Transfer of pharmaceutical residues in soils and plants from farmyard manure

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The society is increasingly discussing environmental pollution by pharmaceutical residues. The excretion of drugs and their metabolites together with improper waste disposal has led to considerable concentrations of various compounds in many different environments. Many studies deal with pharmaceutical residues in water, such as surface, ground and drinking water. More research is needed concerning these residues entering the food and feed chain through vegetables and crops as a result of plant fertilization with farmyard manure.

A study was conducted in a collaborative research project by the Center for Agricultural Technology (LTZ) Augustenberg and the Chemical and Veterinarian Investigation Institute (CVUA) in Karlsruhe to determine a possible uptake of pharmaceutical residues by plants and soil.

Therefore trials were conducted to verify the absorption of two representatives of the antibiotic group (tetracycline and enrofloxacin), which most probably will reach the soil and ultimately the crop after fertilization with farmyard manure. Analysis should clarify if relevant concentrations of these antibiotics in farmyard manure lead to significant residues in soil and plants.

Extensive field trials with corn, barley and wheat where conducted. Therefore farmyard manure containing tetracycline and enrofloxacin was used, first with a realistic substance concentration and also with a worst-case-concentration:

Table 1: antibiotic concentrations in farmyard manure

	tetracycline	**enrofloxacin**
realistic approach	0,3 mg/l	0,05 mg/l
worst-case-approach	7 mg/l	1 mg/l

The realistic scenario resulted from a six month pig fattening and a single treatment over two days at the beginning of production of the pig livestock. The worst-case-scenario included a treatment at the beginning of production and two additional treatments with the antibiotics during fattening. After the spreading of manure, soil and plant samples were collected at different times and analyzed.

In case of the trials with barley and wheat, there were no antibiotic residues detected in soil or plants about 20 days after application (first sampling date) of the manure containing the active substances. This applies to the realistic scenario as well as to the worst-case-scenario.

In case of the corn trials, only minor tetracycline residues (30 µg/kg) were detected in soil samples sampled at the 4-6-leave-stage of the worst-case-scenario. In soil samples of later sample dates and also in all plant samples, there were no antibiotic residues to be founded. In the realistic approach in trials of tetracycline and also in all trials with enrofloxacin, there were no agent residues detected, neither in soil nor in plant samples.

The investigations clearly indicate that under realistic conditions the spreading of farmyard manure originating from a treated herd does not lead to residues of tetracycline and enrofloxacin in corn, barley and wheat. Also in soil there were no active residues expected after short duration of manuring.