New Project

PC 281a

Tomato: application of next generation diagnostics for improved detection and understanding of root diseases.

Project Number:	PC 281a
Project Title:	Tomato: application of next generation diagnostics for improved detection and understanding of root diseases.
Project Leader:	Dr Tim O'Neill
Contractor:	ADAS UK Ltd; University of Nottingham
Industry Representative:	Mr Paul Simmonds; Cornerways Nursery Dr Philip Morley, TGA Technical Officer
Start Date:	01 October 2012
End Date:	31 December 2013
Project Cost (total project cost):	£49,500 (£58,500)

Project Summary:

Root diseases pose a serious threat to tomato production with increased risk where irrigation run-off is recycled. Fungicides previously used for root disease control are no longer approved or very restricted. Growers generally wish to control root diseases without the use of fungicides. There is increasing evidence that microbial diversity on roots can benefit plant health through reducing root disease and inducing systemic resistance to some foliar pathogens. Molecular methods now provide an excellent tool for studying the largely unexplored world of root zone microorganisms. Project PC 281 using the molecular method T-RFLP revealed a tremendous diversity of microorganisms on tomato roots and variations between crops. Building on information gained in PC 281, this project aims to apply next generation diagnostics to improve detection, understanding and control of tomato root diseases. Earlier diagnosis will permit earlier intervention. In phase 1, a laboratory based microarray will be developed and used to monitor 50 taxa of root microorganisms over a full season on rockwool-grown tomato and in irrigation water. A portable on-site rapid diagnostic kit will also be developed that can detect 12 microorganisms simultaneously with a high degree of specificity; this will be used to supplement microarray tests to add higher specificity where required.

In phase 2 of the project, these next generation diagnostic tools will be used to investigate how tomato root zone microbial populations vary between crops, how they can be changed and to determine if any individual or combination of microorganisms is indicative of disease or resistance to disease.

Aims & Objectives:

(i) Project aim(s):

To permit earlier diagnosis and intervention against root disease problems through routine monitoring of rhizosphere microorganisms and an increased understanding of factors that affect their development.

(ii) Project objective(s):

Phase 1 (Oct 2012 - Dec 2013)

1. To develop a laboratory-based microarray that reliably detects and provides quantitative information on around 50 fungi and bacteria reported to cause or control tomato root diseases.
2. To monitor the variation in occurrence and relative levels of rhizosphere microorganisms in three rockwool tomato crops over a growing season.
3. To identify some physical factors in the rockwool root zone environment, or other crop production factors, that appear to greatly influence rhizosphere microbial populations.
4. To develop a portable rapid diagnostic kit that can be used to detect up to 12 pathogens simultaneously with a high degree of specificity.

Phase 2 (Oct 2013 – Dec 2015

5. To optimise microarray and Lamp diagnostic tests for phase 2 work.
6. To determine how some applied changes in the rockwool root zone physical environment (as identified from Objective 3), affect rhizosphere microbial populations, root appearance and root disease.
7. To determine if microarray test results on rockwool tomato rhizosphere microorganisms are informative of root health and/or crop yield.
8. To determine the effect of some different growing media, varieties and rootstocks on rhizosphere microbial populations.
9. To determine the effect of recycling irrigation water, and treatment of water using a slow sand filter or other system, on rhizosphere microbial populations.
10. To assess the usefulness of on-site disease diagnosis using a portable rapid diagnostic kit that can detect up to 12 pathogens.
11. Determine effect of selected biological amendments on rhizosphere microorganisms.

Benefits to industry

- Next generation molecular diagnostic tools available to study tomato rhizosphere microorganisms.
- On-site rapid diagnostic equipment available for detection of up to 12 pre-specified fungal, bacterial and viral pathogens.
- Knowledge of how tomato root zone microorganisms on a rockwool crop change in occurrence and level over a season.
- Identification of rockwool root zone environment variable (e.g. pH, conductivity, irrigate practices) that change microbial populations.
- Possible identification of individual or combinations of rhizosphere microorganisms that are indicative of root disease risk, tolerance to root disease, or increased resistance to some foliar diseases.

<u>Outputs from Phase 1</u>

1. Knowledge of when pathogenic fungi infect tomato roots and for how long they are present before symptoms occur on roots or in the crop (and whether they can occur without the occurrence of symptoms).
2. Knowledge of the combinations of pathogenic and non-pathogenic fungi and bacteria occurring on tomato roots in rockwool crops and how they change over a season.
3. A comparison of microorganism populations on tomato roots in crops grown with run-to-water and recycled irrigation solution.
4. Knowledge of how well the microarray (used alone or with the Lamp-based diagnostic) can identify the cause of root rots and stem base vascular infections in tomato.

Disclaimer

Further information

Email the HDC office (hdc@hdc.ahdb.org.uk), quoting your HDC number, alternatively contact the HDC at the address below:

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