Incorporation of antimicrobial agents into vegetable from manured soil and microbiological effects

I. Michels[1], F. Chowdhury[1], A. Friese[2], U. Rösler[2], M. Freitag[3], M. Grote[1]
[2] FU Berlin, Institut für Tier und Umwelthygiene, [3] FH SWF, Abt. Soest, FB Agrarwirtschaft
[1]Universität Paderborn, Department Chemie, Warburgerstraße 100, 33098 Paderborn
presenter: inga.michels@upb.de; correspondence: magrote@zitmail.uni-paderborn.de

antibiotics, manure, vegetable, ESBL- *E. coli*

A potentially large source of antibiotics and resistant bacteria is livestock waste, distributed on fields as fertilizer. Former investigations show the incorporation of antibiotics into various crops under hydroponic and field conditions [1, 2, 3]. The ingestion of contaminated plants by farm animals or humans constitutes a potential risk for the development of bacterial resistance [4]. In particular, the contamination of food plants with Extented-spectrum β-lactamase (ESBL)-producing bacteria due to the application of manure from pig and poultry on fields is a matter of concern in the BMBF-research project RESET (www.reset-verbund.de).
In order to assess possible consequences with regard to food safety, in two cultivation periods leek and white cabbage were grown on experimental plots. In 2011 seedlings were fertilized with animal excrements from pigs and broilers. The excrements were spiked separately with enrofloxacin (ENR), tetracycline (TC) or amoxicillin (AMO). Furthermore ESBL- *E. coli* were added to the manure and then applicated to fields combined with the antibiotics. The content of antibiotic residues in the harvested vegetables was generally low (0.1- 0.3 µg ENR/kg fw). ESBL- *E. coli* were found in/on plant seedlings and in/on leaves of a cabbage sample (ENR-spiked manure).
In the cultivation period 2012, only pig manure was applied. Instead of tetracycline a further β-lactam (ceftiofur, CEF) besides AMO and ENR was added to the manure. Again the uptake of ENR from soil via roots and incorporation into the vegetable plants was detected. The fate of the administered β-lactams is not yet clear and the progress of conversion, decomposition or adsorption of AMO and CEF in manure and soil is still under investigation. Moreover, several ESBL- *E. coli* were found in soil, roots and edible parts of one leek.
Hence, it cannot be excluded, that consumers of conventionally grown vegetables may be exposed simultaneously to traces of antibiotic active residues and multi-resistant germs.

The authors are grateful to the Federal Ministry of Education and Research (BMBF) for the financial support.

[1] M. Grote, C. Schwake-Anduschus, R. Michel, H. Stevens, W. Heyser, G. Langenkämper, T. Betsche, M. Freitag, *Incorporation of veterinary antibiotics into crops from manured soil.* Landbauforschung Völkenrode - FAL Agricultural Research, 57 (1) 25-32 (2007).
[2] M. Grote, D. H. Meriç, G. Langenkämper, H. Hayen, T. Betsche, M. Freitag, *Untersuchungen zum Transfer pharmakologisch wirksamer Substanzen aus der Nutztierhaltung in Porree und Weißkohl,* Journal für Verbraucherschutz und Lebensmittelsicherheit, 4, 287-304 (2009).
[3] F. Chowdhury, *Untersuchungen zur Aufnahme von Antibiotika in Rotkohl und Möhren – Verbreitungspfade und mögliche Verbraucherrisiken*, Dissertation Universität Paderborn (2012).
[4] L. Du, W. Liu, *Occurrence, fate and ecotoxicity of antibiotics in agro-ecosystems,* Agron. Sustain. Dev., (2012) 32:309-327.