your communication about plant research, crop improvement and breeding or crop production? N=94



When the seed & breeding sector was asked how frequently they use food values in their communication about plant research, crop improvement and breeding or crop production, the value: environmental impact has a median response of "often", while the values: safety, nutrition, price, taste, origin, fairness, appearance, and convenience have a median response of "sometimes", and the values: naturalness and tradition have a median response of "seldom".

Q3.7 Can you provide an example of a communication relating to plant research, crop improvement and breeding or crop production which, in your experience was effective? N=94

Wordcloud based on frequency of key words describing the respondent's answers:

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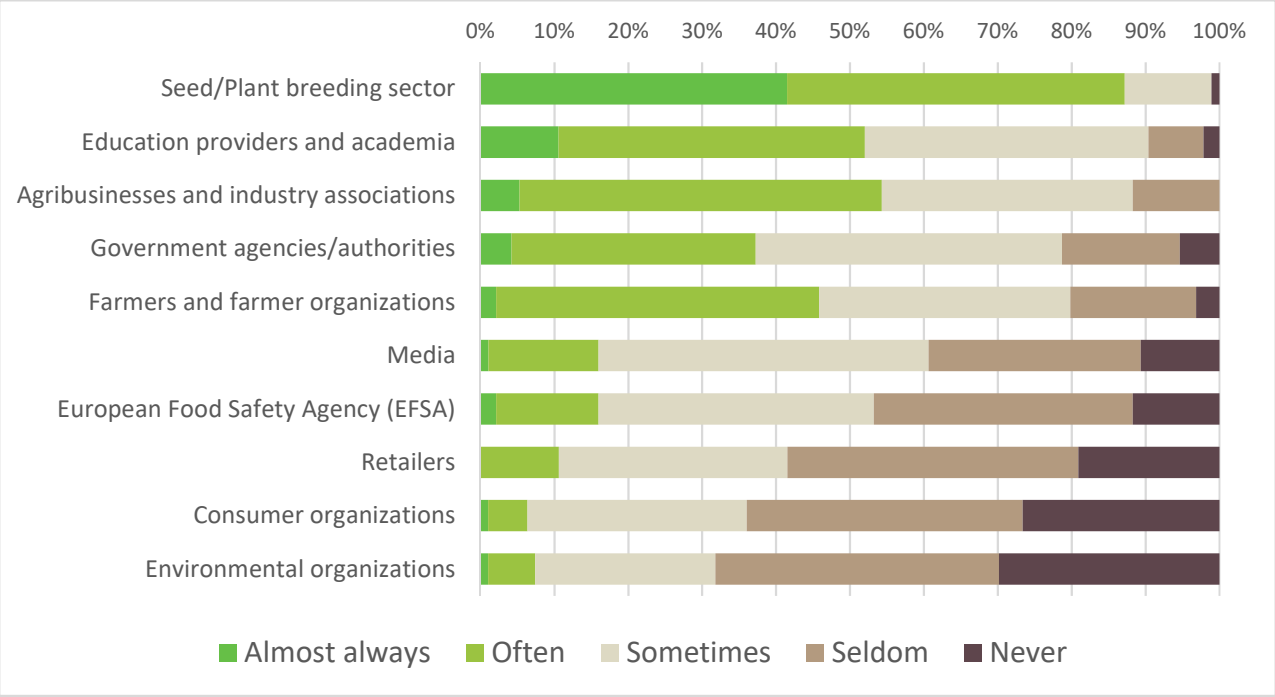
2.3.2 OPINION OF THE SHG ON ONGOING COMMUNICATION ACTIVITIES

Q4.1 How frequently do you use information from these stakeholders in your communication about plant research, crop improvement and breeding or crop production? N=94



When the seed & breeding sector was asked how frequently they use information from various stakeholders in their communication about plant research, crop improvement and breeding or crop production, the stakeholders: seed/plant breeding sector, education providers and academia, and agribusinesses and industry associations have a median response of "often", while the stakeholders: government agencies/authorities, farmer and farmer organizations, media, and EFSA have a median response of "sometimes", and the stakeholders: environmental organizations, consumer organizations, and retailers have a median response of "seldom". In addition, the seed/plant breeding sector has a response of "almost always" in the first Quartile.

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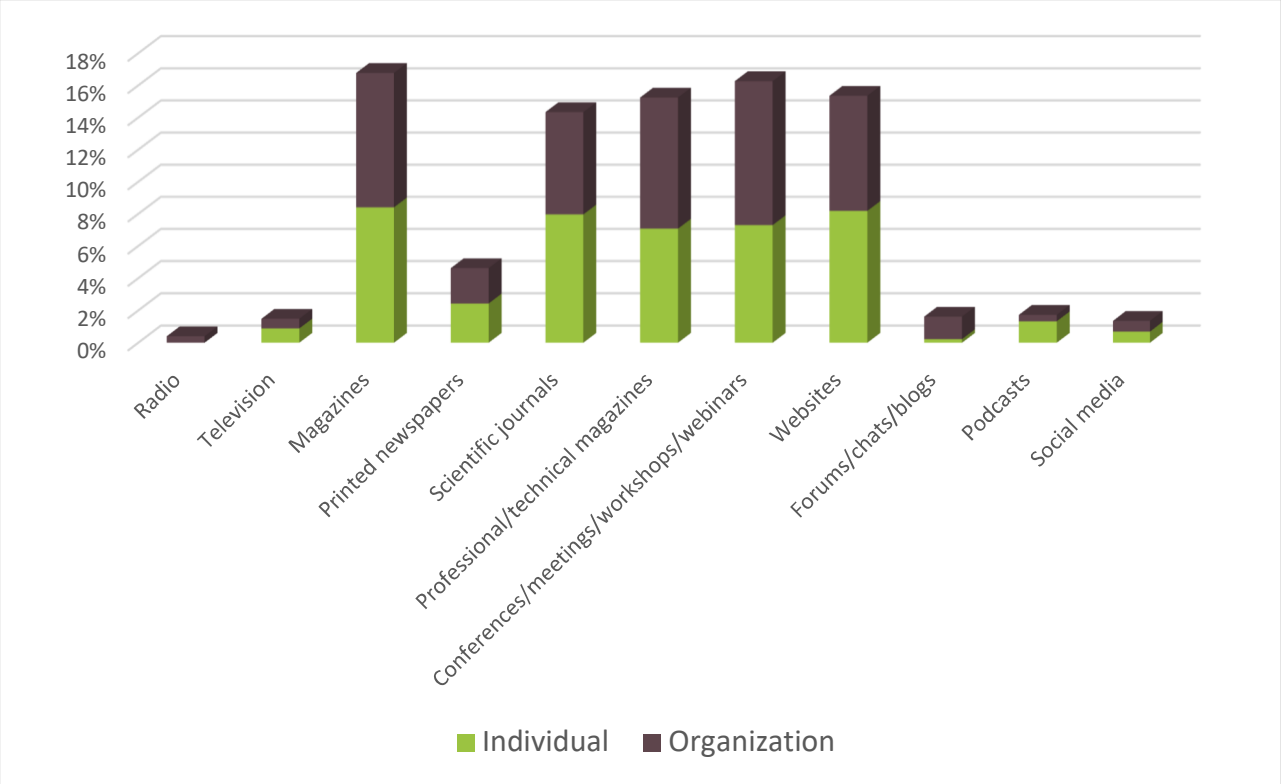
Q4.2 Which of the following channels do you use to learn about plant research, crop improvement and breeding or crop production? N=94



The seed & breeding sector uses primarily the channels: (professional/technical) magazines, conferences/meetings/workshops/webinars, websites and scientific journals to learn more about plant research, crop improvement and breeding or crop production.

	Radio	Television	Magazines	Printed newspapers	Scientific journals	Professional/technical magazines	Conferences/meetings/workshops/webinars	Websites	Forums/chats/blogs	Podcasts
≤44 years N=22	0%	10%	35%	25%	80%	**55%**	**60%**	**70%**	5%	**25%**
>45 years N=27	0%	8%	15%	23%	77%	**81%**	**81%**	**88%**	0%	**4%**

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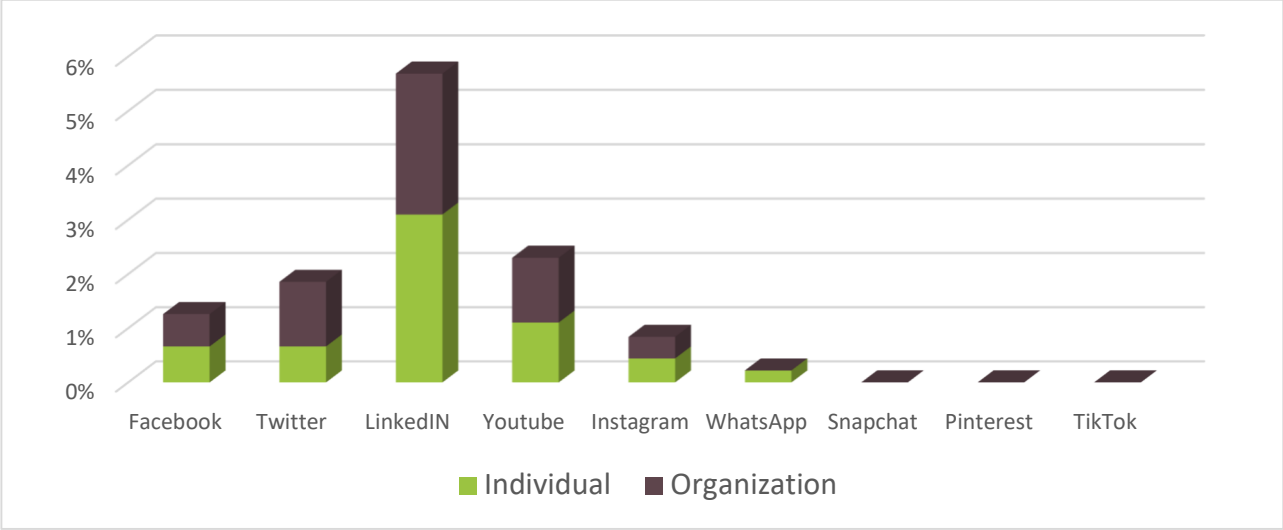

The seed & breeding sector uses primarily the social media platform LinkedIN to learn more about plant research, crop improvement and breeding or crop production.

	Facebook	Twitter	LinkedIN	Youtube	Instagram	WhatsApp	Snapchat	Pinterest	TikTok	
≤44 years N=22	5%	10%	35%	15%	5%	0%	0%	0%	0%	
>45 years N=27	8%	4%	27%	8%	4%	4%	0%	0%	0%	

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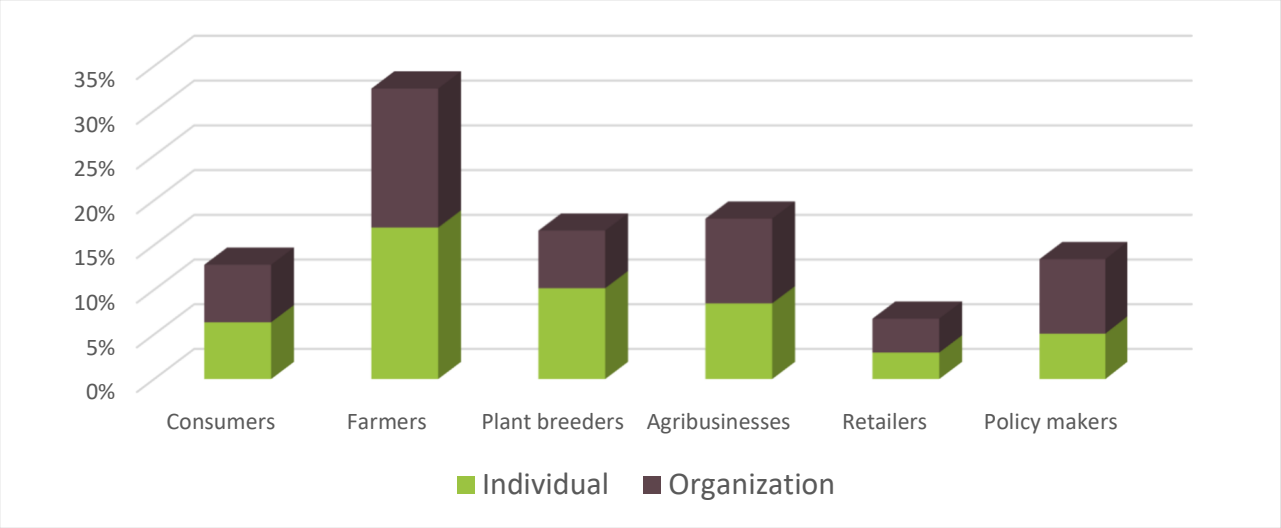
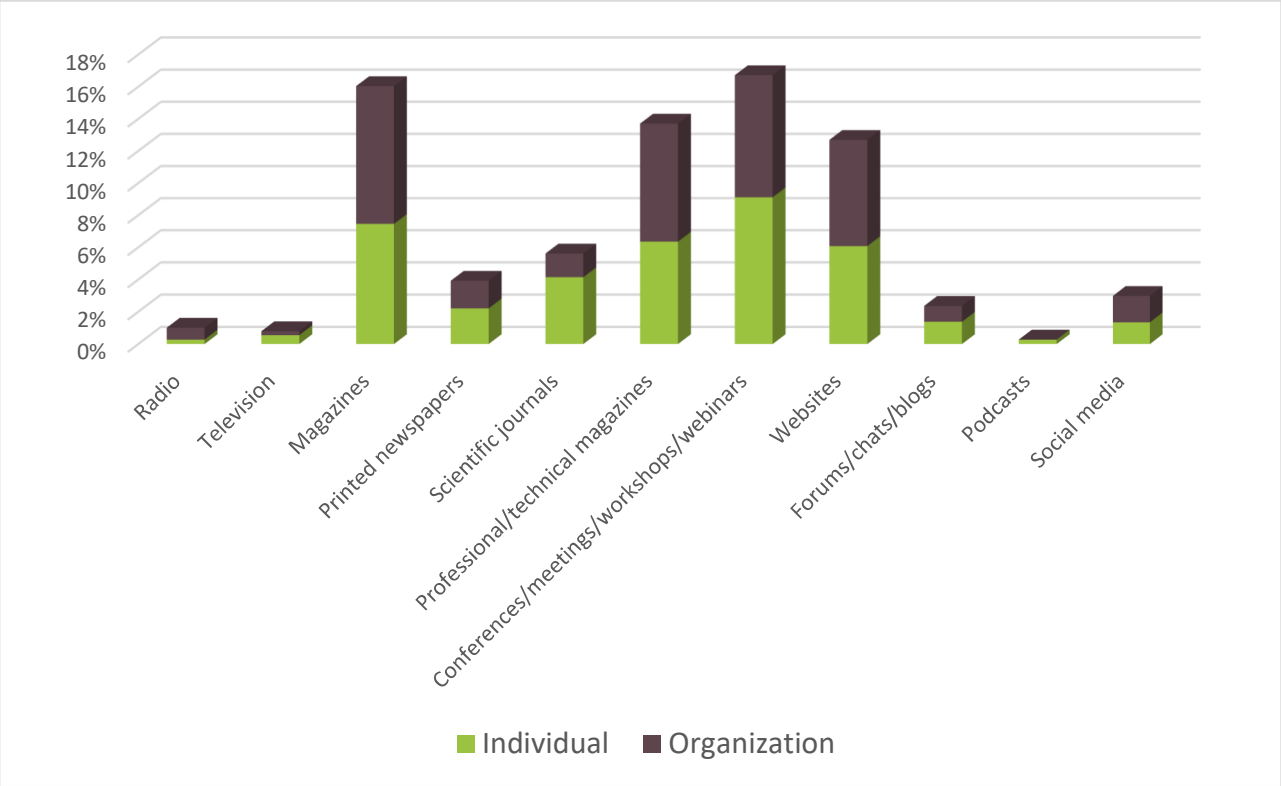
Q4.3 Which are your main target groups to communicate with about plant research, crop improvement and breeding or crop production? N=94



The main target groups of the seed & breeding sector to communicate with about plant research, crop improvement and breeding or crop production are farmers, and to a lesser extent agribusinesses.

Q4.4 Which of the following channels do you use to communicate with your main target groups about plant research, crop improvement and breeding or crop production? N=94



The seed & breeding sector uses primarily the channels: conferences/meetings/ workshops/webinars, (professional/technical) magazines, and websites to communicate with their target groups about plant research, crop improvement and breeding or crop production.

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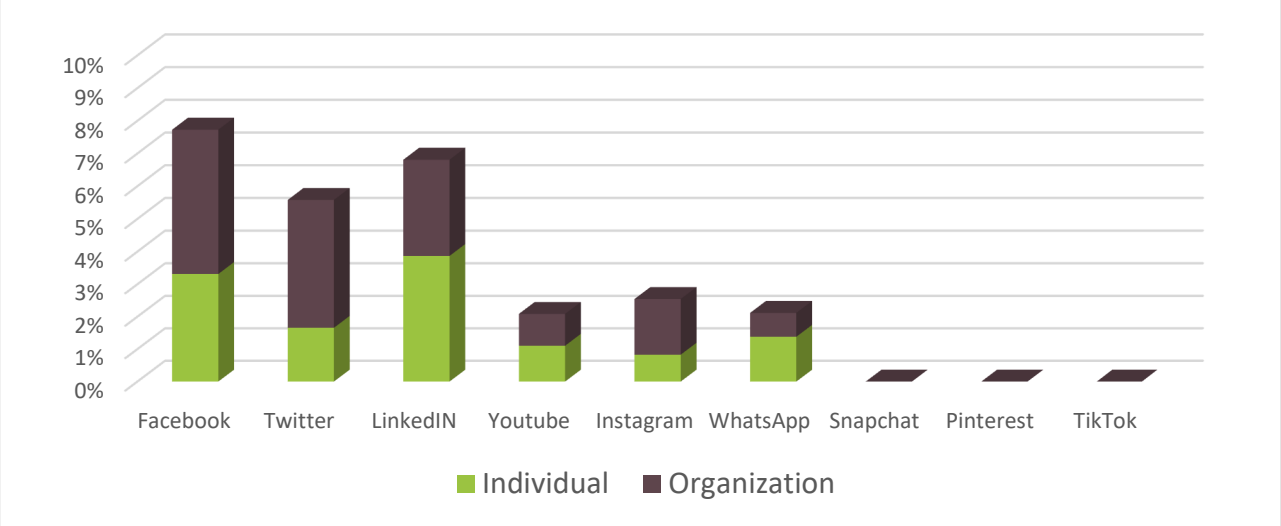
	Radio	Television	Magazines	Printed newspapers	Scientific journals	Professional/technical magazines	Conferences/meetings/ workshops/webinars	Websites	Forums/chats/blogs	Podcasts
≤44 years N=22	5%	5%	5%	**25%**	**25%**	**25%**	**60%**	**40%**	5%	5%
>45 years N=27	0%	4%	4%	**12%**	**38%**	**69%**	**81%**	**54%**	15%	0%



The seed & breeding sector uses primarily the social media platforms: Facebook, LinkedIN, and Twitter to communicate with their target groups about plant research, crop improvement and breeding or crop production.

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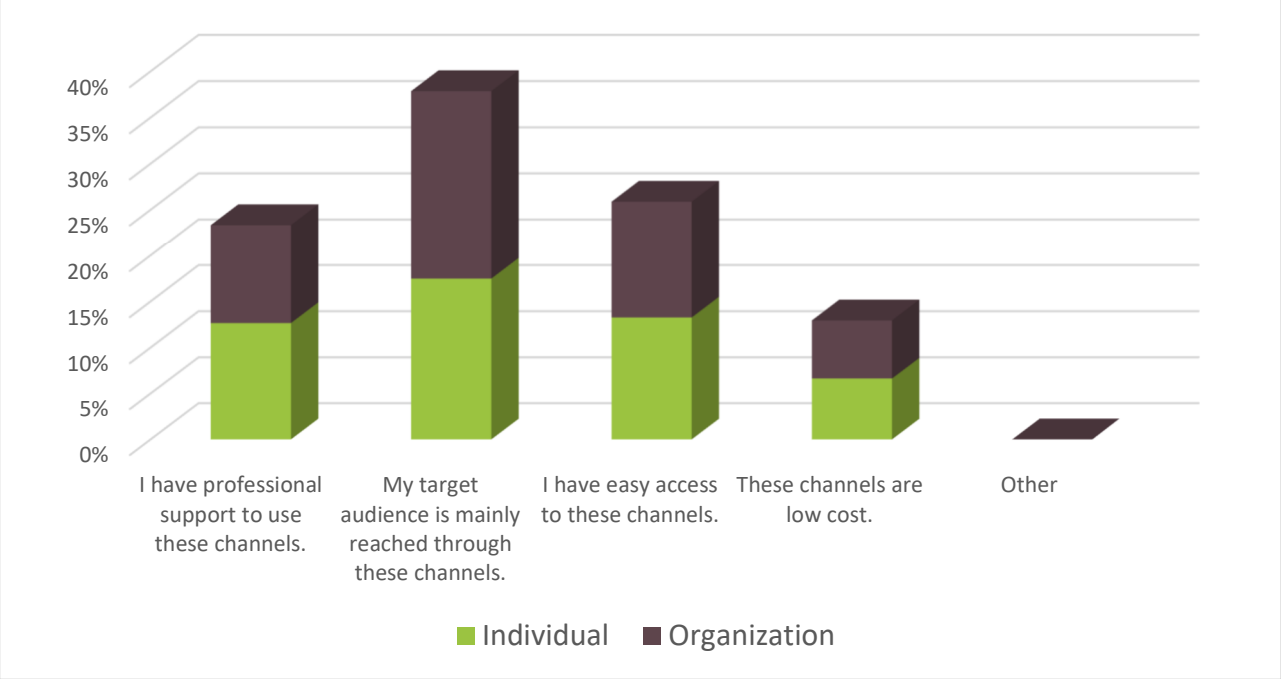
	Facebook	Twitter	LinkedIN	Youtube	Instagram	WhatsApp	Snapchat	Pinterest	TikTok	
≤44 years N=22	30%	**20%**	30%	0%	5%	10%	0%	0%	0%	
>45 years N=27	23%	**8%**	31%	4%	8%	12%	0%	0%	0%	

Q4.5 Why do you specifically use these channels to communicate about plant research, crop improvement and breeding or crop production? N=94



The seed & breeding sector specifically uses certain channels to communicate about plant research, crop improvement and breeding or crop production because "their target audience is mainly reached through these channels", and "they have easy access to these channels".

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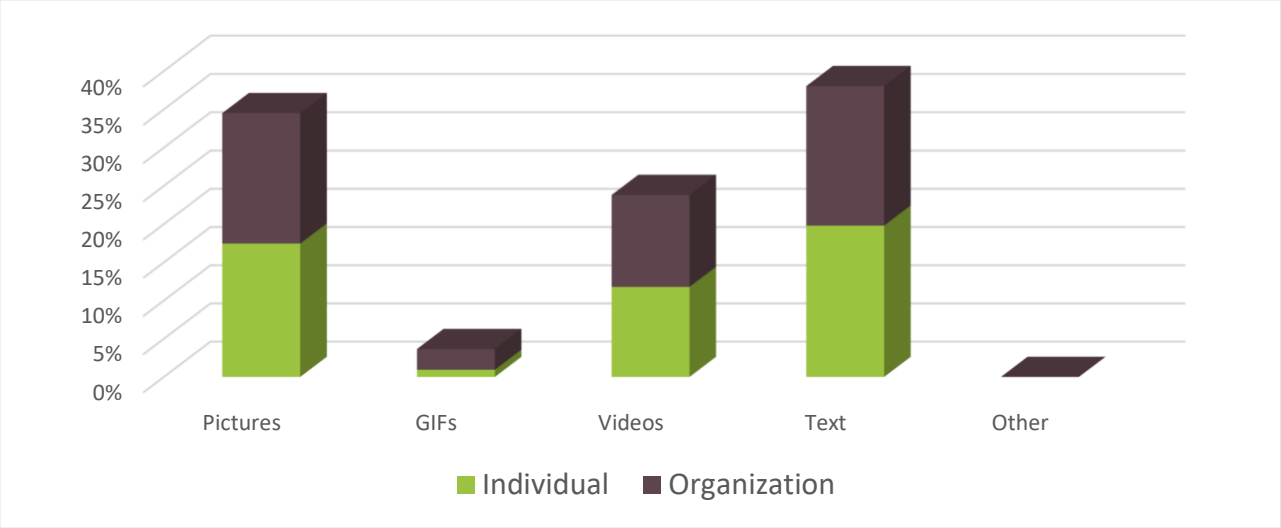
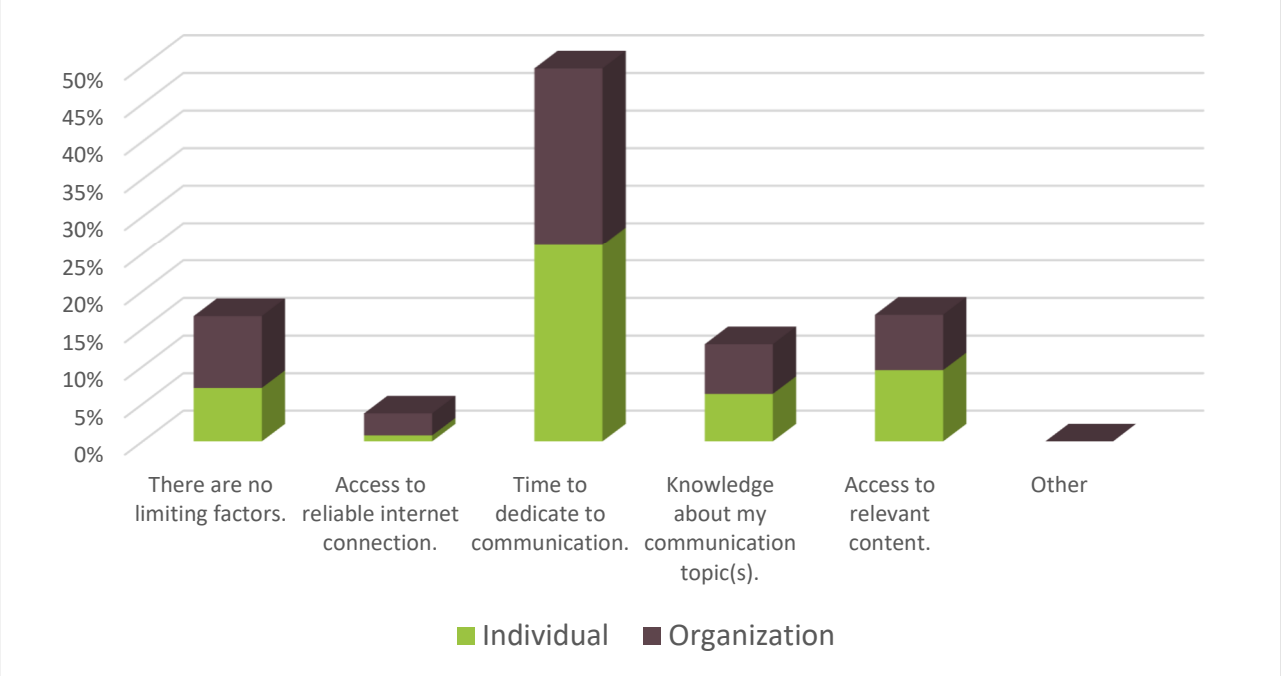
Q4.6 Which of the following tools do you use to communicate about plant research, crop improvement and breeding or crop production? N=94



The seed & breeding sector most frequently uses text and pictures to communicate about plant research, crop improvement and breeding or crop production.

2.3.3 NEEDS OF THE SHG RELATED TO ONGOING COMMUNICATION ACTIVITIES

Q5.1 What are limiting factors for you to communicate to others? N=94



The seed & breeding sector their main limiting factor to communicate to others is time to dedicate to communication.

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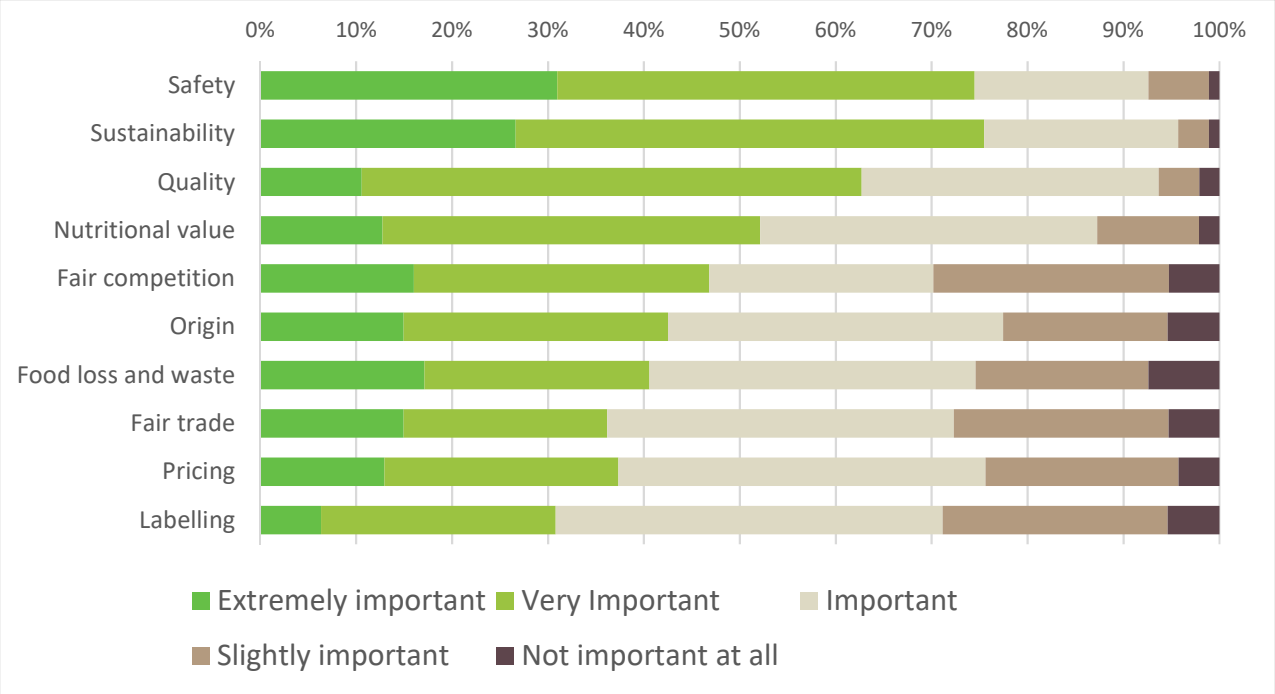
Q5.2 How do you rate the importance of addressing the following aspects through communication efforts? N=94



The options: safety, sustainability, quality, and nutritional value have a median response of "very important" regarding their importance in communication efforts by the seed & breeding sector, while the options: fair competition, origin, food loss and waste, fair trade, pricing, and labelling have a median response of "important". In addition, the options: sustainability, and safety have a response of "extremely important" in the first Quartile.

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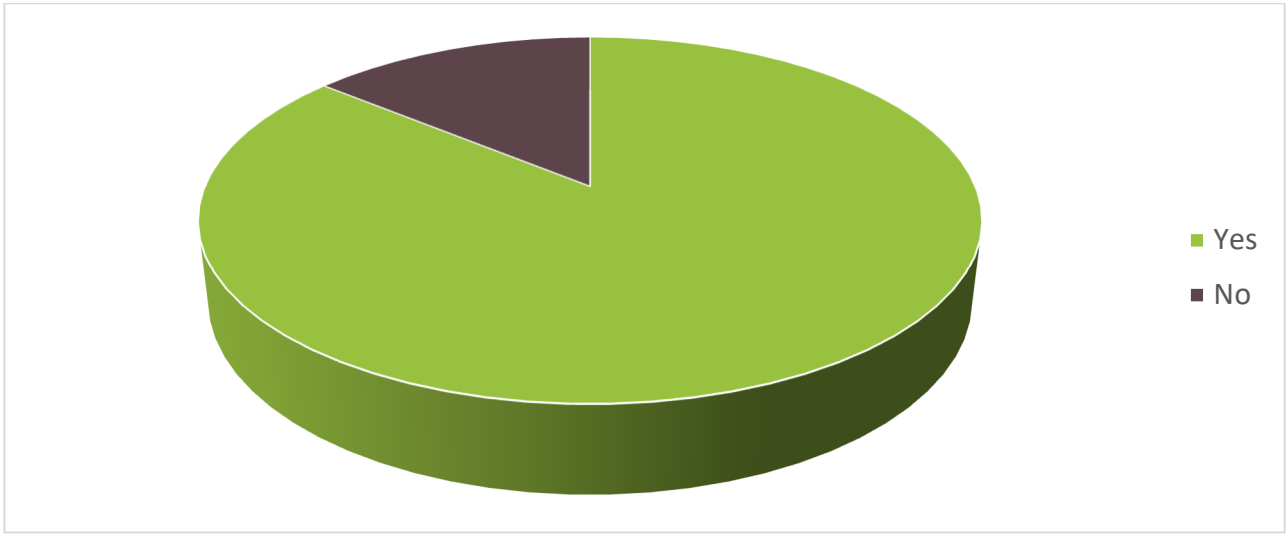
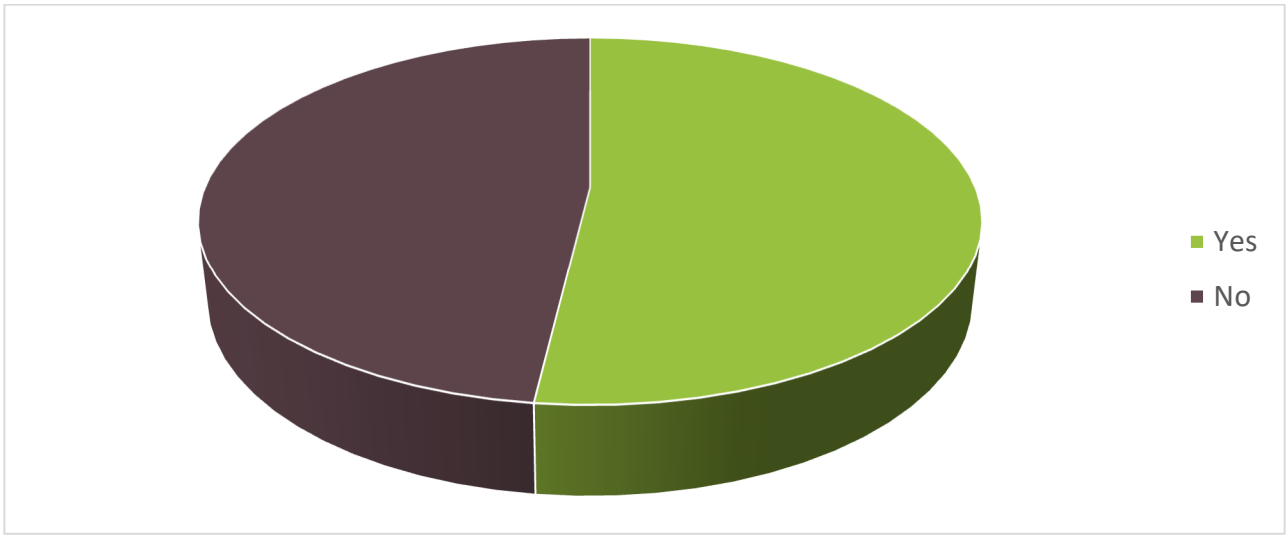
2.4 *Experience, opinion and needs of the SHG related to communication about gene editing in plants*

Q6.1 Are you familiar with gene editing in plants? N=100



A total of 86% respondents of the seed & breeding sector indicated that they are familiar with gene editing in plants.

Q6.2 Do you communicate about gene editing in plants? N=100



Nearly half of the respondents from the seed & breeding sector indicated that they communicate about gene editing in plants.

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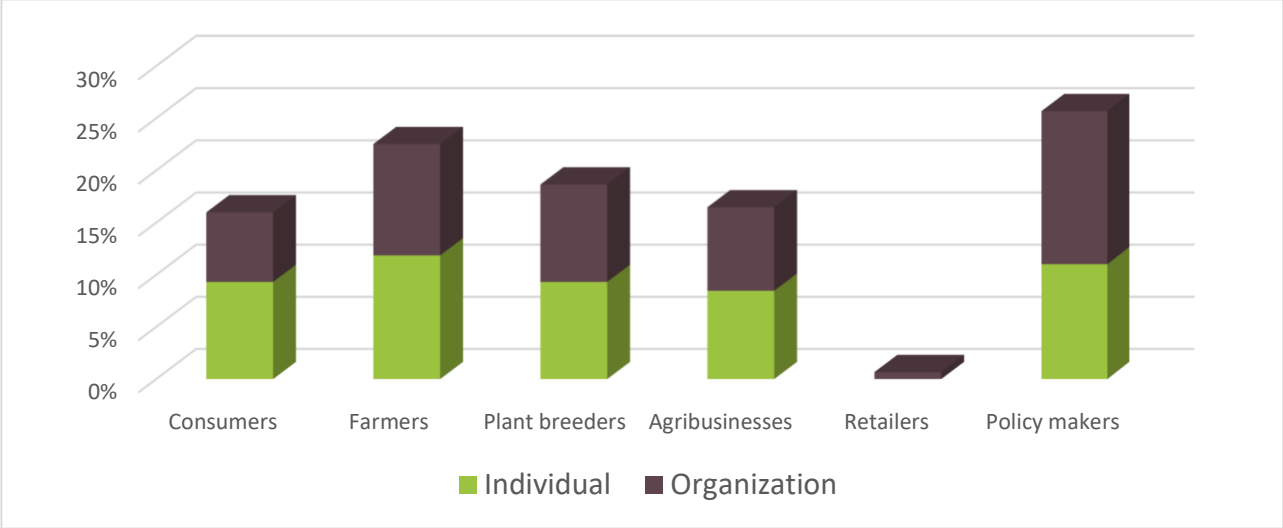
Q6.3 Which are your main target groups to communicate with about gene editing in plants? N=52



The main target groups of the seed & breeding sector to communicate with about gene editing in plants are policy makers, farmers, and plant breeders.

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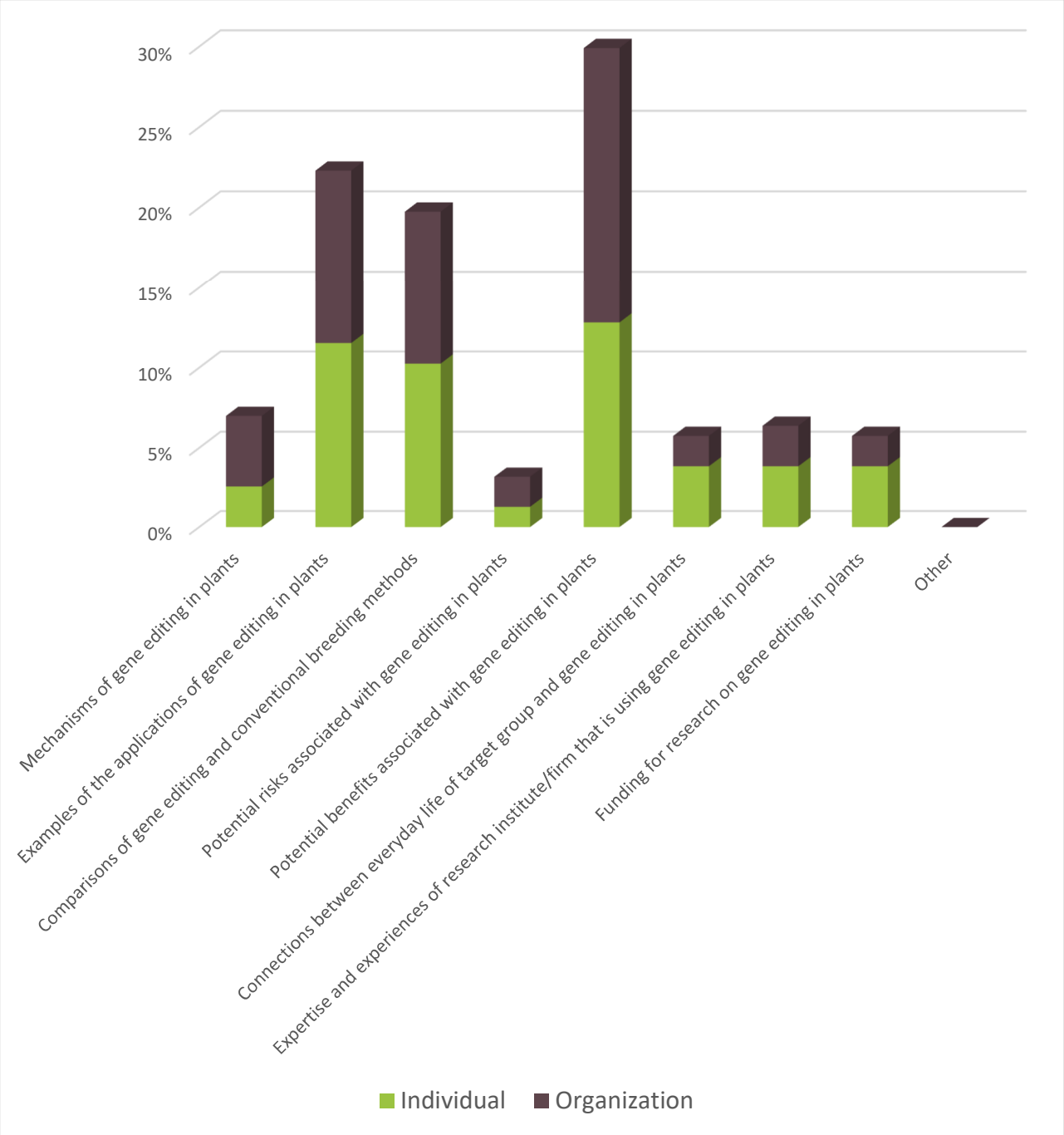
Q6.4 What specific topics are most important to you when communicating about gene editing in plants? N=52



The seed & breeding sector indicated that "potential benefits associated with gene editing in plants" is the most important topic when communicating about gene editing in plants, and to a lesser extent "examples of the applications of gene editing in plants", and "comparisons of gene editing and conventional breeding methods".

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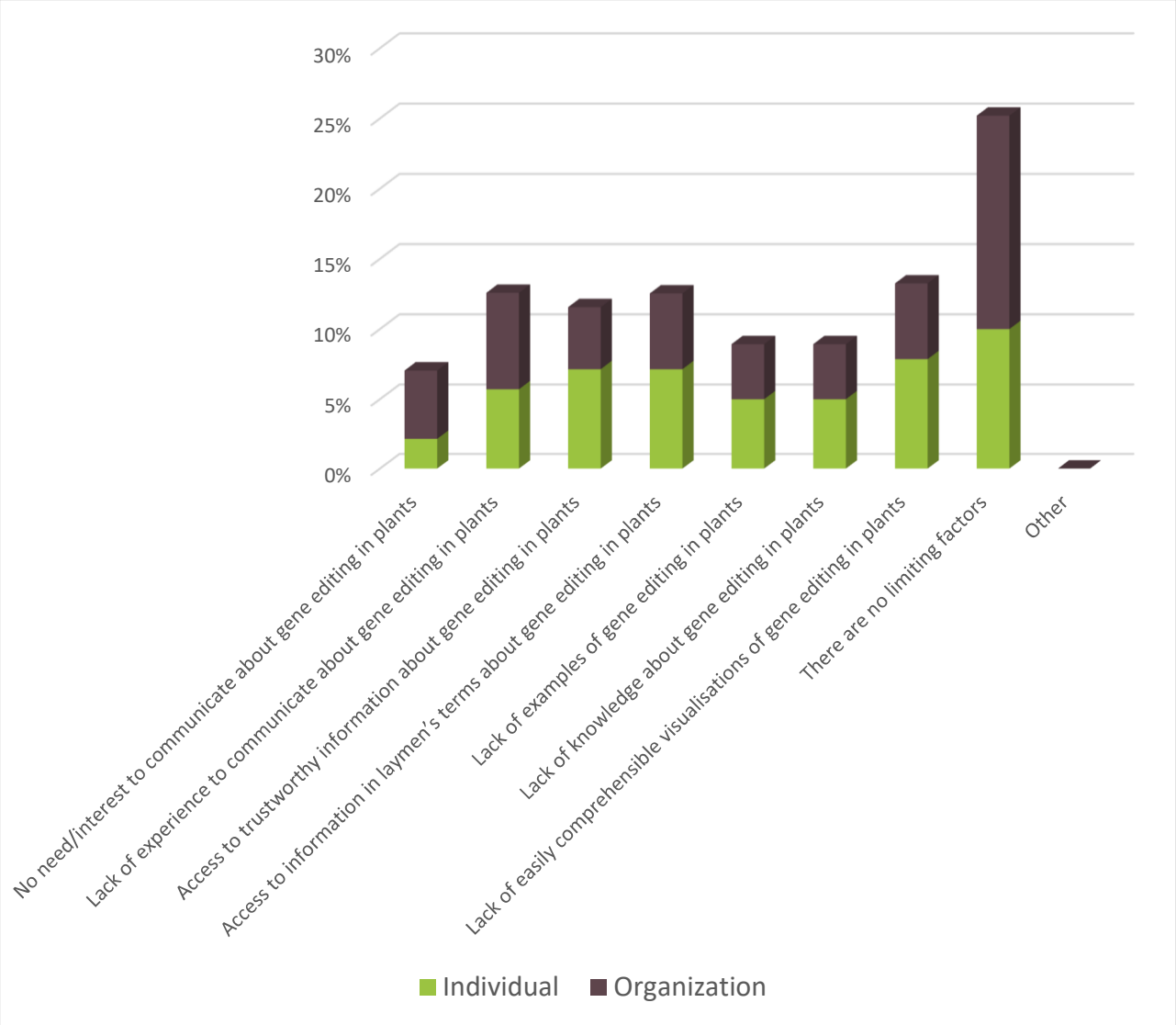
Q6.5 What are the main limiting factors for you to communicate about gene editing in plants? N=100



There are no main limiting factors for the seed & breeding sector to communicate about gene editing in plants. To a lesser extent "Lack of easily comprehensible visualisations of gene editing in plants", "Access to information in laymen's terms about gene editing in plants", and "Lack of experience to communicate about gene editing in plants" were indicated as limiting factors.

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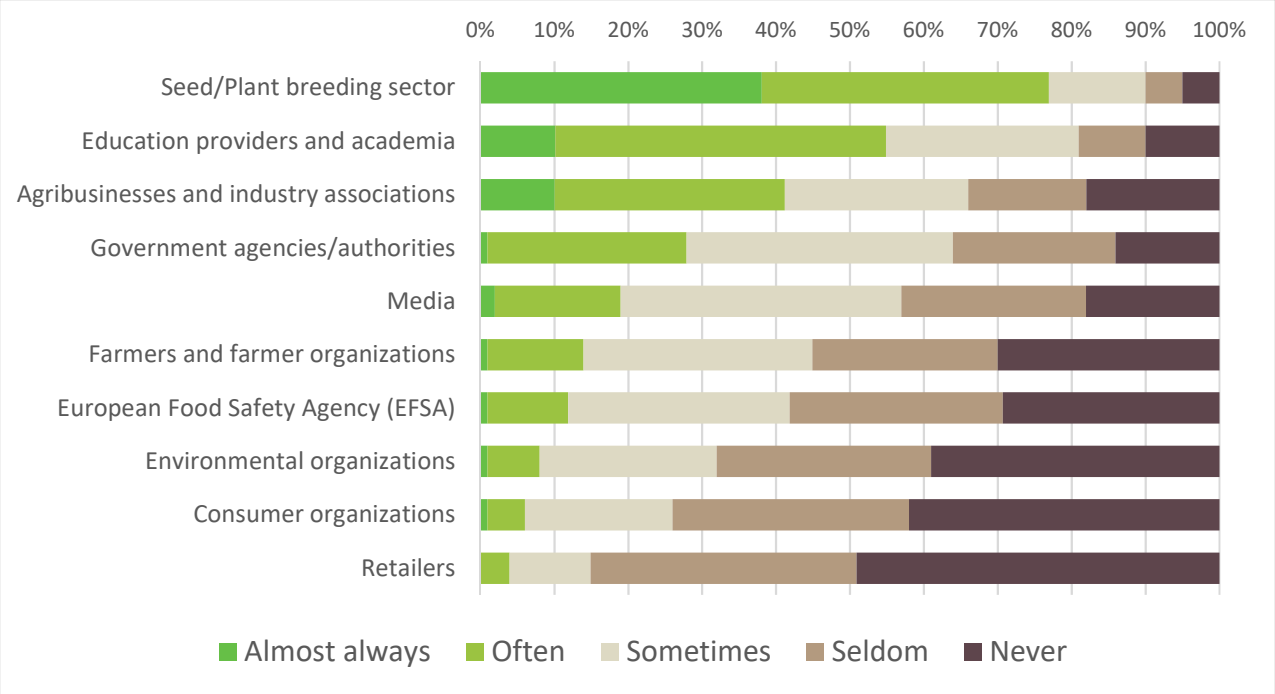
Q6.6 How frequently do you inform yourself by engaging with the following stakeholders on gene editing in plants? N=100



Seed/plant breeding sector and education providers and academia have a median response of "often" regarding how frequently the seed & breeding sector engages with various stakeholders to inform themselves on gene editing in plants. Agribusinesses and industry associations, government agencies/authorities, and media have a median response of "sometimes" and farmers and farmer organizations, EFSA, environmental organizations, consumer organizations, and retailers have a median response of "seldom".

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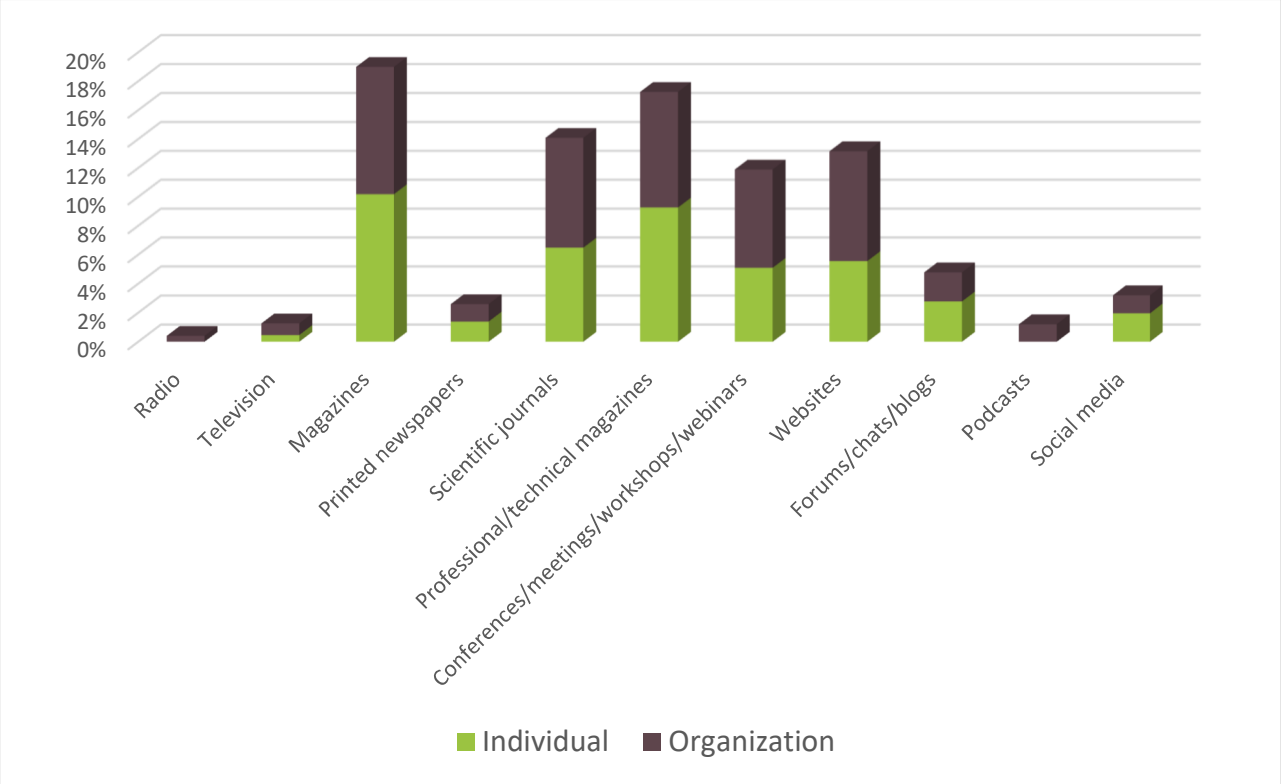
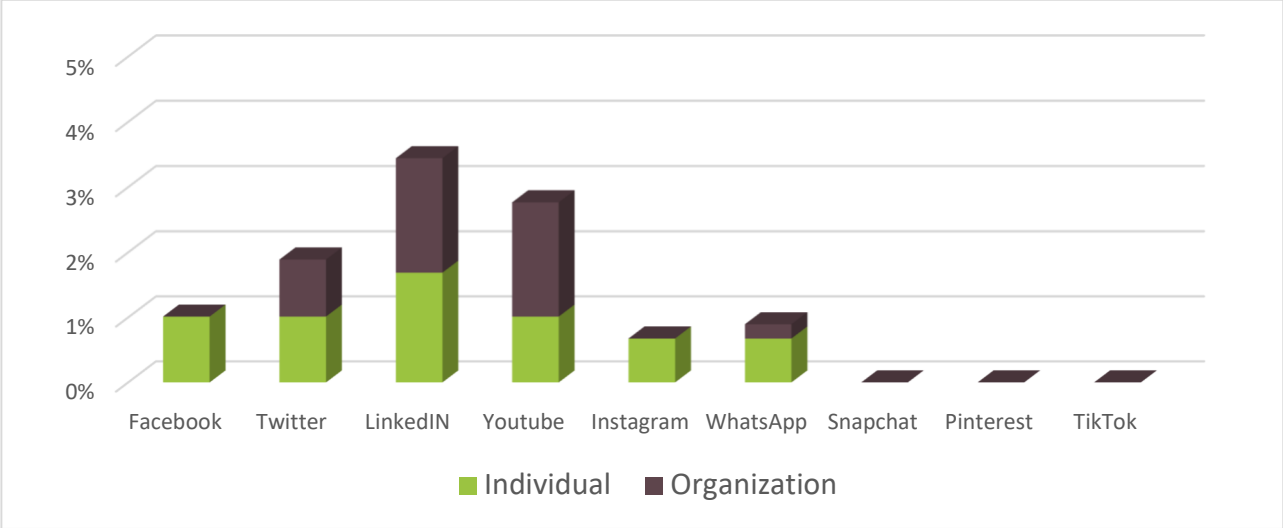
Q6.7 Which of the following channels do you use to learn about gene editing in plants? N=100



The seed & breeding sector uses primarily the channels: (professional/technical) magazines, scientific journals, websites and conferences/meetings/workshops/webinars to learn more about gene editing in plants.

	Radio	Television	Magazines	Printed newspapers	Scientific journals	Professional/technical magazines	Conferences/meetings/workshops/webinars	Websites	Forums/chats/blogs	Podcasts
≤44 years N=22	0%	9%	14%	9%	73%	**55%**	**50%**	59%	0%	**14%**
>45 years N=27	0%	4%	7%	7%	78%	**78%**	**70%**	59%	11%	**0%**



No significant results. Threshold is 5,26%.

	Facebook	Twitter	LinkedIN	Youtube	Instagram	WhatsApp	Snapchat	Pinterest	TikTok	
≤44 years N=22	5%	**14%**	**27%**	9%	5%	0%	0%	0%	0%	
>45 years N=27	4%	**4%**	**7%**	11%	0%	4%	0%	0%	0%	

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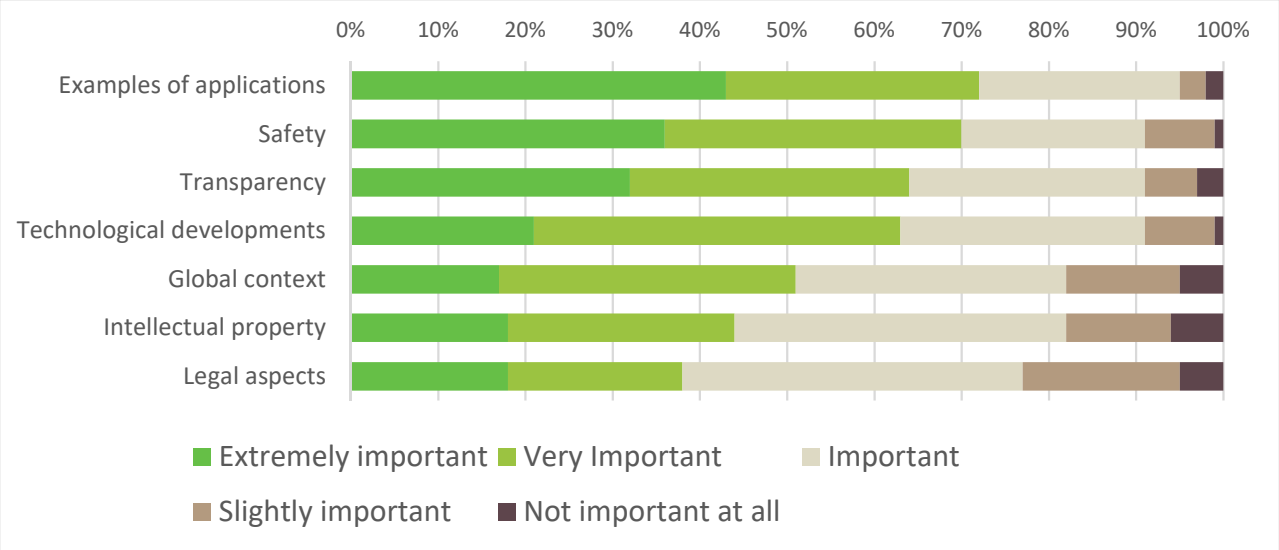
Q6.8 Which of the following aspects do you regard as important for communicating about gene editing in plants in the future? N=100



The majority of options have a median response of "very important" regarding their importance in future communication about gene editing in plants by the seed & breeding sector. Legal aspects, and intellectual property have a median response of "important". In addition, the options: examples of applications, and safety have a response of "extremely important" in the first Quartile.

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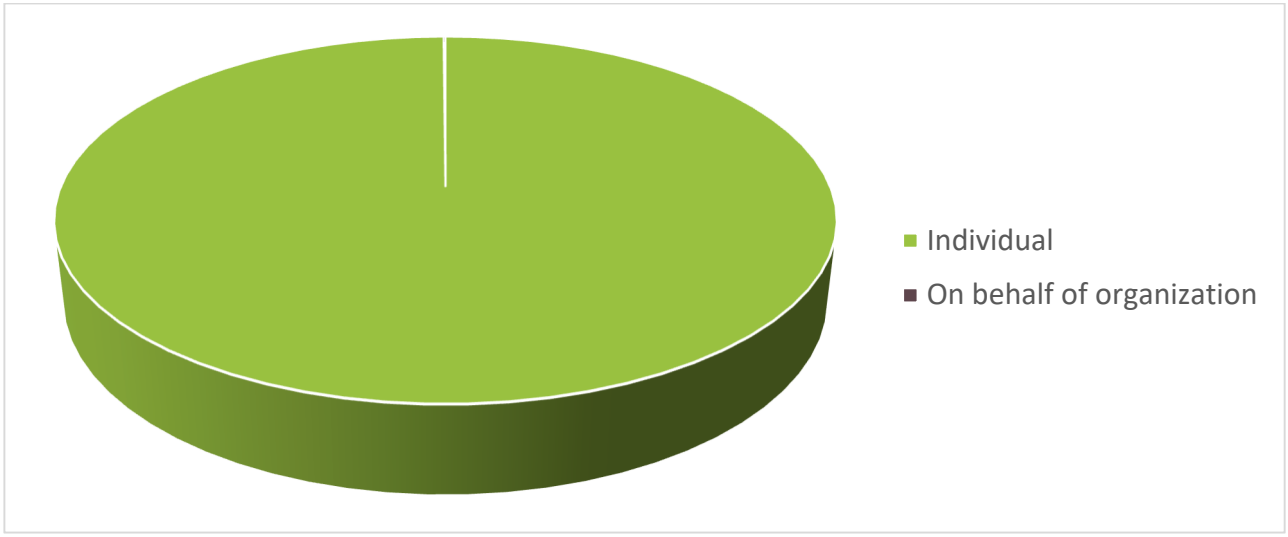
3 POLICY MAKER-LEVEL SURVEY RESULTS

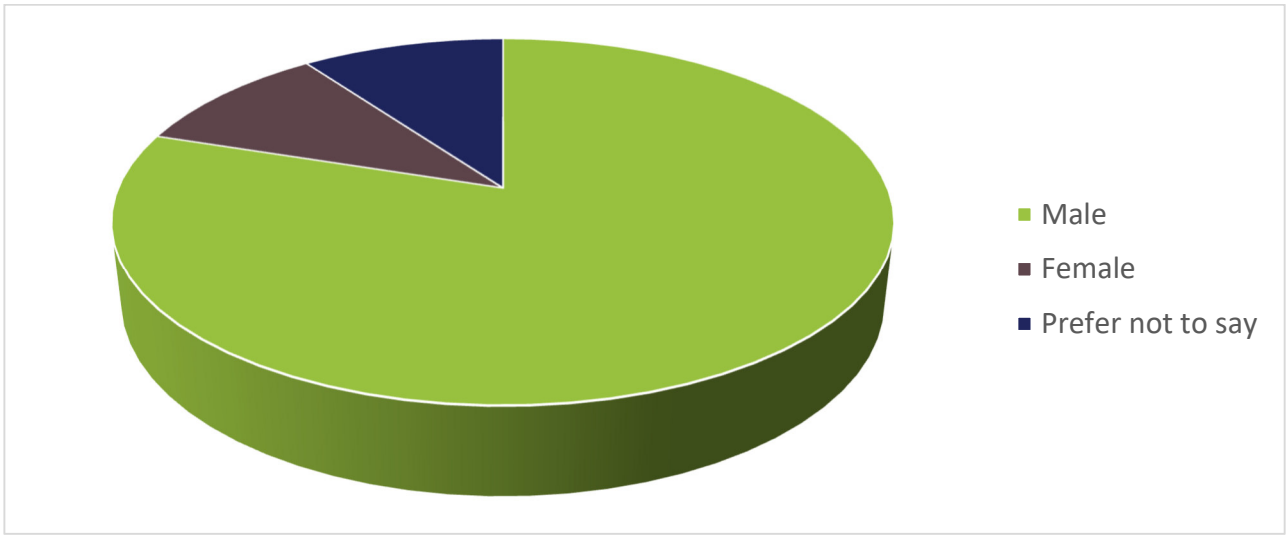
3.1 *Description of the survey sample*

Q1.1 Are you filling in this form on behalf of yourself or the organization your work for? N=11



The majority of responses (91%) is from participants that answered on behalf of themselves. Only one response is on behalf of the organization that the participant works for. Therefore, the data of the single response on behalf of an organization was combined with the data of the ten individual responses for the survey analysis of this stakeholder group.

Q1.2 Please specify your gender. N=10



Approximately 80% of the policy makers are male.

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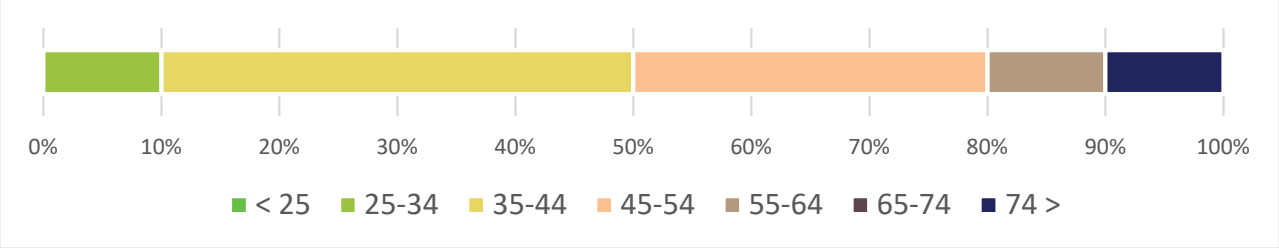
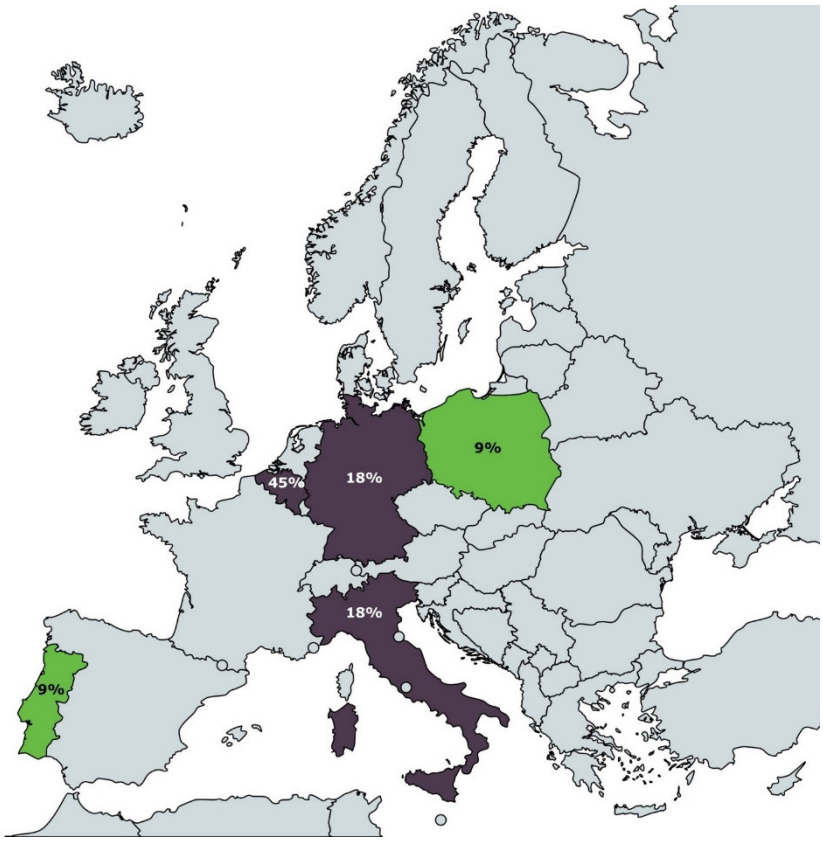
Q1.3 What is your age range? N=10



The age range of the policy makers is predominantly between 35-54 years old.

Q1.4 In which country do you work? N=11



Responses are primarily from Belgium, Germany, Italy, Poland and Portugal. Country distribution of the survey responses is color-coded: above 15% is indicated in brown, between 5% and 15% is indicated in green.

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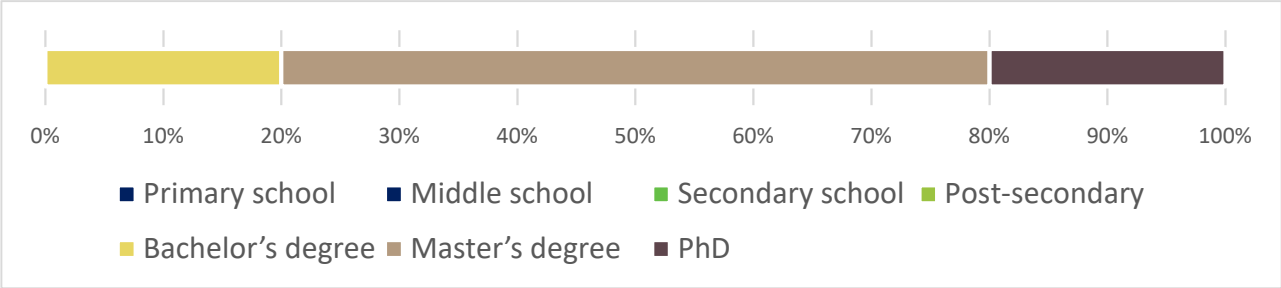
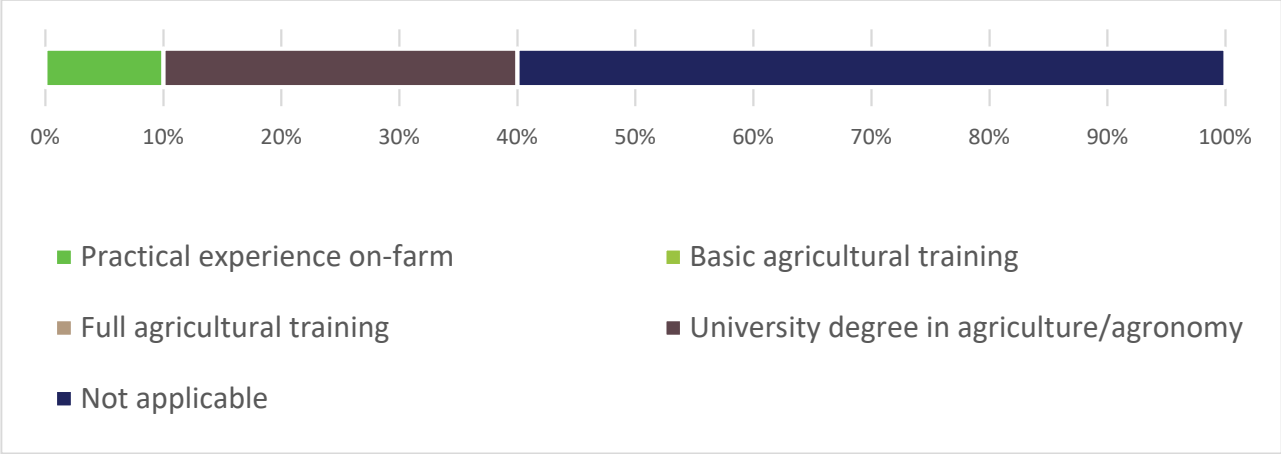
Q1.5 What is your highest formal completed education level? N=10



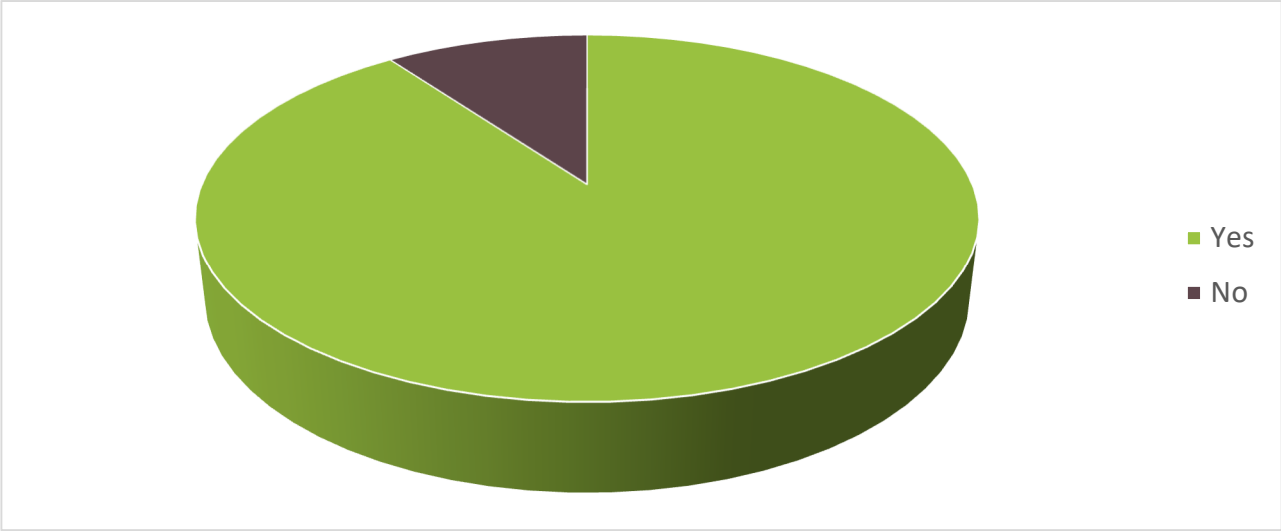
All participants have at least a Bachelor's degree.

Q1.6 What is your highest completed level of agricultural education? N=10



A total of 30% of the policy makers have a university degree in agriculture/agronomy.

Q1.7 Is communication part of your professional tasks? N=10



The majority of policy makers (90%) indicated that communication is part of their professional tasks.

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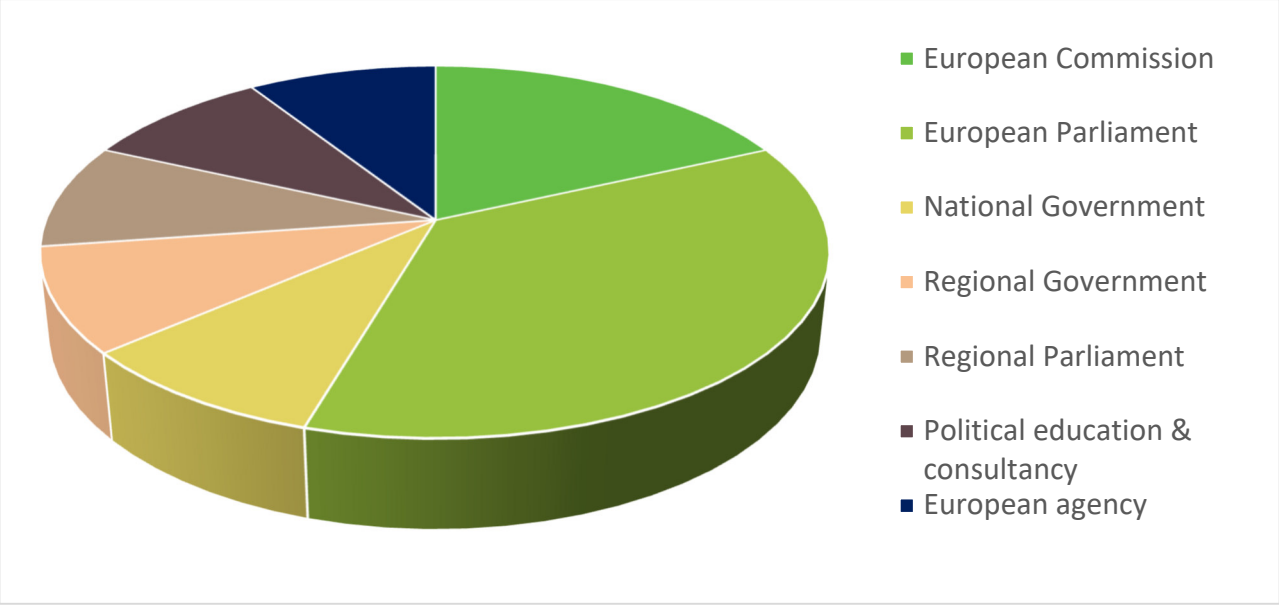
Q1.8 Which of the following best describes the governmental body you work for? N=11



A total of respectively 36% and 18% of the responses are from participants who work at the European Parliament and European Commission. The remaining responses are from participants who work at a National Government, Regional Parliament/Government, European agency or for political education and consultancy.

Q1.9 Nationality of the MEPs (related to Q1.8): (N=4)

(IT) 50%

(LU) 25%

(PT) 25%

The nationality of the MEPs who participated is Italian (50%), Portuguese (25%) and Luxembourgish (25%).

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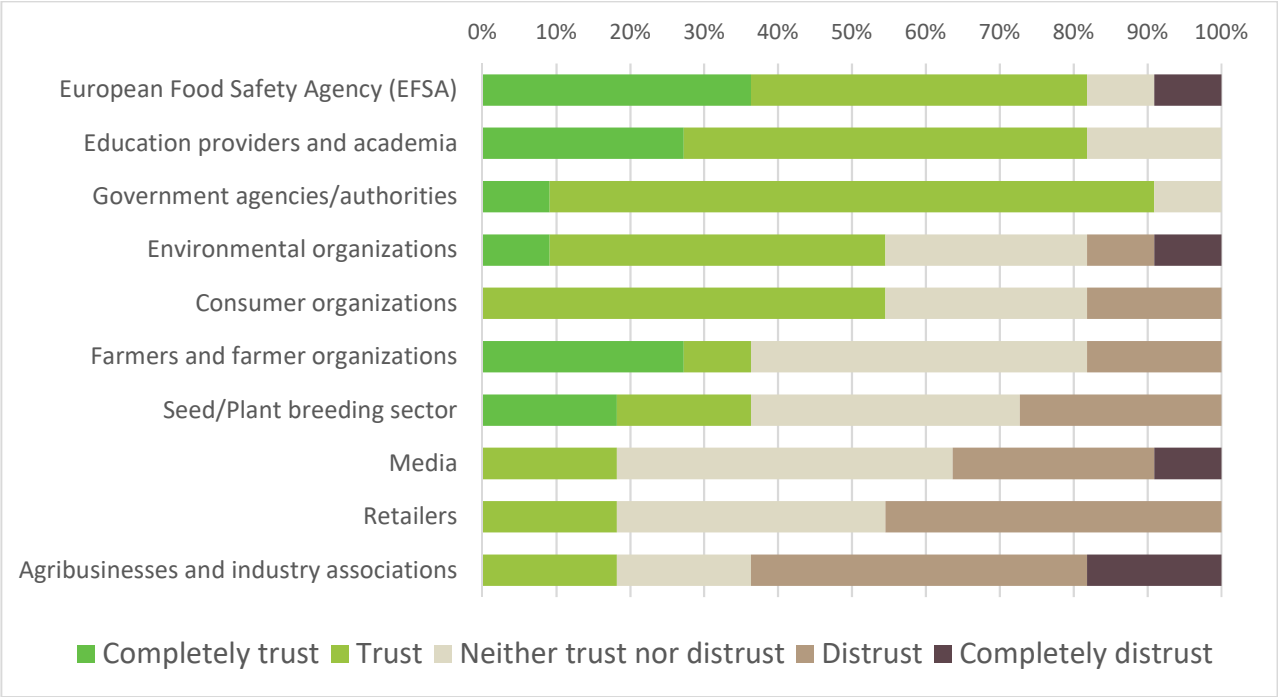
3.2 *General perception and knowledge of the SHG*

Q2.1 Please indicate your degree of trust in the following organizations regarding information and communication about food production in Europe. N=11



EFSA, education providers and academia, government agencies/authorities, environmental organizations, and consumer organizations have a median response of "trust" regarding the degree of trust of policy makers in information and communication about food production in Europe. Farmers and farmer organizations, seed/plant breeding sector, media, and retailers have a median response of "neither trust nor distrust", and agribusinesses and industry associations have a median response of "distrust". In addition, EFSA, education providers and academia, and farmers and farmer organizations have a response of "completely trust" in the first Quartile.

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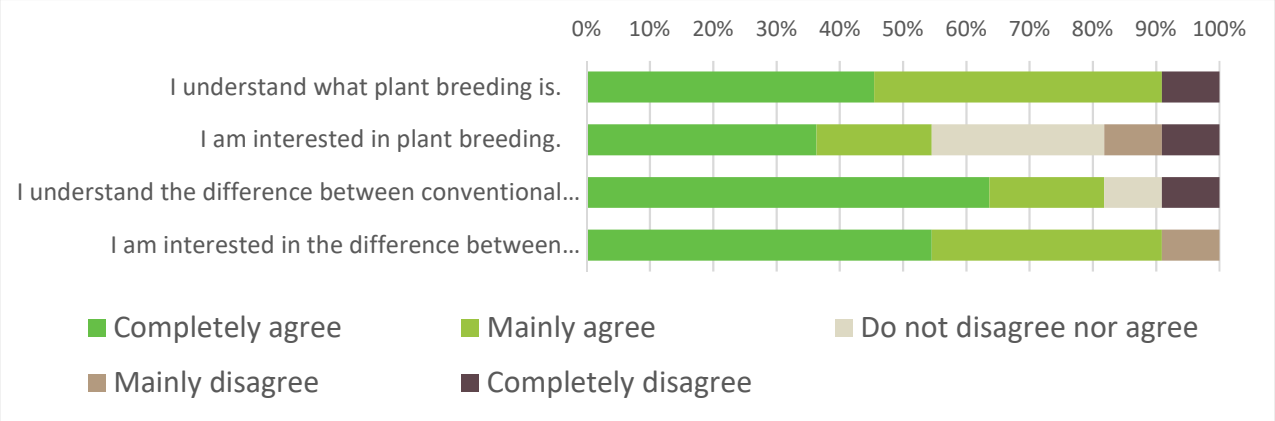
Q2.2 How do you self-assess your knowledge about plant breeding? N=11



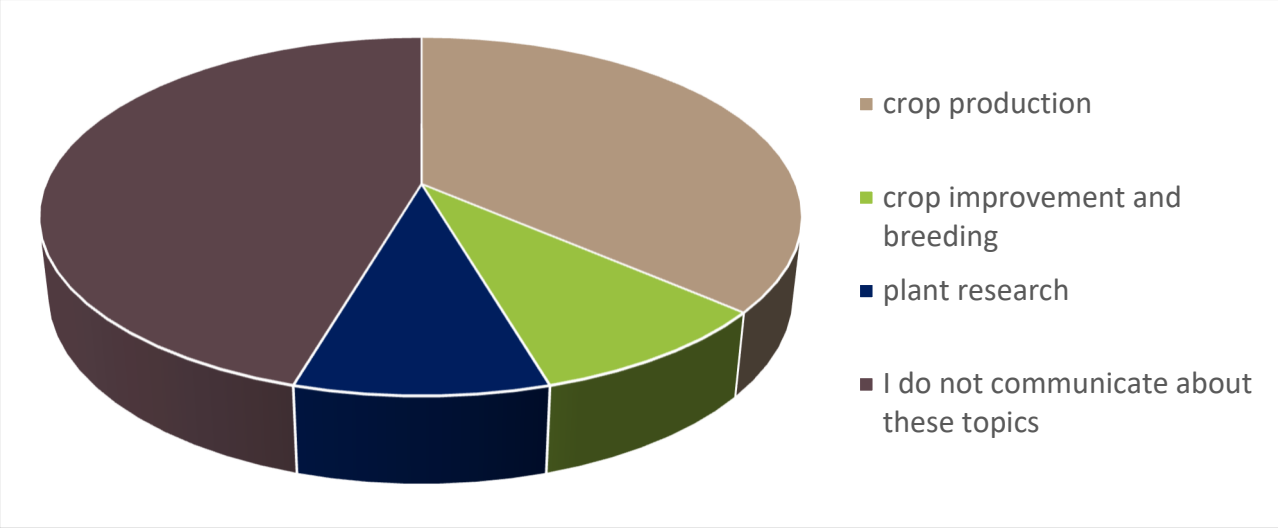
At least 80% of the policy makers completely agree or mainly agree with the statement that they understand what plant breeding is as well as what the difference is between conventional and new plant breeding methods.

Nearly 90% of the policy makers completely agree or mainly agree with the statement that they are interested in the difference between conventional and new plant breeding methods, while only 50% of the policy makers are interested in plant breeding (in general).

3.3 *Experience, opinion and needs of the SHG related to communication about different aspects of food systems*

3.3.1 Experience of the SHG on ongoing communication activities

Q3.1 On which topic do you have the most experience communicating? N=11



Nearly half of the policy makers responded that they do not communicate about plant research, crop improvement and breeding or crop production. Furthermore, respectively 36%, 9% and 9% of the policy makers indicated that they have most experience in communication about crop production, crop improvement and breeding, and plant research.

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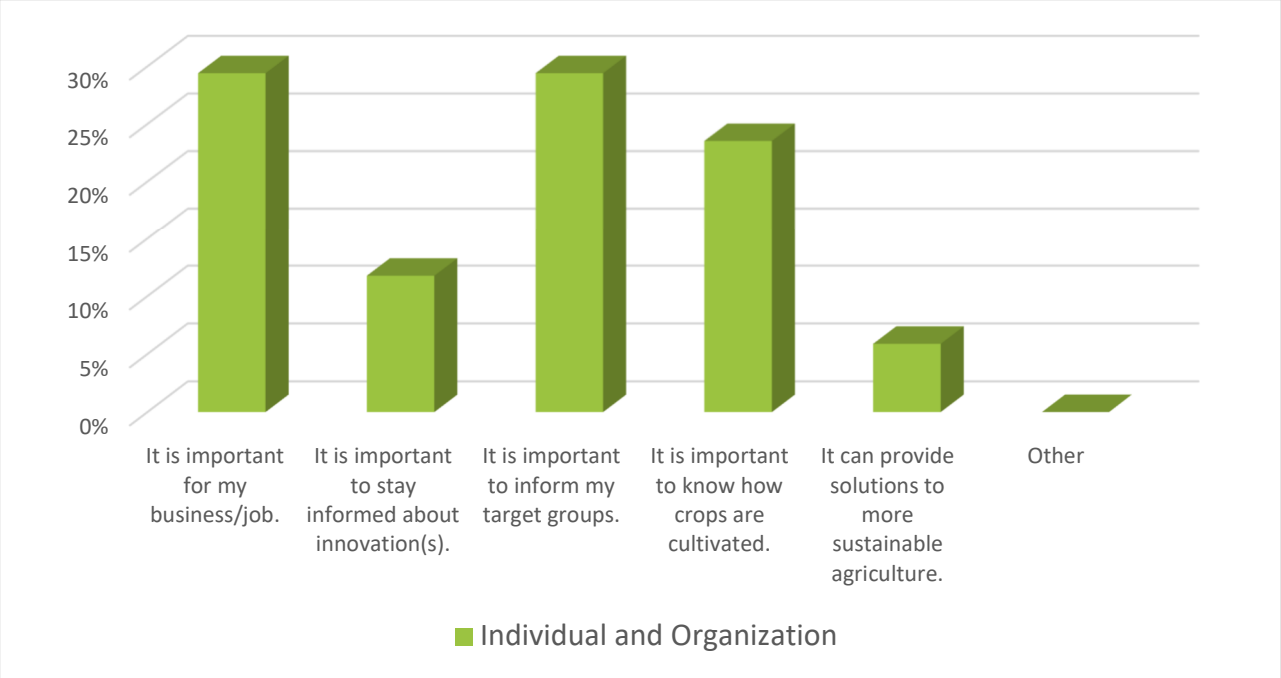
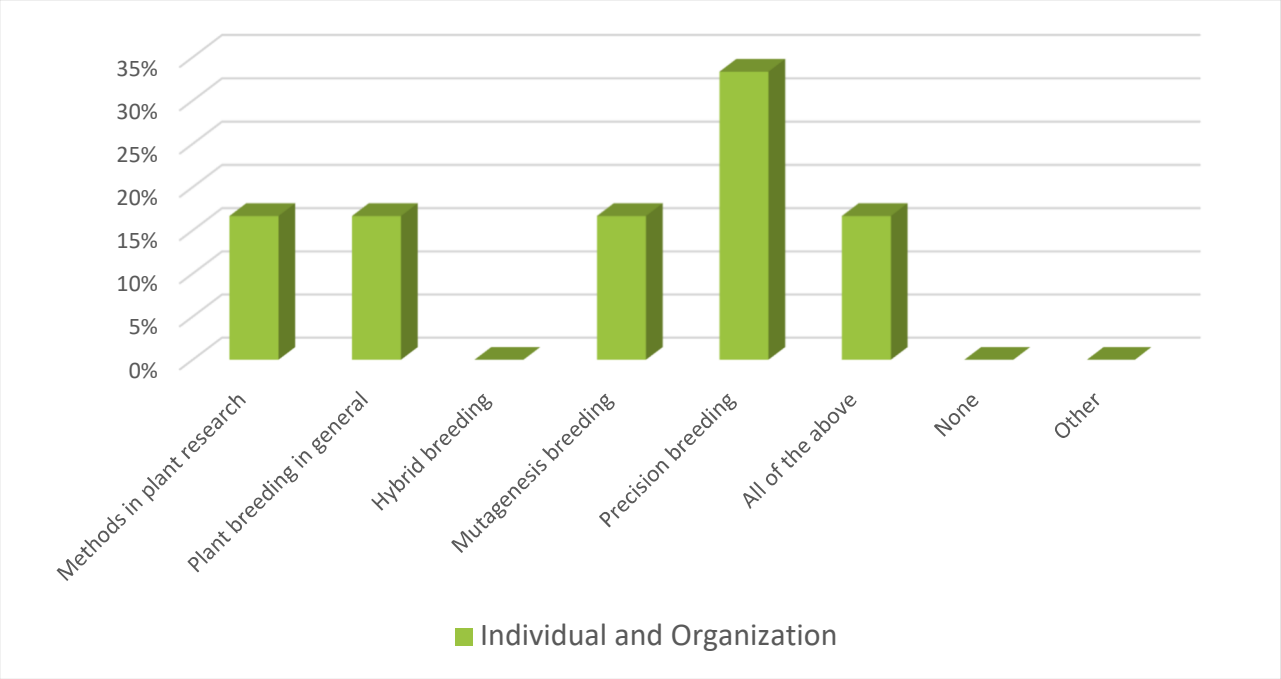
Q3.2 Why do you engage with others in communication about plant research, crop improvement and breeding or crop production? N=6



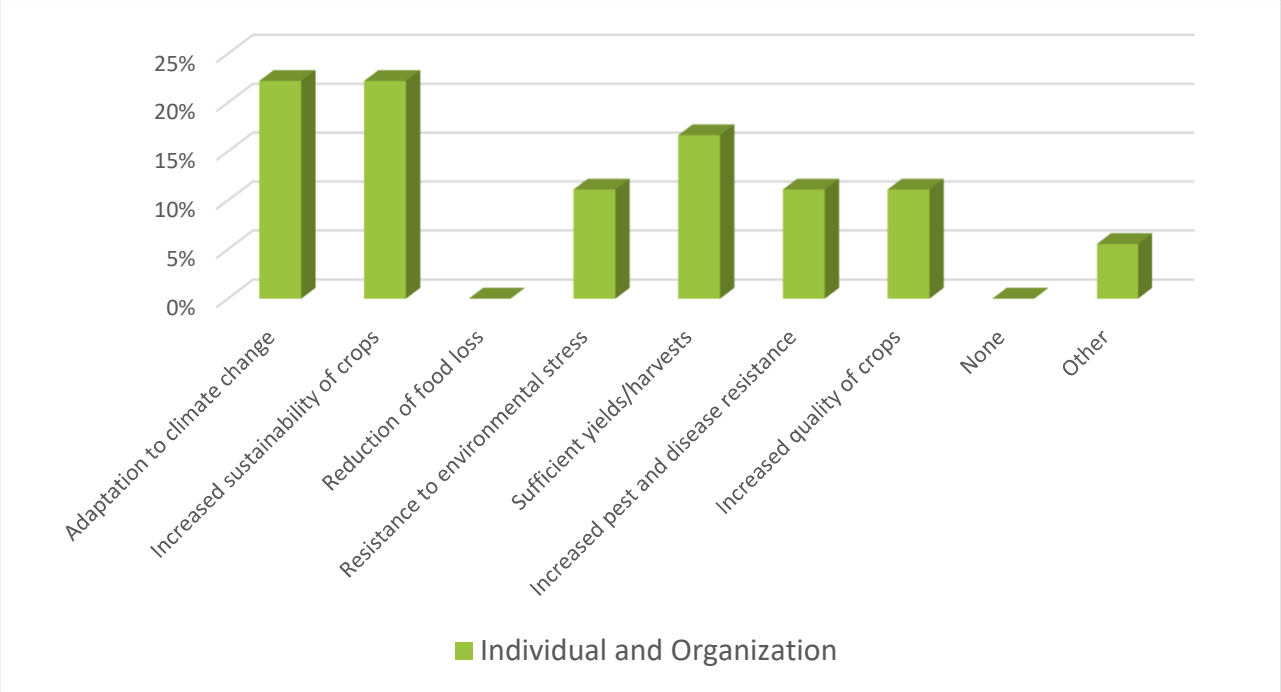
Policy makers indicated that they engage with others in communication about plant research, crop improvement and breeding or crop production because: "it is important for my business/job", and "it is important to inform my target groups".

Q3.3 About which of the following techniques of plant breeding do you communicate? N=6



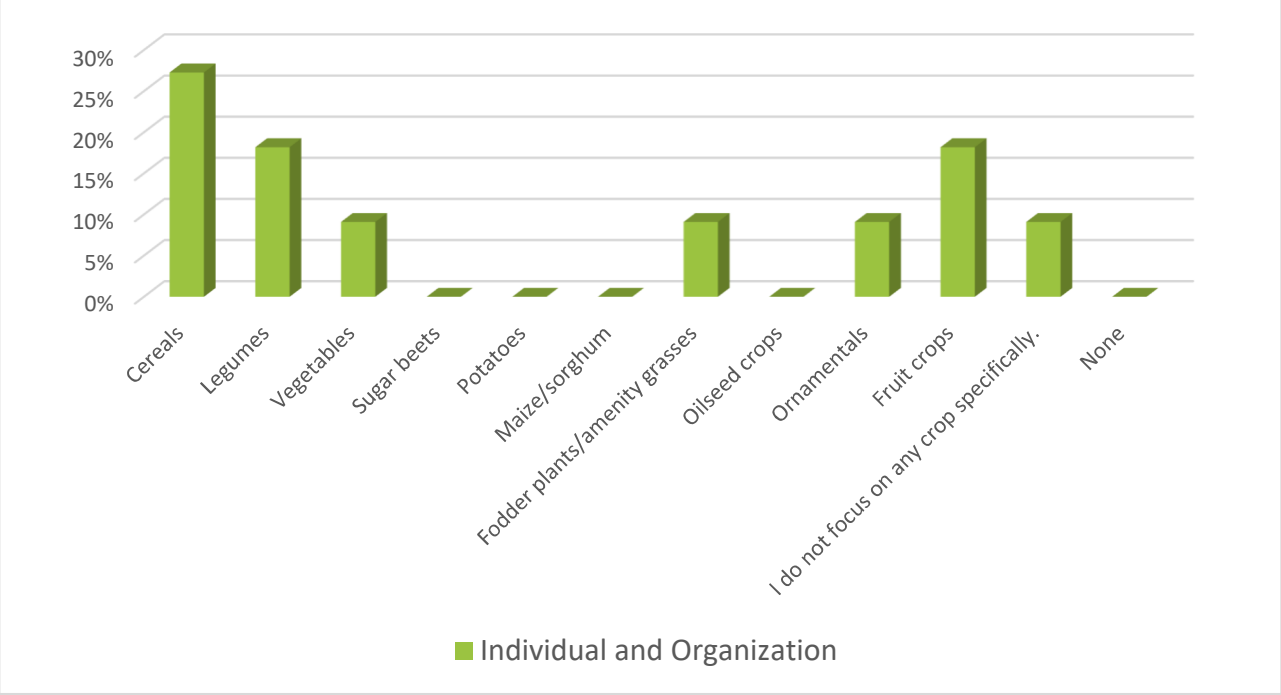
Policy makers communicate mainly about precision breeding.

Q3.4 About what crop characteristics do you mainly communicate? N=6



Policy makers communicate mainly about the crop characteristic "adaptation to climate change", "increased sustainability of crops", and "sufficient yields/harvests".

Q3.5 About which crops do you mainly communicate? N=6



Policy makers communicate mainly about cereals, and to a lesser extent about fruit crops, and legumes.

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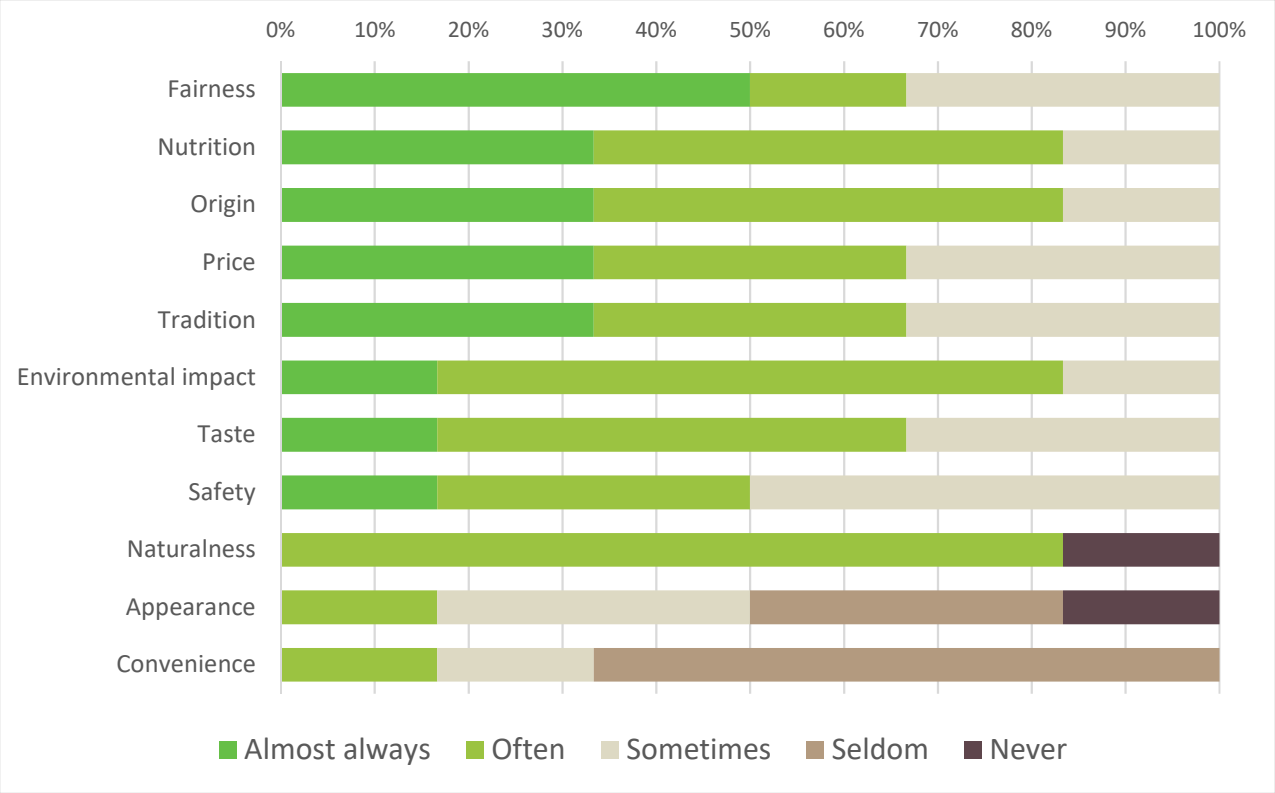
Q3.6 How frequently do you use the following food values in your communication about plant research, crop improvement and breeding or crop production? N=6



When policy makers were asked how frequently they use food values in their communication about plant research, crop improvement and breeding or crop production, fairness has a median response of "almost always", while the values: nutrition, origin, price, tradition, environmental impact, taste, safety, and naturalness have a median response of "often", and the values: appearance, and convenience have a median response of "sometimes". In addition, the options: fairness, nutrition, origin, price, and tradition have a response of "almost always" in the first Quartile.

Q3.7 Can you provide an example of a communication relating to plant research, crop improvement and breeding or crop production which, in your experience was effective? N=6

Wordcloud based on frequency of key words describing the respondent's answers:

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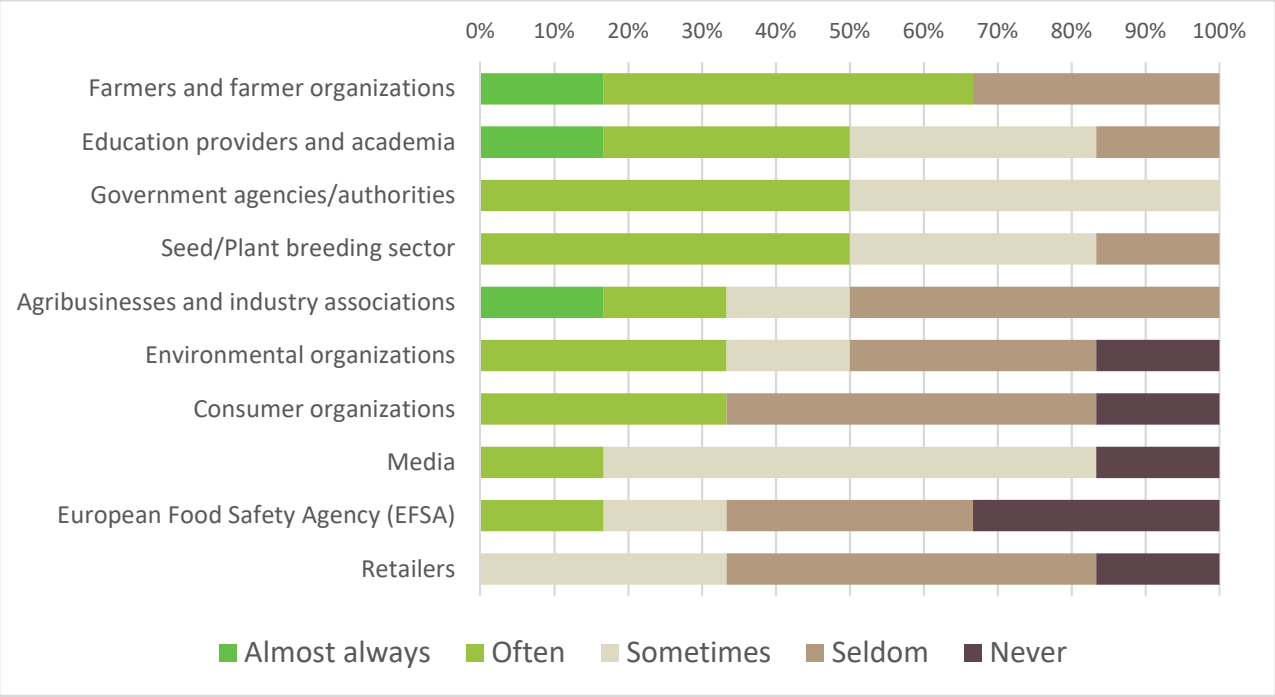
3.3.2 OPINION OF THE SHG ON ONGOING COMMUNICATION ACTIVITIES

Q4.1 How frequently do you use information from these stakeholders in your communication about plant research, crop improvement and breeding or crop production? N=6



When policy makers were asked how frequently they use information from various stakeholders in their communication, the stakeholders: farmer and farmer organizations, education providers and academia, government agencies/authorities, and seed/plant breeding sector have a median response of "often", while the stakeholders: agribusinesses and industry associations, environmental organizations, and media have a median response of "sometimes", and the stakeholders: EFSA, and retailers have a median reponse of "seldom".

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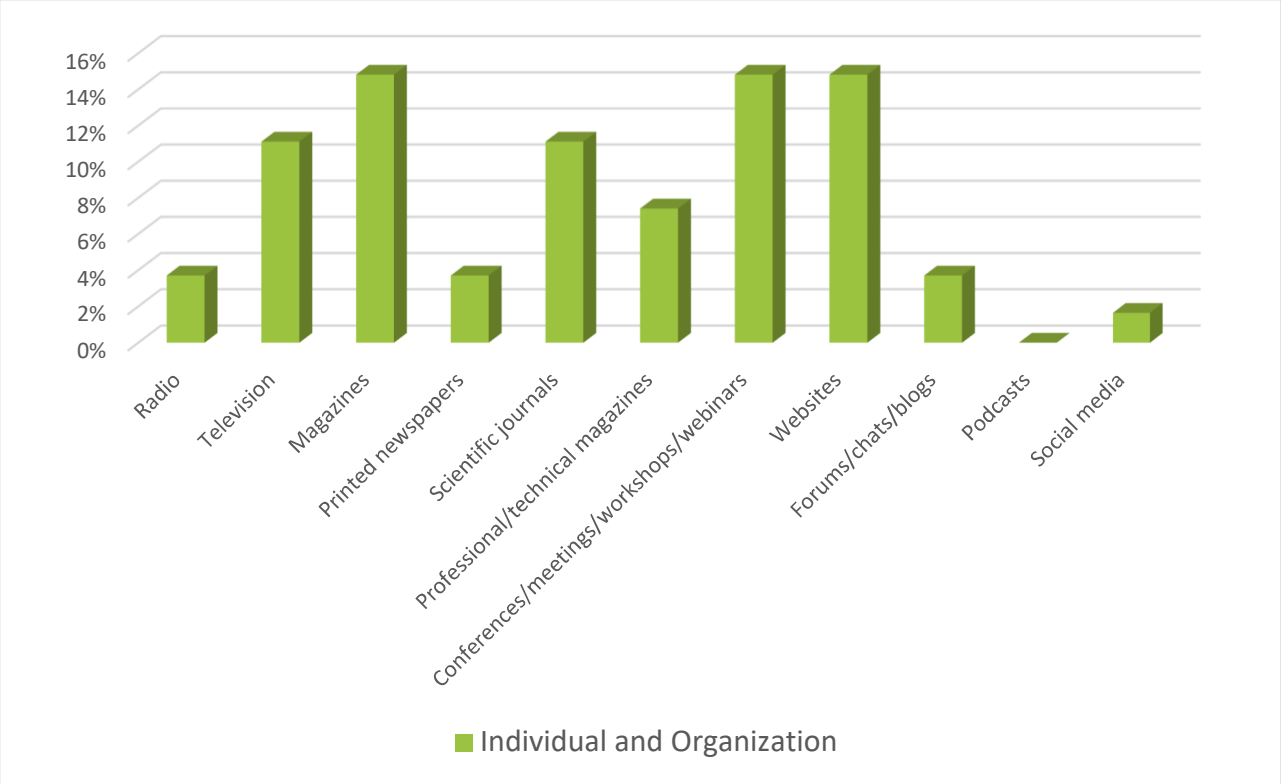
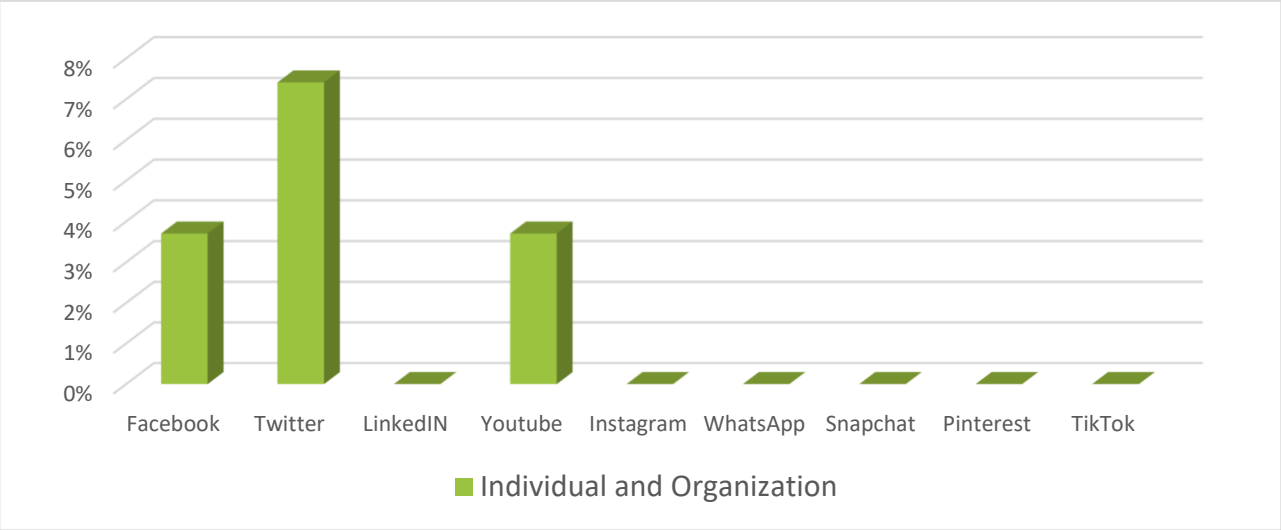
Q4.2 Which of the following channels do you use to learn about plant research, crop improvement and breeding or crop production? N=6

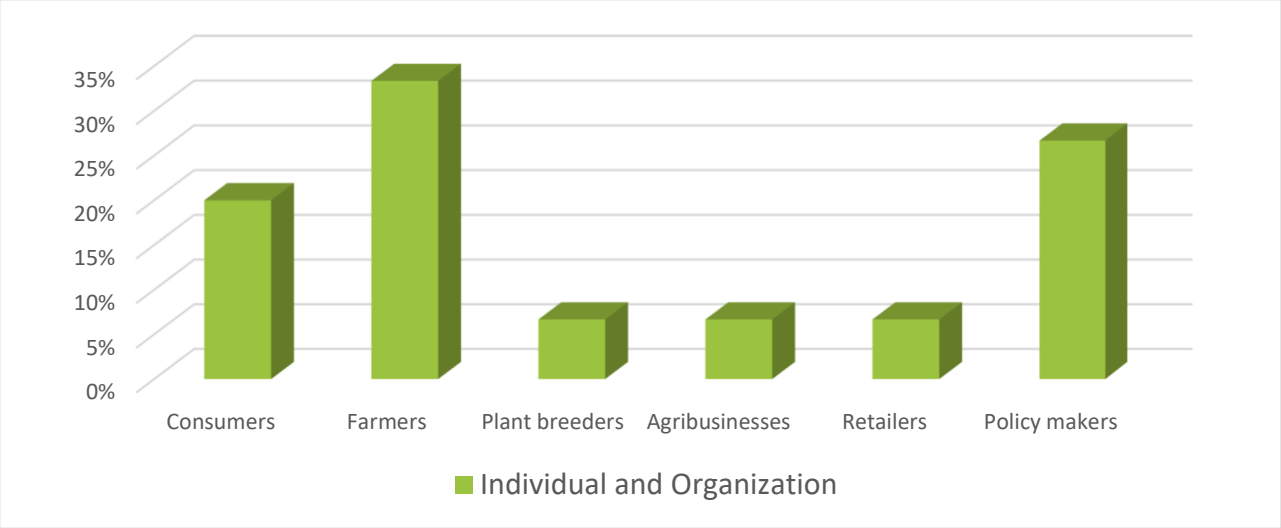


Policy makers use primarily the channels: magazines, conferences/meetings/workshops/ webinars, websites, scientific journals, and television to learn more about plant research, crop improvement and breeding or crop production.



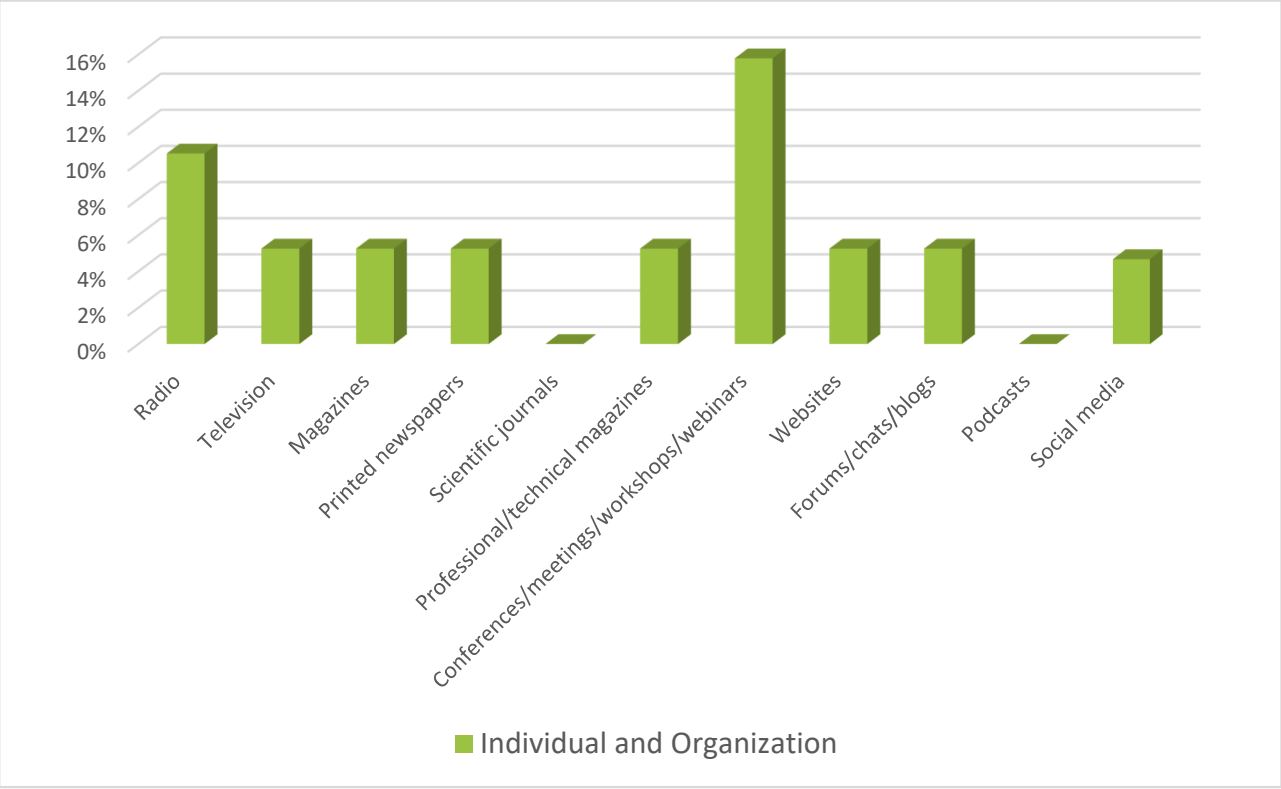
Policy makers use primarily the social media platform Twitter to learn more about plant research, crop improvement and breeding or crop production.

Q4.3 Which are your main target groups to communicate with about plant research, crop improvement and breeding or crop production? N=6



The main target groups of farmers and farmer organizations to communicate with about plant research, crop improvement and breeding or crop production are farmers, policy makers, and consumers.

Q4.4 Which of the following channels do you use to communicate with your main target groups about plant research, crop improvement and breeding or crop production? N=6



Policy makers use primarily the channels: conferences/meetings/workshops/webinars, and radio to communicate with their target groups about plant research, crop improvement and breeding or crop production.

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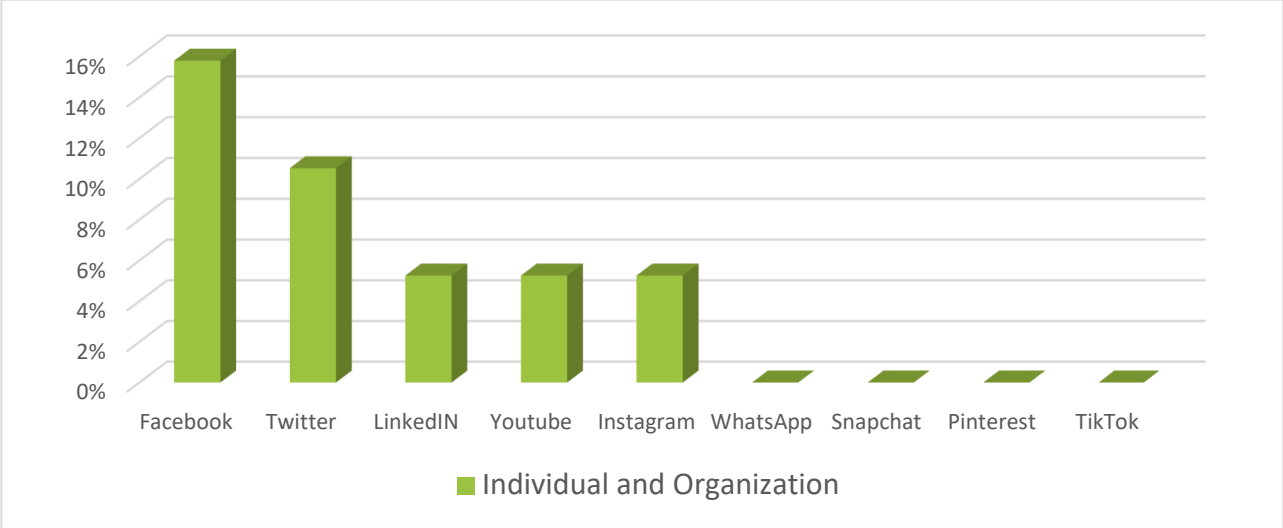
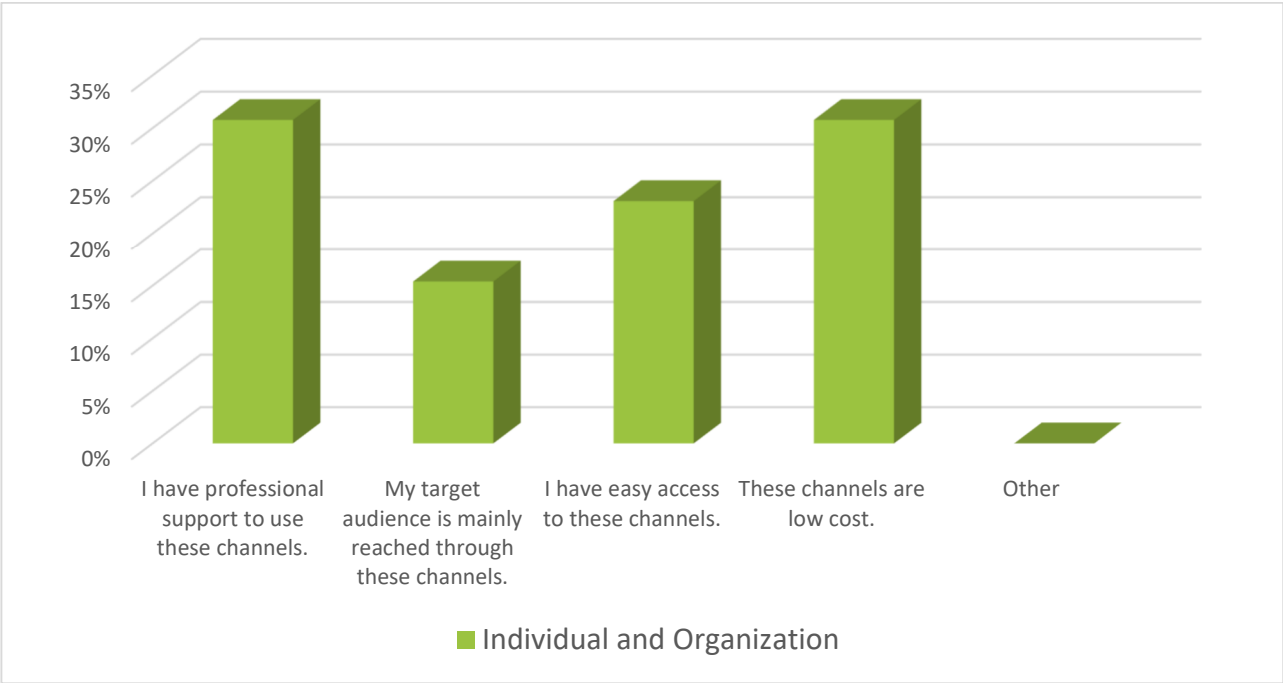


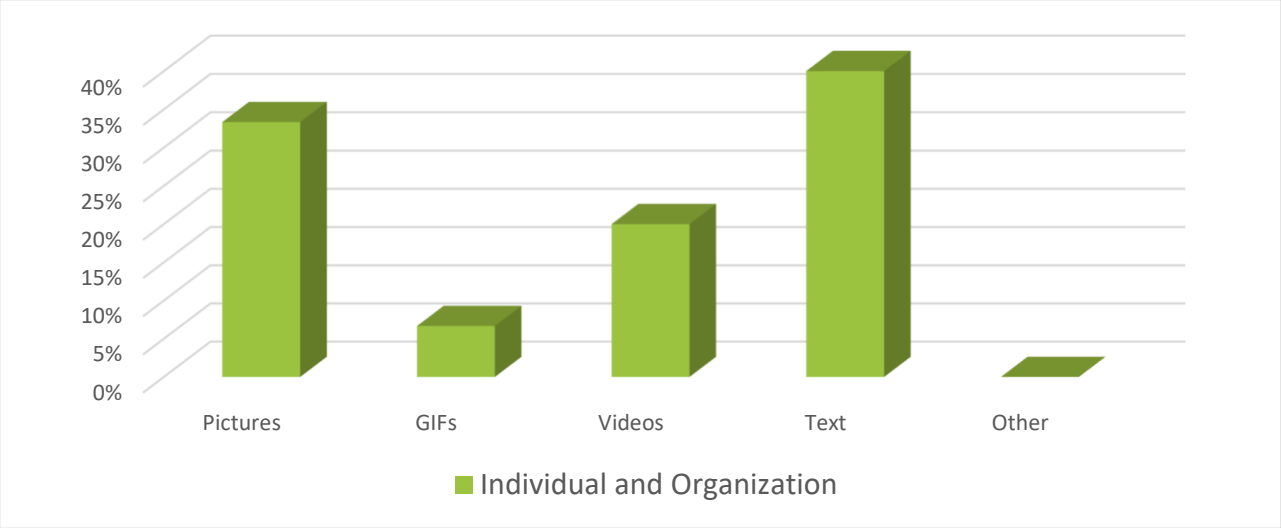
Policy makers use primarily the social media platforms: Facebook, Twitter and to a lesser extent LinkedIN, Youtube, and Instagram to communicate with their target groups about plant research, crop improvement and breeding or crop production.

Q4.5 Why do you specifically use these channels to communicate about plant research, crop improvement and breeding or crop production? N=6



Policy makers specifically use certain channels to communicate about plant research, crop improvement and breeding or crop production because "they have professional support to use these channels", and "these channels are low cost".

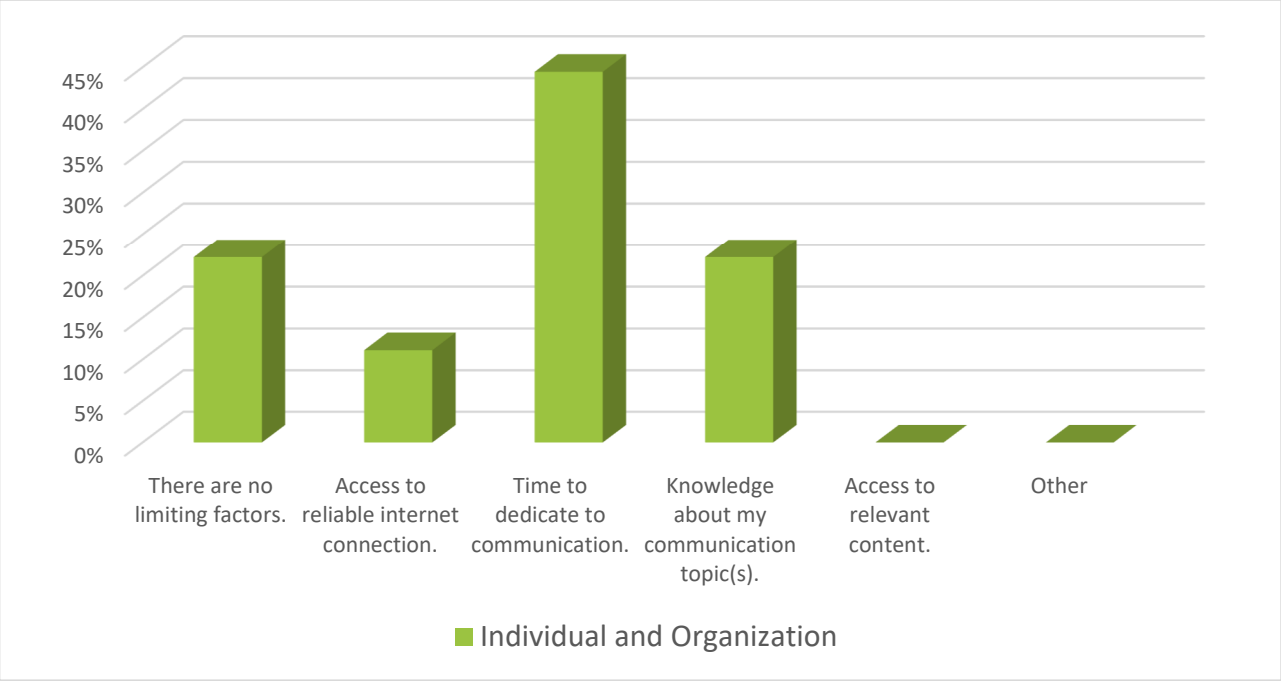
Q4.6 Which of the following tools do you use to communicate about plant research, crop improvement and breeding or crop production? N=6



Policy makers most frequently use text and pictures to communicate about plant research, crop improvement and breeding or crop production.

3.3.3 NEEDS OF THE SHG RELATED TO ONGOING COMMUNICATION ACTIVITIES

Q5.1 What are limiting factors for you to communicate to others? N=6



Policy makers their main limiting factor to communicate to others is time to dedicate to communication. To a lesser extent "knowledge about my communication topic(s)", and "there are no limiting factors" were indicated as limiting factors.

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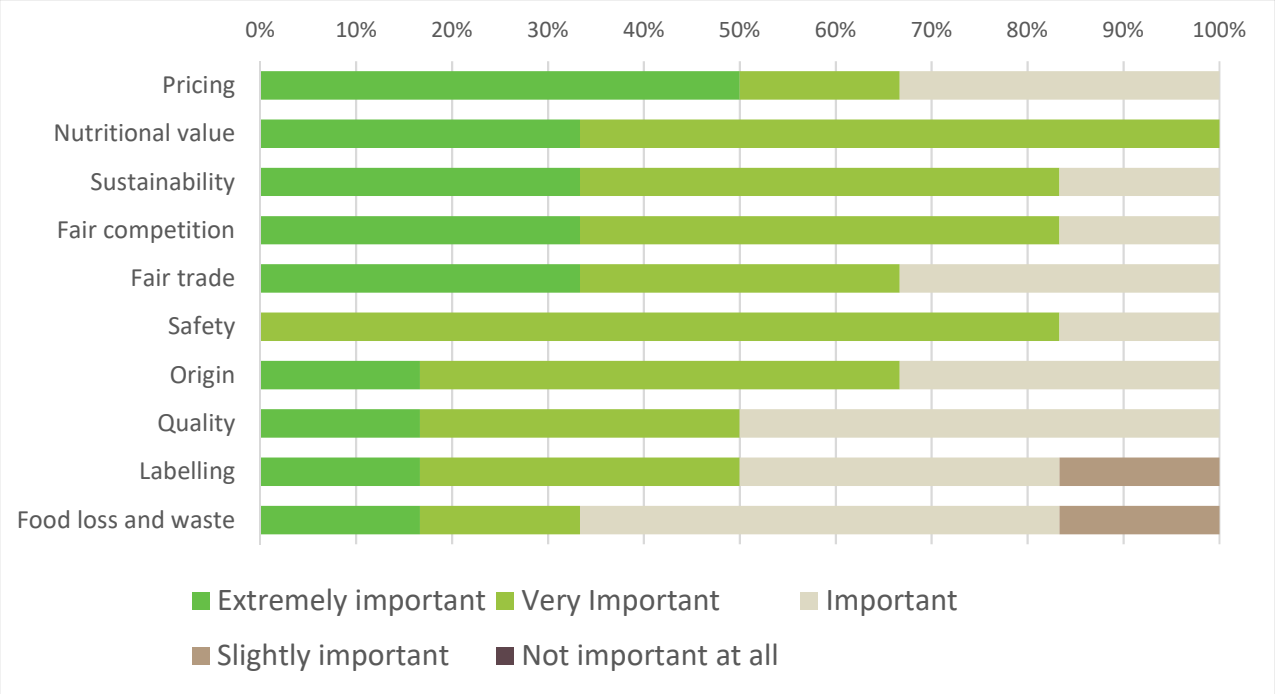
Q5.2 How do you rate the importance of addressing the following aspects through communication efforts? N=6



All options except food loss and waste have a median response of "very important" regarding their importance in communication efforts by policy makers. In addition, the options: pricing, nutritional value, sustainability, fair competition, and fair trade have a response of "extremely important" in the first Quartile.

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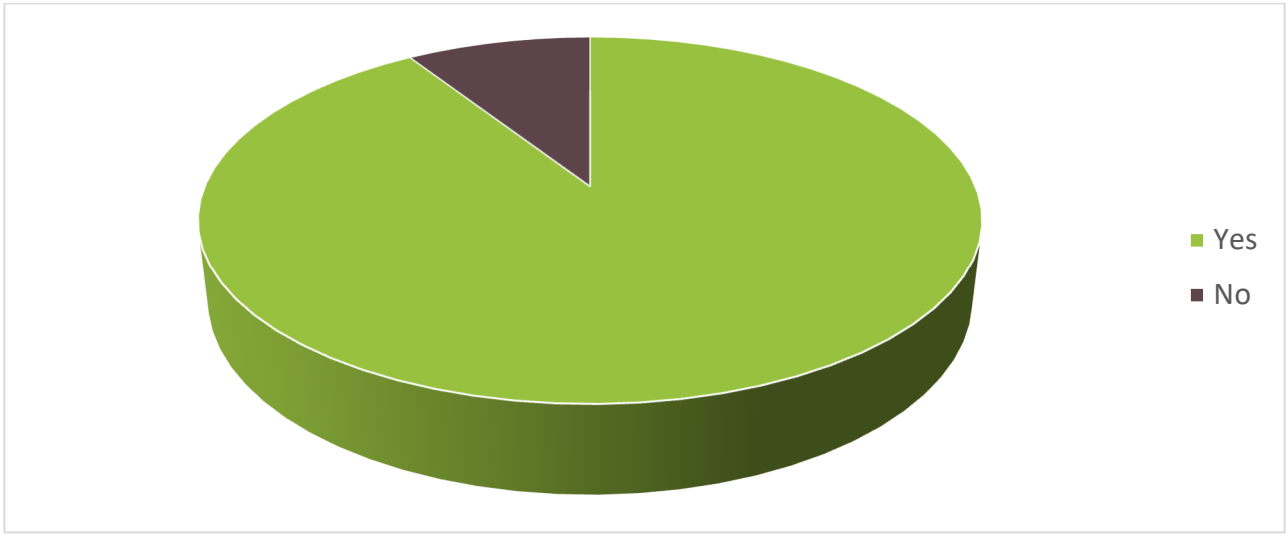
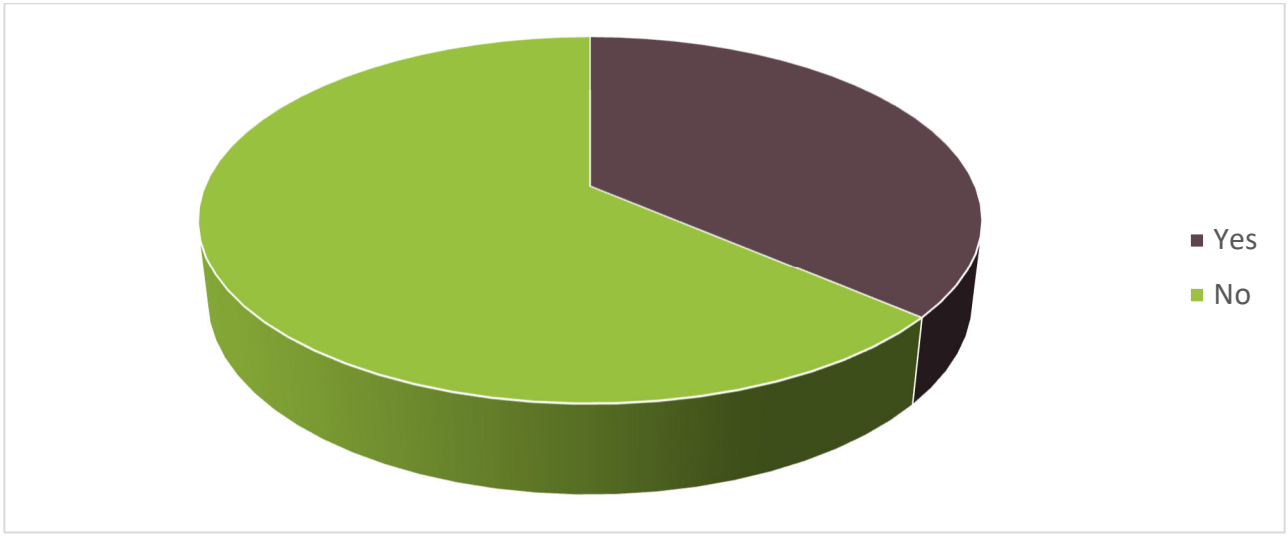
3.4 *Experience and opinion of the SHG related to communication about gene editing in plants*

Q6.1 Are you familiar with gene editing in plants? N=11



A total of 91% of the policy makers indicated that they are familiar with gene editing in plants.

Q6.2 Do you communicate about gene editing in plants? N=11



A total of 36% of the policy makers indicated that they communicate about gene editing in plants.

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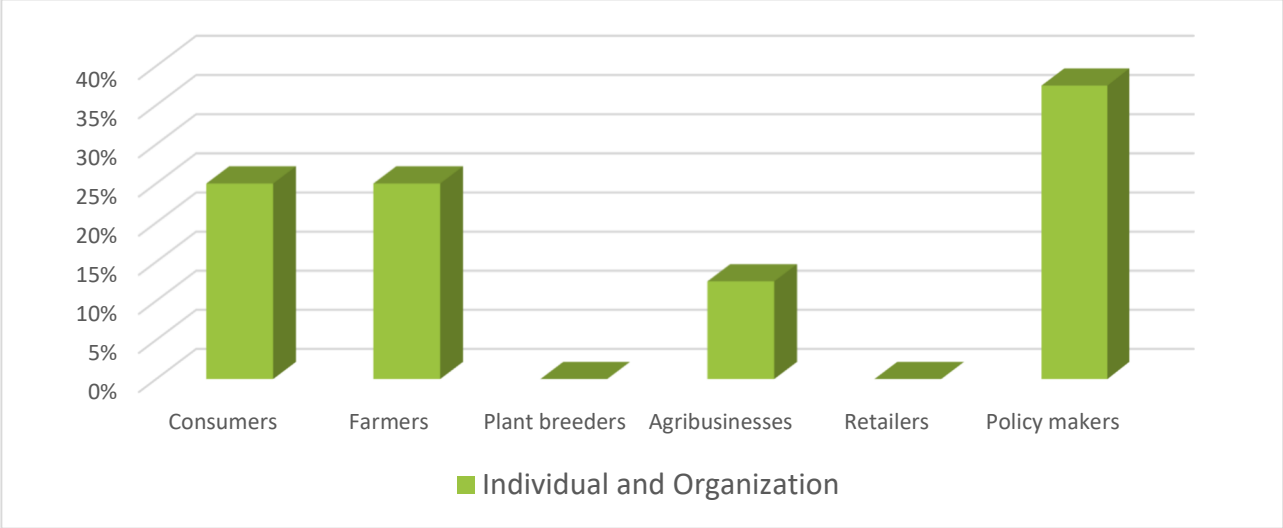
Q6.3 Which are your main target groups to communicate with about gene editing in plants? N=4



The main target groups of policy makers to communicate with about gene editing in plants are policy makers, farmers, and consumers.

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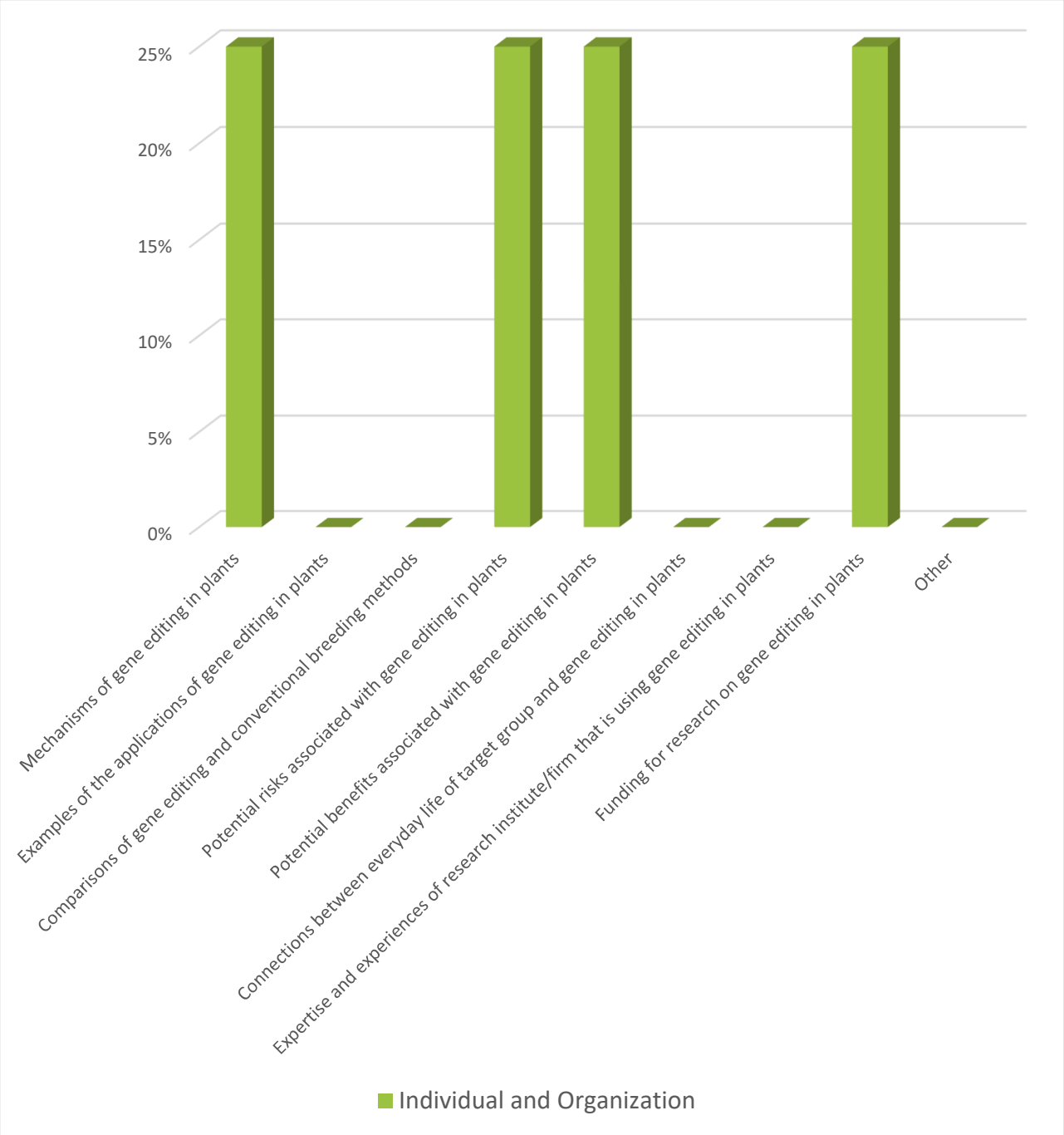
Q6.4 What specific topics are most important to you when communicating about gene editing in plants? N=4



Policy makers indicated that "mechanisms of gene editing in plants", "potential risks associated with gene editing in plants", "potential benefits associated with gene editing in plants", and "funding for research on gene editing in plants" are the most important topics when communicating about gene editing in plants.

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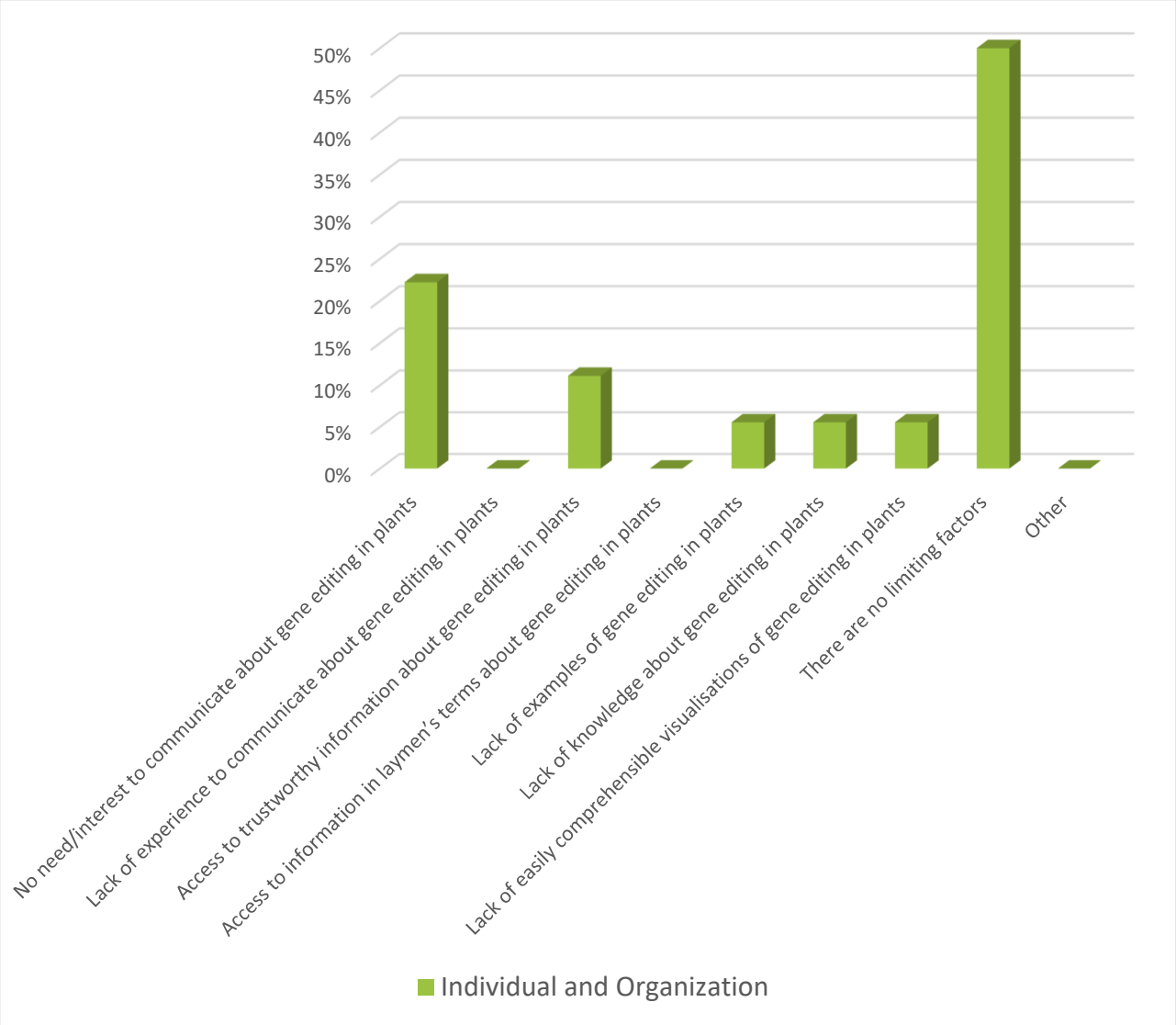
Q6.5 What are the main limiting factors for you to communicate about gene editing in plants? N=11



There are no main limiting factors for policy makers to communicate about gene editing in plants. To a lesser extent "no need/interest to communicate about gene editing in plants" was indicated as a limiting factor.

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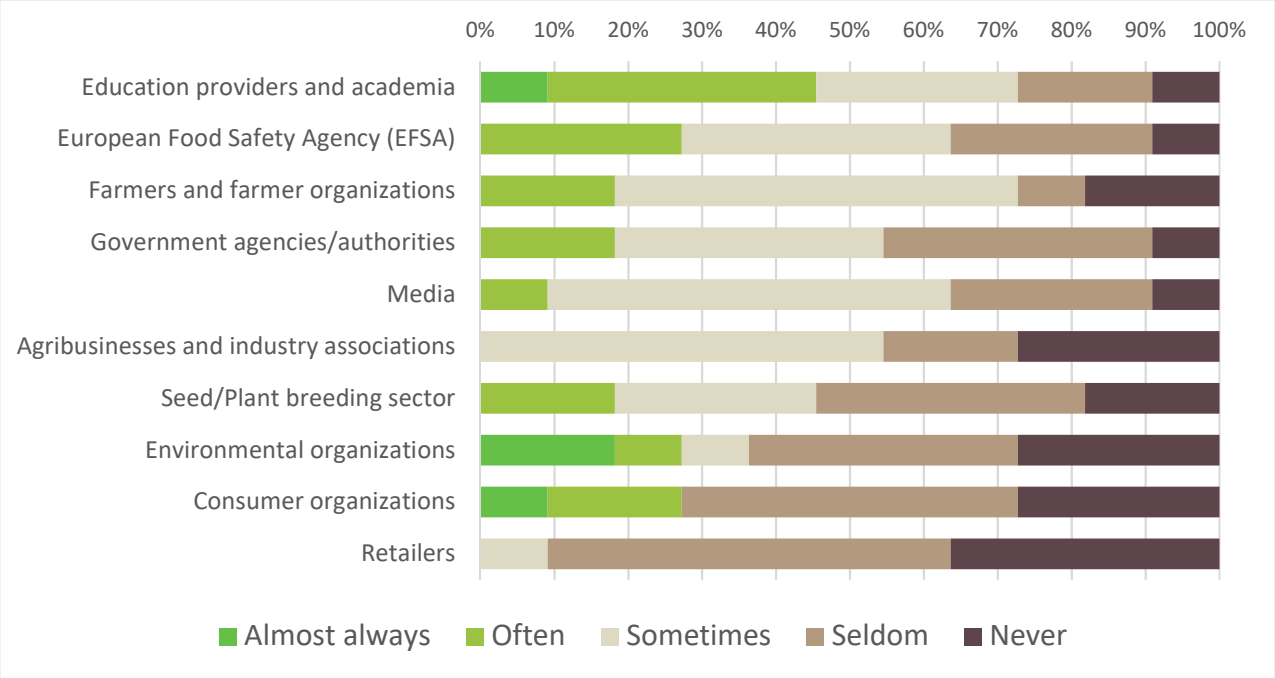
Q6.6 How frequently do you inform yourself by engaging with the following stakeholders on gene editing in plants? N=11



Education providers and academia, EFSA, farmers and farmer organizations, government agencies/authorities, media, and agribusinesses and industry associations have a median response of "sometimes" regarding how frequently policy makers engage with various stakeholders to inform themselves on gene editing in plants. The seed/plant breeding sector, environmental organizations, consumer organizations, and retailers have a median response of "seldom".

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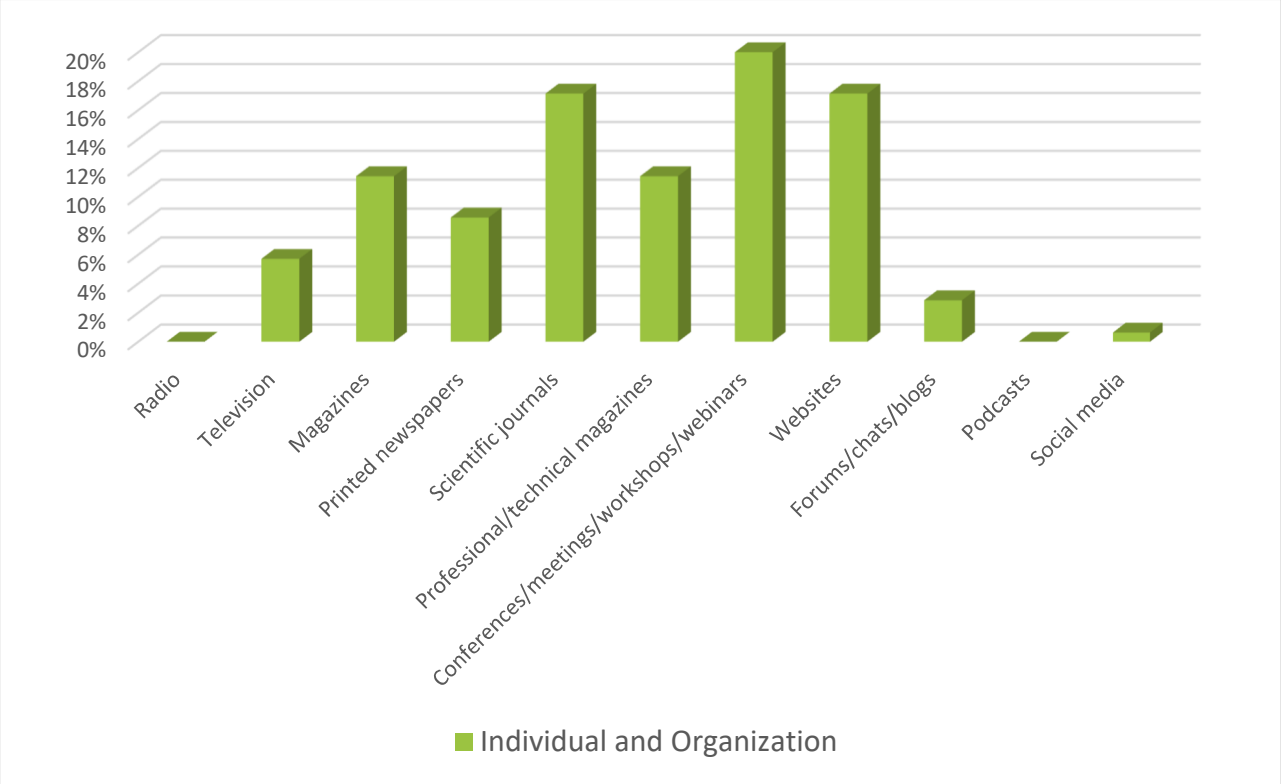
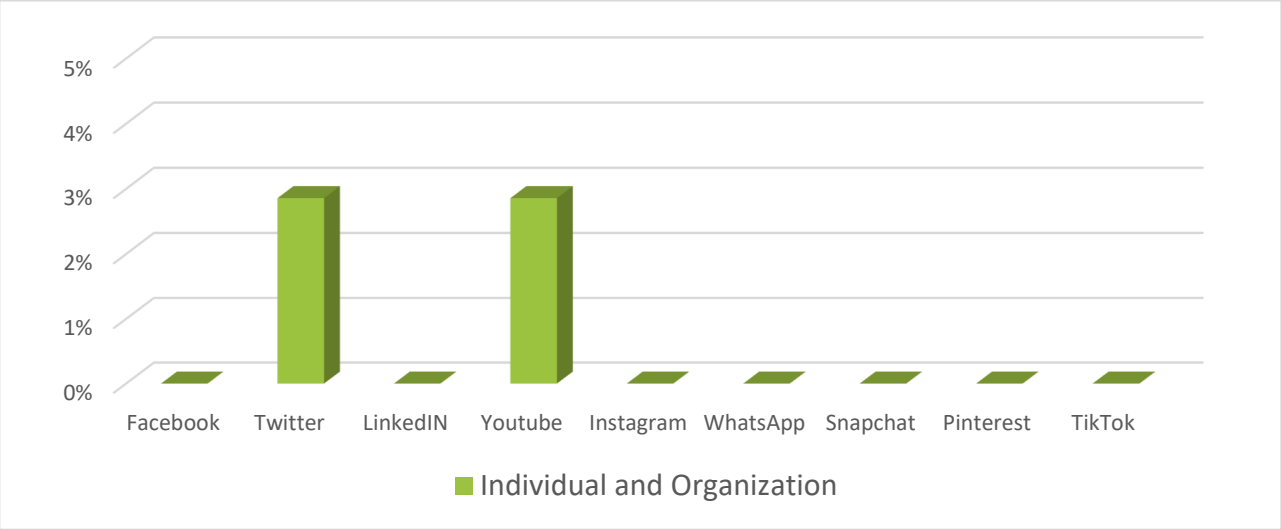
Q6.7 Which of the following channels do you use to learn about gene editing in plants? N=11



Policy makers use primarily the channels: conferences/meetings/workshops/webinars, scientific journals, websites, and (professional/technical) magazines to learn more about gene editing in plants.



No significant results. Threshold is 5,26%.

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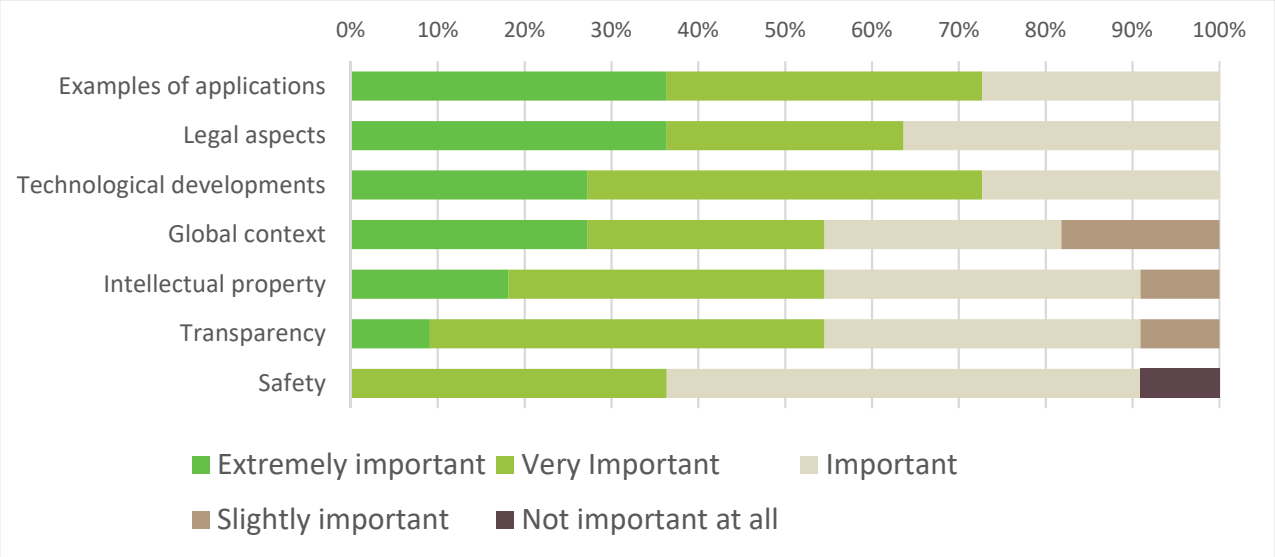
Q6.8 Which of the following aspects do you regard as important for communicating about gene editing in plants in the future? N=11



All the options except safety have a median response of "very important" regarding their importance in future communication about gene editing in plants by policy makers. In addition, the options: examples of applications, legal aspects, technological developments and global context have a response of "extremely important" in the first Quartile.

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4 INTEGRATIVE ANALYSIS OF THE SURVEY RESULTS FROM FARMERS, BREEDERS AND POLICY MAKERS

Q3.6 How frequently do you use the following food values in your communication about plant research, crop improvement and breeding or crop production?

	Naturalness	Taste	Price	Safety	Convenience	Nutrition	Tradition	Origin	Appearance	Environmental impact
≤44 years N=37	2,52	2,83	3,31	3,45	2,17	3,07	**2,14**	3,14	2,93	2,59
>45 years N=51	2,48	3,25	3,35	3,67	2,71	3,40	**2,85**	3,50	3,17	2,88

Q4.2 Which of the following channels do you use to learn about plant research, crop improvement and breeding or crop production?

	Radio	Television	Magazines	Printed newspapers	Scientific journals	Professional/technical magazines	Conferences/meetings/ workshops/webinars	Websites	Forums/chats/blogs	Podcasts
≤ 44 years N=37	3%	14%	**28%**	21%	69%	**55%**	**59%**	**62%**	7%	**21%**
> 45 years N=51	4%	13%	**17%**	23%	60%	**75%**	**77%**	**75%**	10%	**4%**
≤ Bachelor N=24	**10%**	**20%**	20%	**15%**	**45%**	**80%**	**60%**	**55%**	5%	5%
> Master N=66	**2%**	**11%**	21%	**25%**	**70%**	**63%**	**74%**	**75%**	11%	12%

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	Radio	Television	Magazines	Printed newspapers	Scientific journals	Professional/technical magazines	Conferences/meetings/ workshops/webinars	Websites	Forums/chats/blogs	Podcasts
All countries N=166	4%	10%	19%	20%	66%	75%	79%	75%	10%	9%
Germany N=50	4%	10%	20%	20%	73%	69%	86%	73%	8%	6%
France N=27	**9%**	9%	14%	**32%**	64%	82%	73%	68%	0%	5%
Poland N=14	0%	**0%**	**43%**	21%	57%	71%	71%	79%	14%	14%
Italy N=13	0%	9%	9%	**0%**	73%	91%	82%	73%	**0%**	**0%**
Romania N=10	0%	**20%**	**0%**	**0%**	**30%**	80%	70%	90%	**30%**	**30%**

	Facebook	Twitter	LinkedIN	Youtube	Instagram	WhatsApp	Snapchat	Pinterest	TikTok	
≤ 44 years N=37	10%	17%	28%	10%	7%	3%	0%	0%	3%	
> 45 years N=51	10%	13%	21%	8%	2%	8%	0%	0%	0%	
≤ Bachelor N=24	**20%**	20%	**10%**	10%	5%	5%	0%	0%	5%	
> Master N=66	**7%**	12%	**28%**	9%	4%	7%	0%	0%	0%	

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	Facebook	Twitter	LinkedIN	Youtube	Instagram	WhatsApp	Snapchat	Pinterest	TikTok	
All countries N=166	9%	13%	24%	12%	3%	4%	0%	0%	1%	
Germany N=50	6%	16%	24%	16%	4%	2%	0%	0%	2%	
France N=27	14%	**18%**	27%	**0%**	**0%**	**0%**	0%	0%	0%	
Poland N=14	**21%**	**0%**	**7%**	14%	7%	**0%**	0%	0%	0%	
Italy N=13	**18%**	9%	18%	18%	**9%**	9%	0%	0%	0%	
Romania N=10	10%	10%	20%	**20%**	**0%**	**20%**	0%	0%	0%	

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Q4.4 Which of the following channels do you use to communicate with your main target groups about plant research, crop improvement and breeding or crop production?

	Radio	Television	Magazines	Printed newspapers	Scientific journals	Professional/technical magazines	Conferences/meetings/ workshops/webinars	Websites	Forums/chats/blogs	Podcasts
≤ 44 years N=37	3%	7%	3%	**24%**	**17%**	**21%**	**55%**	34%	**7%**	3%
> 45 years N=51	10%	10%	4%	**10%**	**25%**	**54%**	**69%**	42%	**21%**	0%
≤ Bachelor N=24	10%	**20%**	0%	10%	15%	45%	60%	**25%**	10%	0%
> Master N=66	7%	**5%**	5%	18%	25%	40%	65%	**44%**	18%	2%

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	Radio	Television	Magazines	Printed newspapers	Scientific journals	Professional/technical magazines	Conferences/meetings/ workshops/webinars	Websites	Forums/chats/blogs	Podcasts
All countries N=166	7%	10%	6%	15%	17%	49%	65%	50%	12%	3%
Germany N=50	4%	**4%**	8%	16%	16%	39%	69%	43%	18%	2%
France N=27	**14%**	9%	9%	18%	**5%**	59%	50%	50%	**5%**	5%
Poland N=14	7%	7%	**0%**	14%	14%	50%	50%	79%	14%	0%
Italy N=13	9%	**27%**	**0%**	18%	**36%**	55%	91%	**27%**	9%	0%
Romania N=10	**0%**	**40%**	**0%**	**0%**	10%	40%	70%	40%	20%	**20%**

	Facebook	Twitter	LinkedIN	Youtube	Instagram	WhatsApp	Snapchat	Pinterest	TikTok	
≤ 44 years N=37	31%	24%	21%	3%	7%	17%	0%	0%	3%	
> 45 years N=51	31%	21%	27%	6%	8%	15%	0%	0%	0%	
≤ Bachelor N=24	**40%**	**35%**	**15%**	0%	10%	20%	0%	0%	5%	
> Master N=66	**28%**	**18%**	**28%**	7%	7%	14%	0%	0%	0%	

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	Facebook	Twitter	LinkedIN	Youtube	Instagram	WhatsApp	Snapchat	Pinterest	TikTok	
All countries N=166	34%	26%	25%	8%	9%	11%	0%	0%	1%	
Germany N=50	29%	27%	18%	**6%**	8%	10%	0%	0%	2%	
France N=27	32%	27%	**36%**	**5%**	9%	14%	0%	0%	0%	
Poland N=14	**79%**	**7%**	**7%**	14%	**0%**	7%	0%	0%	0%	
Italy N=13	18%	9%	27%	**9%**	**18%**	**9%**	0%	0%	0%	
Romania N=10	30%	**10%**	**10%**	10%	**0%**	**30%**	0%	0%	0%	

Q6.7 Which of the following channels do you use to learn about gene editing in plants?

	Radio	Television	Magazines	Printed newspapers	Scientific journals	Professional/technical magazines	Conferences/meetings/ workshops/webinars	Websites	Forums/chats/blogs	Podcasts
≤ 44 years N=37	0%	**14%**	11%	14%	**54%**	**51%**	**43%**	51%	**5%**	8%
> 45 years N=51	0%	**2%**	10%	10%	**73%**	**73%**	**63%**	55%	**16%**	0%
≤ Bachelor N=24	0%	4%	9%	13%	**57%**	70%	**39%**	**26%**	9%	0%
> Master N=66	0%	8%	11%	11%	**68%**	62%	**60%**	**63%**	12%	5%

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	Radio	Television	Magazines	Printed newspapers	Scientific journals	Professional/technical magazines	Conferences/meetings/ workshops/webinars	Websites	Forums/chats/blogs	Podcasts
All countries N=166	2%	6%	10%	11%	64%	70%	64%	58%	10%	7%
Germany N=50	**6%**	4%	12%	16%	72%	66%	64%	52%	16%	10%
France N=27	4%	4%	15%	19%	67%	74%	52%	52%	**4%**	**0%**
Poland N=14	0%	**0%**	7%	7%	57%	71%	71%	71%	0%	7%
Italy N=13	0%	10%	**0%**	**0%**	50%	70%	40%	60%	10%	**30%**
Romania N=10	0%	**0%**	8%	**0%**	77%	77%	77%	54%	15%	**0%**

	Facebook	Twitter	LinkedIN	Youtube	Instagram	WhatsApp	Snapchat	Pinterest	TikTok	
≤ 44 years N=37	11%	16%	16%	8%	5%	5%	0%	0%	0%	
> 45 years N=51	4%	8%	12%	8%	0%	6%	0%	0%	0%	
≤ Bachelor N=24	13%	17%	9%	4%	4%	4%	0%	0%	0%	
> Master N=66	5%	9%	15%	9%	2%	6%	0%	0%	0%	

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All countries N=166	5%	10%	15%	10%	1%	4%	0%	0%	0%	
Germany N=50	4%	**16%**	10%	14%	2%	**0%**	0%	0%	0%	
France N=27	4%	4%	19%	**0%**	0%	7%	0%	0%	0%	
Poland N=14	14%	**0%**	**7%**	**0%**	**7%**	**0%**	0%	0%	0%	
Italy N=13	**0%**	0%	15%	15%	0%	8%	0%	0%	0%	
Romania N=10	**20%**	10%	20%	10%	0%	**20%**	0%	0%	0%	

Q6.8 Which of the following aspects do you regard as important for communicating about gene editing in plants in the future?

	Technological developments	Examples of applications	Safety	Legal aspects	Intellectual property	Transparency	Global context
Professional experience in communication N=66	3,71	3,88	3,92	**3,35**	**3,27**	3,82	3,55
No professional experience in communication N=22	3,82	3,95	4,18	**2,86**	**2,73**	3,50	3,36