EVALUATING THE IMPACT OF ZINC APPLICATION ON THE PRESENCE OF ANTIMICROBIAL RESISTANCE IN SPINACH AND ITS PRODUCTION ENVIRONMENT.

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INTRODUCTION

Although antimicrobial resistance (AMR) is a significant public health threat, limited information is available on AMR dissemination in the food production environment, particularly in plant production systems. Antibiotic residues and antimicrobial resistant organisms (AROs) may be present in animal excrement and enter the soil, or AROs may be naturally present in the natural environment. Consequently, AMR genes may spread to agricultural fields and food products. Additionally, there is a lack of knowledge about the impact of other selective pressures on the dissemination of AMR genes in the agri-food environment. Several studies have demonstrated that heavy metals may play a role in promoting AMR gene transmission. Therefore, to assess the impact of zinc application on the AMR profile, this study assessed the presence of clinically relevant AMR bacteria in spinach and soil, with or without zinc amendment of the soil.

METHODOLOGY

In total 44 soil samples and 20 spinach samples were collected from two production sites. Enterobacteriaceae were enumerated from each sample and the presence of extended-spectrum beta lactamase producing Enterobacteriaceae (ESBL), carbapenemase producing Enterobacteriaceae and ciprofloxacin resistant Enterobacteriaceae was assessed on selective agars following enrichment. Suspect colonies were identified by Maldi-TOF. Further antimicrobial susceptibility profiling was undertaken on confirmed Enterobacteriaceae isolates. Concurrently, physiochemical analysis was utilised to measure the concentration of zinc in the growing plots.

RESULTS

Overall, 15 AMR Enterobacteriaceae belonging to a number of different species were isolated from soil and spinach samples, from plots with and without zinc amendment. Serratia fonticola was the predominant species detected in both samples: found in 8 isolates from soil and 5 from spinach, whilst one Enterobacter cloacae isolate and one Escherichia coli isolate were identified in soil and spinach samples, respectively.

DISCUSSION

This study demonstrated that fresh food products and their production environment can host Enterobacteriaceae with clinically relevant resistance phenotypes that may affect humans and animals through the food chain. Further studies are necessary to determine whether the presence of elevated levels of zinc impacts the soil and plant resistome.