



Plant microbiomes conferring a protective effect against human pathogens in plants.

Safeguarding food

TEAGASC researchers recently hosted an international stakeholder workshop, which focused on protecting fresh produce from human pathogens through an enhanced understanding of the plant microbiome.

Growing consumption of fresh produce and an increasingly complex international food supply chain necessitates that efforts to protect consumers of plant produce from human pathogens take a global dimension. Teagasc is working with researchers across 39 countries to deliver the best international scientific advice to growers on protecting their produce from microorganisms that can cause human illness.

Protecting fresh produce

With an enhanced emphasis on the impact the food we consume has on our health, there has been an increased consumer demand for fresh plant produce including salad, fruit and raw vegetable crops that can be supplied year round, and that can be consumed in a variety of different ways. Meeting this demand has resulted in the development of complex international produce distribution networks, and an increased need to ensure food safety standards. Ready-to-eat-crops, which by their nature are not cooked prior to consumption, require particular care during production to ensure that they are not contaminated with human pathogens. Food-borne outbreaks resulting from the consumption of fresh produce have been reported worldwide. It is clear that certain groups of human pathogenic microorganisms are well adapted for surviving and living on plant crops when a contamination event takes place, and in some cases, microorganisms similar to pathogens can be considered part of the normal microbial community (or microbiome) associated with the crops. Key to safeguarding consumers is: minimising the potential for contamination of crops with human pathogens;

understanding the capacity of human pathogens to integrate into the plant microbiome; and, determining if any elements of the microbiome pose a risk to human health. As food crosses borders, a co-operative approach is required to ensure safe production practice.

Role of microbiomes in plant protection from pathogens

Plants naturally have a diverse community of microorganisms associated with them that includes bacteria, fungi, viruses, archaea and protozoa. The plant microbiome is critically important for crop health. It facilitates the establishment of the plant, provides essential nutrients and vitamins, enhances tolerance to stress experienced by the plant, and can provide protection from colonisation of the plant by plant or human pathogens. The latter is achieved by the microbiome stimulating plant defences, competing with the pathogen for resources, infecting or preying on the pathogen, or otherwise being directly antagonistic to pathogen establishment. The microbiome that forms around the plant system is impacted by a wide range of factors, including climate, soil type, and the type of crop that is grown. Further, how we manage these crop systems has a strong impact on the plant microbiomes and the soils they grow in. Agricultural practices such as fertilisation, tilling, manure amendments, irrigation, liming, etc., can all change the composition of the microbial community and how it is functioning. From both a plant health and consumer safety perspective, understanding how the microbiomes associated with crops are altered by agricultural practices (either positively or negatively), and what impact this has on their capacity to



Some participants in the best practice stakeholder workshop pictured in Teagasc, Dublin (September 2019).

Pictured (left) are participants from the recent workshop on a tour of horticultural facilities at Teagasc Dublin, led by Michael Gaffney, Teagasc.



suppress pathogens that might cause illness in consumers, is important for informing best agricultural practice.

Huplant Cost Action

The Huplant Cost Action was established in 2017 and will run until 2021 with the main objective of combining and strengthening pan-European research efforts on the role that plant microbiomes play in the ecological behaviour and public risk of human pathogenic microorganisms. Huplant seeks to understand the ecology of these organisms in plants, identify them, assess whether they cause a risk to human health, and determine sanitary and agricultural management procedures to control the risks from microorganisms during production. Supported by Huplant, a recent 'International Stakeholder Workshop on Best Practice for the Control of Human Pathogenic Microorganisms in Plant Production Systems' was held by Teagasc in Dublin, with the aim of bringing together relevant stakeholders to examine hazards and control strategies in plant production systems in order to ensure the biological safety of horticultural products. With a particular focus on examining interventions used across Europe, the regulatory landscape and undertaking risk analysis, the workshop aimed to generate a series of best practice recommendations that could feasibly be implemented by growers, and identify barriers to implementation of current best practice.

Acknowledgements

Huplant control (Control of human pathogenic micro-organisms in plant production systems) is a COST (European Cooperation in Science and Technology) action (CA 16110) scientific network supported by the EU Framework Programme Horizon Europe.

For more information go to <https://huplantcontrol.igzev.de>

Authors

Fiona Brennan

Soil microbiologist, Soils and Land Use Department, Johnstown Castle, Co. Wexford
Correspondence: fiona.brennan@teagasc.ie

Kaye Burgess

Senior Research Officer, Food Safety Department, Teagasc Food Research Centre, Ashtown, Dublin 15

Michael Gaffney

Senior Research Officer, Horticultural Development Department, Teagasc, Ashtown, Dublin 15

