

TOMRES

A novel and integrated approach to increase multiple and combined stress tolerance in plants using tomato as a model

September 2019

WP6 -Outreach, dissemination and capacity building



DELIVERABLE D6.5
**TOMRES opinion paper (policy brief) concerning
research policy and regulatory issues**



TOMRES has received funding by the European Union's Horizon 2020 Research and Innovation programme under Grant Agreement N°727929

Document Information

Grant Agreement Number	727929	Acronym	TOMRES	
Full Title of the project	A novel and integrated approach to increase multiple and combined stress tolerance in plants using tomato as a model			
Call identifier	Horizon 2020-SFS-2016-2, Topic SFS-01-2016 "Solutions to multiple and combined stresses in crop production"			
Start Date	01/06/2017	Duration	42 months	
Project Website	www.tomres.eu			
Project Coordinator	Andrea Schubert, DISAFA, Università degli Studi di Torino (UNITO), Italy			
Deliverable	D6.5 TOMRES opinion paper (policy brief) concerning research policy and regulatory issues			
Work Package	WP6 - Outreach, dissemination and capacity building			
Objective of the document	Report on key recommendations of TOMRES partners to policy makers at European and national level.			
Date of Delivery	Contractual	31/08/2019	Actual	30/09/2019
Type	Report	Dissemination Level	Public	
Lead Beneficiary	European Plant Science Organisation, EPSO			
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Version	1.0	Issue date	30/09/2019	
Changes	\\			



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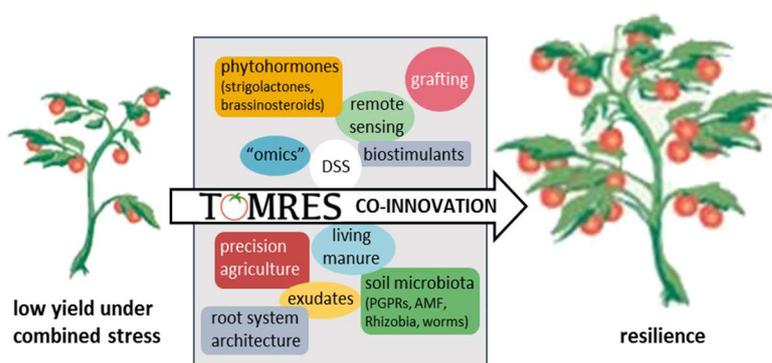
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TOMRES Project Summary

Tomato is a main EU agricultural commodity, cultivated all over Europe in open and protected field and in glasshouses, representing a biological and agronomical model crop. Combined water and nutrient stress is a major problem for tomato farmers and solutions are needed to safeguard yields, while preserving the environment.

The overall goal of TOMRES is to enhance resilience to combined water and nutrient stress in tomato and to maximize water (WUE) and nutrient use efficiency (NUE) by designing and testing in the field (open and protected) novel combinations of genotypes and management practices reducing the environmental impact of agricultural activities.



To this aim, TOMRES will select, among over 10,000 available accessions, rootstocks and scions tolerating combined stress, while retaining fruit quality and yield, taking advantage of innovative screening approaches. Novel traits, in particular belowground, to be exploited in breeding, will be identified. The role of selected hormones (strigolactones and brassinosteroids) will be studied to identify further resilience traits. TOMRES will test and optimize sustainable crop management strategies such as legume intercropping, precision fertilization and irrigation techniques, manipulation of symbiotic microorganisms, and the use of rootstocks more suited to water and nutrient uptake from the soil.

Novel genotypes X management strategies will be developed with the goal of reducing N and P application by at least 20%, water input by 40%, while granting environmental sustainability and economic viability of the solutions proposed. Testing will be integrated with analysis of environmental (greenhouse emissions, water quality), and of socio-economic impact. Agronomical, environmental, and economical data will be processed to construction of models and of a Decision Support System.

Demonstration and dissemination activities will follow the whole course of the project, and will transfer the results to different environments and other cropping systems, thus ensuring the widest impact of the gained knowledge on the EU economy. Trans-disciplinary knowledge transfer among farmers, breeders, industries, associations and scientists will be granted by a solid multi-actor approach since the planning stage.

Tab.1 TOMRES Project Partners

No	Participant organisation name (and acronym)	Country
1 (C*)	Università degli Studi di Torino (UNITO)	Italy
2	Agricultural University of Athens (AUA)	Greece
3	Agroilla SAT (AGROILLA)	Spain
4	Casella Macchine Agricole Srl (CASELLA)	Spain
5	Confederazione Generale dell'Agricoltura Italiana (CONFRAGRICOLTURA)	Italy
6	Edypro Fertilisantes Srl	Spain
7	Europese Organisatie Voor Wetenschappelijk Plantenonderzoek (EPSO)	Belgium
8	Gaia Epicheirein Anonymi Etaireia Psifiakon Ypiresion (GAIA)	Greece
9	Gautier Semences SAS (GAUTIER)	France
10	Institut Jozef Stefan (JSI)	Slovenia
11	Institut National de la Recherche Agronomique (INRA)	France
12	Neurather Gärtner GbR (NEURATHER)	Germany
13	Novareckon Srl (NOVARECKON)	Italy
14	Raffaele Tamburrino (TAMBURRINO)	Italy
15	Research and Development Institute for Processing and Marketing of the Horticultural Products Horting (HORTING)	Romania
16	Rheinische Friedrich-Wilhelms-Universität Bonn (UBO)	Germany
17	STC Research Foundation (STC)	United Kingdom
18	Strigolab Srl (STRIGOLAB)	Italy
19	Technion – Israel Institute of Technology (TECHNION)	Israel
20	The Hebrew University of Jerusalem (HUJ)	Israel
21	The James Hutton Institute (JHI)	United Kingdom
22	The University of Nottingham (UNO)	United Kingdom
23	Università degli Studi di Milano (UMIL)	Italy
24	Università degli Studi di Napoli Federico II (UNA)	Italy
25	Universitat de Les Illes Balears (UIB)	Spain

*Coordinating institution



Policy Brief

Partners of the TOMRES project make the following four key recommendations to policy makers at European and national level:

1- Combine genetic, molecular, ecological and agronomic strategies for smart agriculture benefiting the environment as well as Food and Nutritional Security

- Encourage contributions from plant scientists to help boosting water- and nutrient-use efficiency of agricultural crops and to improve resource stewardship for resilient production in agriculture, horticulture and forestry.
- Encourage contributions from (plant) scientists to help improving not only the environmental footprint, but as well Food and Nutritional Security
- Develop a food label acknowledging lower environmental footprint without reducing yield and quality
- Engage more stakeholders in research projects through a consultative process from the start

2-Support new technologies – adhere to international agreements – by improving the legislation and supporting flagship projects utilising New Breeding Technologies

3-Ensure continued open access to Digital Sequence Information (DSI) – DSI must NOT be included under the Nagoya protocol which would prevent open access

4-Close the research and innovation cycle in pillar 2 of the Horizon Europe programme 2021-27



1-Combine genetic, molecular, ecological and agronomic strategies for smart agriculture benefiting the environment as well as Food and Nutritional Security

Encourage contributions from plant scientists to help boosting water- and nutrient-use efficiency of agricultural crops and to improve resource stewardship for resilient production in agriculture, horticulture and forestry.

Not only the world's burgeoning population of 7.5 billion, but also the plants on which that population depends, need sufficient and high-quality water for their survival. The increases in droughts and flooding associated with climate change put agricultural production at risk of crop failures, while the fertilizers and pesticides used to generate sufficient and healthy food in turn put groundwater at risk of contamination. Biological research-based solutions are needed to produce breakthroughs in understanding and in knowledge application so that resilient, water- and nutrient-efficient crops, with which we can achieve high yields on low inputs, will be available to farmers and foresters worldwide. Improved crops – with respect to improved root performance and lower water loss - and low-water consumption management systems can contribute to higher yield at less water footprint.

These targets should be priorities under the European Research and Innovation programme 'Horizon Europe', so that we may help deliver on the **UN Sustainable Development Goals** SDG2 "Zero Hunger", Target 2.4; SDG6 "Clean Water", Targets 6.1, 6.3, 6.6; SDG8 "Decent work and economic growth", Target 8.4.; SDG12 "Responsible consumption and production": Targets 12.1-12.2; SDG13 "Climate Action."

In the TOMRES project, partners with diverse expertise are already contributing solutions from genetic, molecular, ecological and agronomic strategies towards smart and precision agriculture. This is a starting point of such a complex approach and should be further encouraged in future.

Encourage contributions from (plant) scientists to help improving not only the environmental footprint, but as well Food and Nutritional Security

Due to the complex nature of plants and ecosystems, projects often tackle either sustainability or food and nutritional security. With science and technology advancing, future projects should address both sides in a systems approach to provide farmers, food companies and consumers integrated solutions.

EPSO proposed such a concept in the mission idea '1001 Crops - Diverse crops for diverse diets, human health and resilient production'.



In the medium-term, related projects could be clustered and actions could be taken forward by those projects currently receiving funding as to avoid missing benefits from finishing and ended projects.

In TOMRES, we integrate earlier and ongoing projects on water and nutrient use efficiency through partners involved in former projects who provide this knowledge transfer. In addition, we invited a coordinator of another earlier project to the Stakeholder Group to ensure continuity. We already take initial steps towards linking research to food and nutritional security by recording yield and basic quality parameters, which could be further developed in future projects.

Develop a food label acknowledging lower environmental footprint without reducing yield and quality

There seems to be no common label yet in Europe acknowledging a lower environmental footprint in crop cultivation without reducing yield and quality of the crop, regardless of the crop improvement technologies and crop management practices used. Such a label would create an innovation pull, provide acknowledgement and possibly better return of investment to breeding companies and to farmers, and help achieving more responsible production (SDG₁₂) and help towards climate action (SDG₁₃), while not compromising on Food and Nutritional Security (SDGs 2 and 3).

Such a label would use as reference the environmental footprint for the same crop production in the same region in the previous year(s), thus encouraging local solutions to global problems.

A 'Low Environmental Footprint' label should be EU-wide, based on objective and measurable criteria, and managed by a public body, to not be confused with the many local and company labels existing.

In the TOMRES project, we would most appreciate such a label and be happy to help develop this. We already include in consumer surveys a preliminary assessment of consumer interest in such a label.

Engage more stakeholders in research projects through a consultative process from the start

In addition to stakeholders participating as project partners in projects under the multi-actor approach, more stakeholders who may lack time and resources, can be engaged on a consultative basis throughout the project, generating a win-win for partners, stakeholders, funders and society.



In the TOMRES project, we engage stakeholders in addition to those being partner, through a dedicated Stakeholder Group (SHG) which has consultative status and helps steering the research, knowledge transfer, dissemination, and outreach of the project in an openly engaged way. This complements the multi-actor approach for advice throughout the project to optimise the project results, their uptake and impact. SHG members are from academia and industry. In addition, farmer and consumer organisation representatives are welcome.

2-Support new technologies – adhere to international agreements – by improving the legislation and supporting flagship projects utilising New Breeding Technologies

Currently, Europe's position on New Breeding Technologies (NBT) as laid down in article 2 of directive 2001/18/EC, which is binding for NBT, is not in line with the definition of Living Modified Organism as it is defined in article 3 (g) in the Cartagena Protocol on Biosafety to the Convention on Biological Diversity, an international agreement signed by 171 countries.

Europe needs to have a more balanced approach to new technologies. This includes improving the legislation and starting flagship projects engaging all stakeholders from scientists, companies, farmers to end-users towards products with consumer benefits on the market in Europe and globally.

In parallel to such projects, new concepts for deregulation, based on public-private risk and benefit sharing, need to be developed to enable Small and Medium-Sized Enterprises (SMEs) bringing such products to the market. Scientists (e.g. in EPSO) invite policy makers to exchange views on the current situation of genome editing in Europe and possible next steps to enable Europe better addressing climate change, achieving food and nutritional security and establishing a sustainable agriculture in Europe and world-wide.

Within TOMRES, new breeding technologies are only used for biological research purposes, but full exploitation of TOMRES results would be enhanced by uptake of this recommendation.

3-Ensure continued open access to Digital Sequence Information (DSI) – DSI must NOT be included under the Nagoya protocol which would prevent open access

To implement the principle of 'Open Science', one of the goals of the European Commission, access to digital sequence information must remain open. This is questioned by some countries outside of Europe.

Scientists (e.g. in EPSO) call upon the convention of parties of the Convention on Biological Diversity (CBD), along with national and EU decision makers to maintain Open Access to Digital Sequence



Information as part of the 'Open Science' principle and therefore NOT to include this in the Nagoya Protocol. Otherwise this would substantially decrease the analysis and improvement of germplasm including that of plants from Developing Countries.

Use of DSI of TOMRES accessions is pivotal to obtaining valuable scientific results.

4-Close the research and innovation cycle in pillar 2 of the Horizon Europe programme 2021-27

Scientists urge to give more balanced consideration to basic research in relation to the other components (applied research, demonstration and innovation actions) of the research and innovation cycle in the Global Challenges and European Industrial Competitiveness programme.

Work by the Initiative for Science in Europe (ISE), the League of European Research Universities (LERU) and Science Europe suggest that due to the increasing focus on higher Technology Readiness Levels (TRLs), the Societal Challenges aspect of Horizon 2020 may miss out on the potential benefits from projects that include, or focus on, basic research (incl. bringing back questions from innovation to basic research) and on linking basic research to applied solutions. It thus hinders ground-breaking solutions for current and future challenges. There has been a steady increase of support for applied research and demonstration actions and a steep increase of support for innovation actions, which is needed. However, support for basic research has dropped dramatically, especially from FP7 to Horizon 2020 and needs to be increased to be balanced for Horizon Europe.

This could be achieved by provisioning funding that addresses Global Challenges through encouraging collaborative basic research as intrinsic component and sometimes focus of Research and Innovation Action projects.

This will widen participation, including from underrepresented countries (EU13) and contribute to resolving gaps in collaborative research. This will create a translational bridge between the Excellent Science and the Innovative Europe pillars.

Increased funding for basic and strategic research may also meet the needs of private companies, who might have in-house capacity for applied research and innovation, but lack motivation, time and funding to do the explorative research which lays the ground for or improving further innovation activities.

This policy brief was developed by the TOMRES partners, led by Karin Metzloff, Simone R.-Schmittgen and Andrea Schubert, based on the discussions at the project meeting in Athens 2019.



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Useful links

TOMRES: www.tomres.eu/

EPSO: www.epsoweb.org

EPSO Submission to the EC consultation on EU research and innovation missions (FP9), 30.3.2018, including 1) 1001 Crops – diverse crops for diverse diets and human health and sustainable production,

EPSO: Access to Digital Sequence Information must remain open, 26.6.2018

EPSO position on FP9, 19.9.2017:

https://epsoweb.org/wp-content/uploads/2018/11/17_09_19_EPSO_Position-on-FP9.pdf

Publications

This will be completed in an updated version of the policy brief which will be available at www.tomres.eu/.



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Citation

Please cite this report as follows:

Karin Metzloff, Simone R.-Schmittgen, Andrea Schubert (2019). DELIVERABLE 6.5 TOMRES opinion paper (policy brief) concerning research policy and regulatory issues. Developed by the EU-H2020 project TOMRES ('A novel and integrated approach to increase multiple and combined stress tolerance in plants using tomato as a model'), funded by the European Union's Horizon 2020 Research and Innovation programme under Grant Agreement Number 727929. DOI: 10.5281/zenodo.4502466.

