

OCCURRENCE AND BIOACCUMULATION OF ANTIBIOTICS IN VEGETABLES – FIELD STUDY

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AIM OF INVESTIGATION:

The aim of this study was to investigate the occurrence and bioaccumulation of antibiotics in vegetables grown under real-field conditions.

GATHERED FACTS:

Wastewater subjected to different treatment is commonly used in agriculture to land **irrigation** in arid and semi-arid regions because of water shortage. In this regard, there is major public concern regarding agricultural applications of **treated wastewater** due to the introduction of **antibiotics** from irrigation waters into crops via plant uptake.

Greenhouse experiments can better estimate the actual antibiotic up-take and accumulation than hydroponic experiments, but some of them have been conducted under unrealistic conditions. **Field experiments** can better assess the actual potential uptake and accumulation of antibiotics by plants and can be integrated into a database for further risk assessment.

RESULTS AND FIRST-HAND EVIDENCES

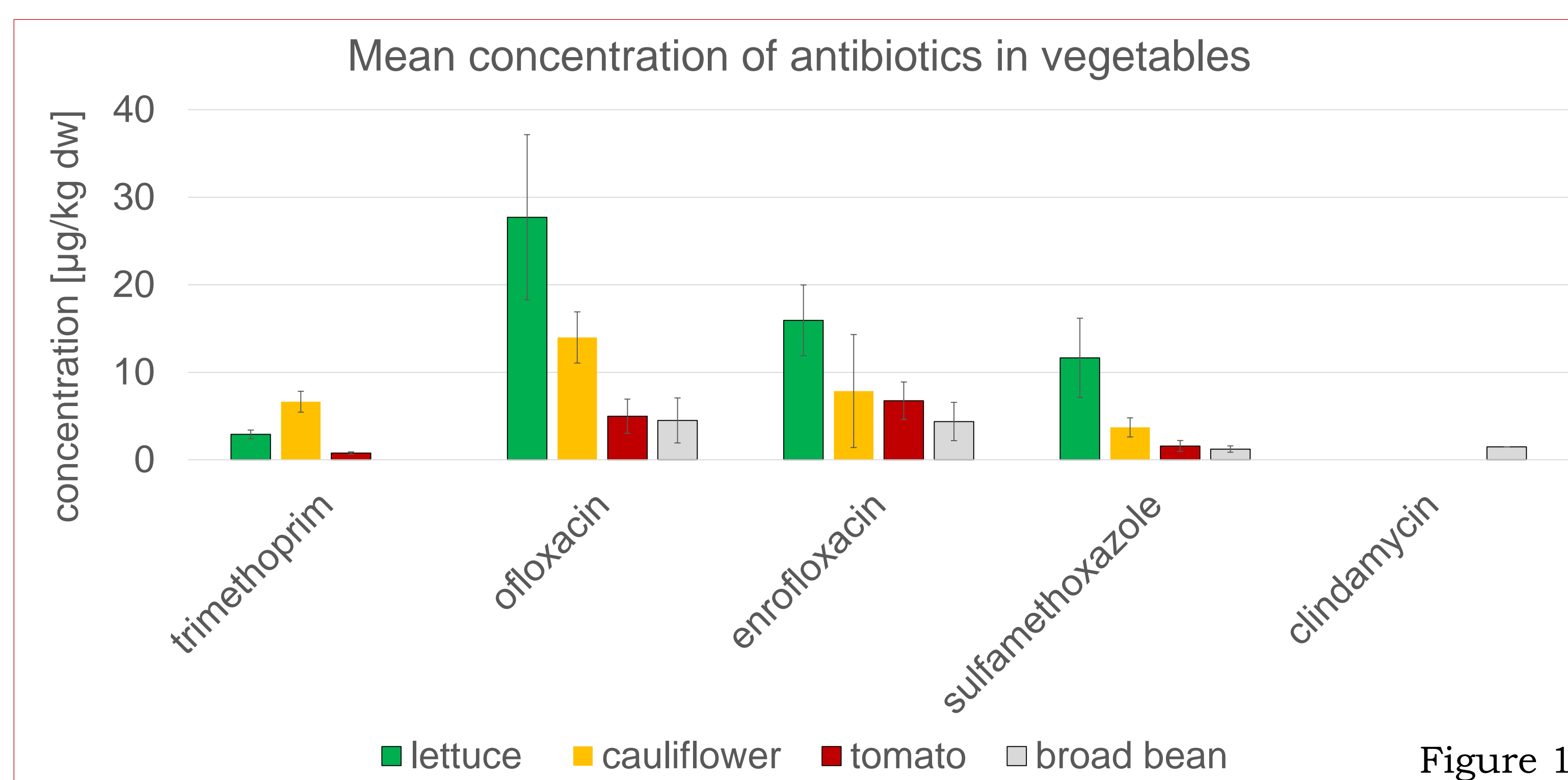


Figure 1

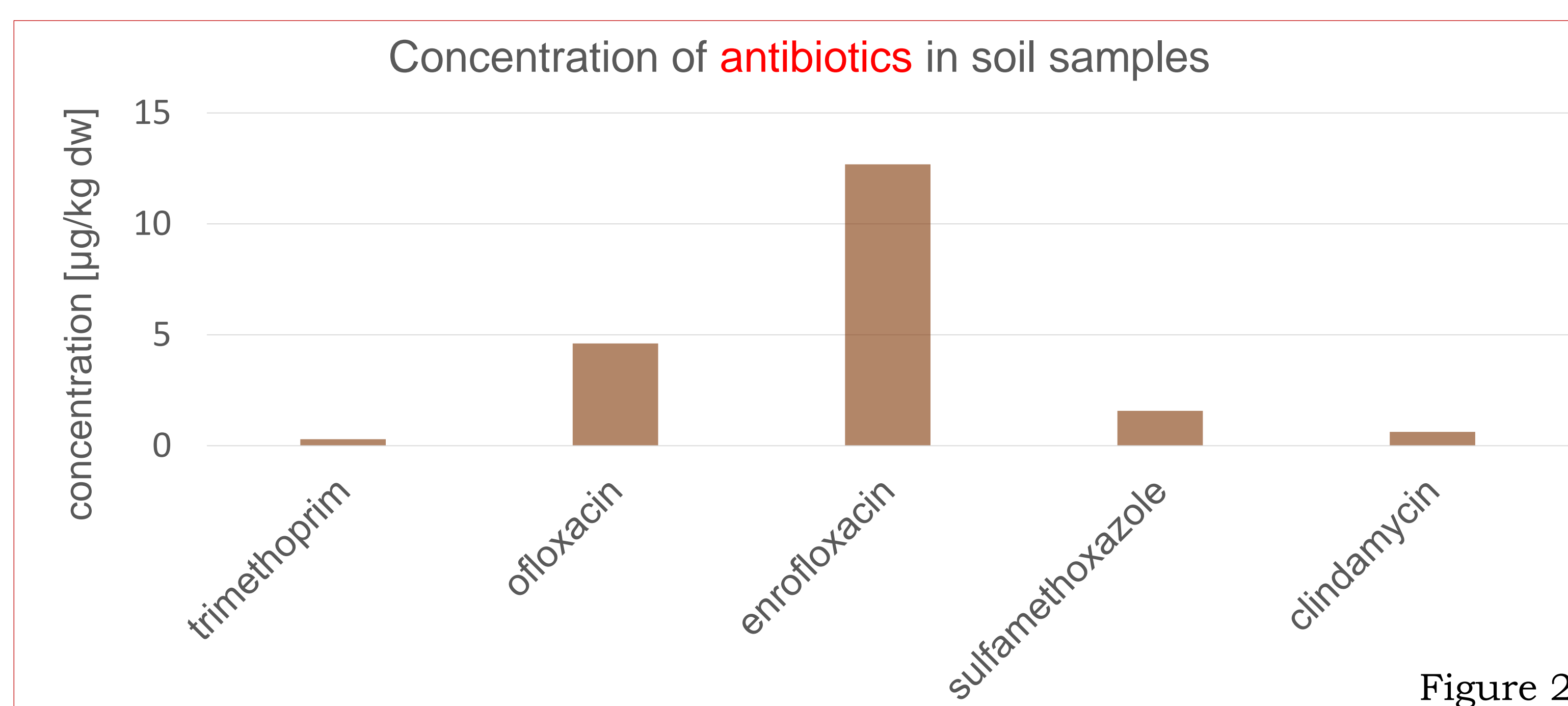


Figure 2

EVIDENCE-BASED CONCLUSIONS

Mean concentration of ofloxacin, enrofloxacin and sulfamethoxazole was the highest in lettuce followed by cauliflower, tomato and broad bean. Whereas descending order for trimethoprim was cauliflower>lettuce>tomato.

Seasonal variations were observed too, namely the antibiotic content was higher in vegetable samples which were grown during summer period than in vegetable samples grown during winter period. **Contemplation on this clue led us to the fact** that during the winter period there was enough rainfall to support crops and additional irrigation was not necessary.

Bioconcentration factor (BCF) values for lettuce showed the highest uptake of antibiotics among investigated vegetables with the maximum calculated value of 10 for trimethoprim. The smallest BCF was for enrofloxacin and ranged from 0.5 (broad bean) to 1.25 (lettuce). On Figure 2 is presented mean concentrations of antibiotics in soil. **Low concentration of trimethoprim** and relatively high concentration of **enrofloxacin in soil** could be responsible for their **high** and small **BCF factors**, respectively. Further investigation is required so the stated conclusion will not be labelled as an allegation.



'It is a capital mistake to theorize before one has data.

Insensibly one begins to twist facts to suit theories, instead of theories to suit facts.'

Sherlock Holmes



EXPERIMENTAL SETUP AND MAIN METHODS

Four types of edible vegetable matrices, namely, lettuce leaves (*Lactuca sativa* L), tomato fruits (*Solanum lycopersicum* L), cauliflower fruits (*Brassicaceae oleracea*) and broad bean seeds (*Vicia faba* L) as well as soil samples were harvested from six farms. In total **80 vegetable samples** and **60 soil samples** were analysed.

For **2 sites among 6, river water** was used for irrigation, whereas additional water sources such as **well water** are also used for **another 2 sites**. The irrigation water for **one sampling site** is mostly made up of **treated wastewater**. Finally, remain **2 sites were** chosen as control sites since **well water and rainfall** are used.

FORENSIC: An analytical method based on ultrasound assisted extraction and SPE clean-up followed by LC-MS/MS determination was used. 10 antibiotics belonging to 4 groups were analysed

1. ofloxacin and enrofloxacin
2. sulfamethazine, sulfamethizole, sulfathiazole, sulfadiazine, sulfadimethoxine, sulfamethoxazole
3. clindamycin and
4. trimethoprim

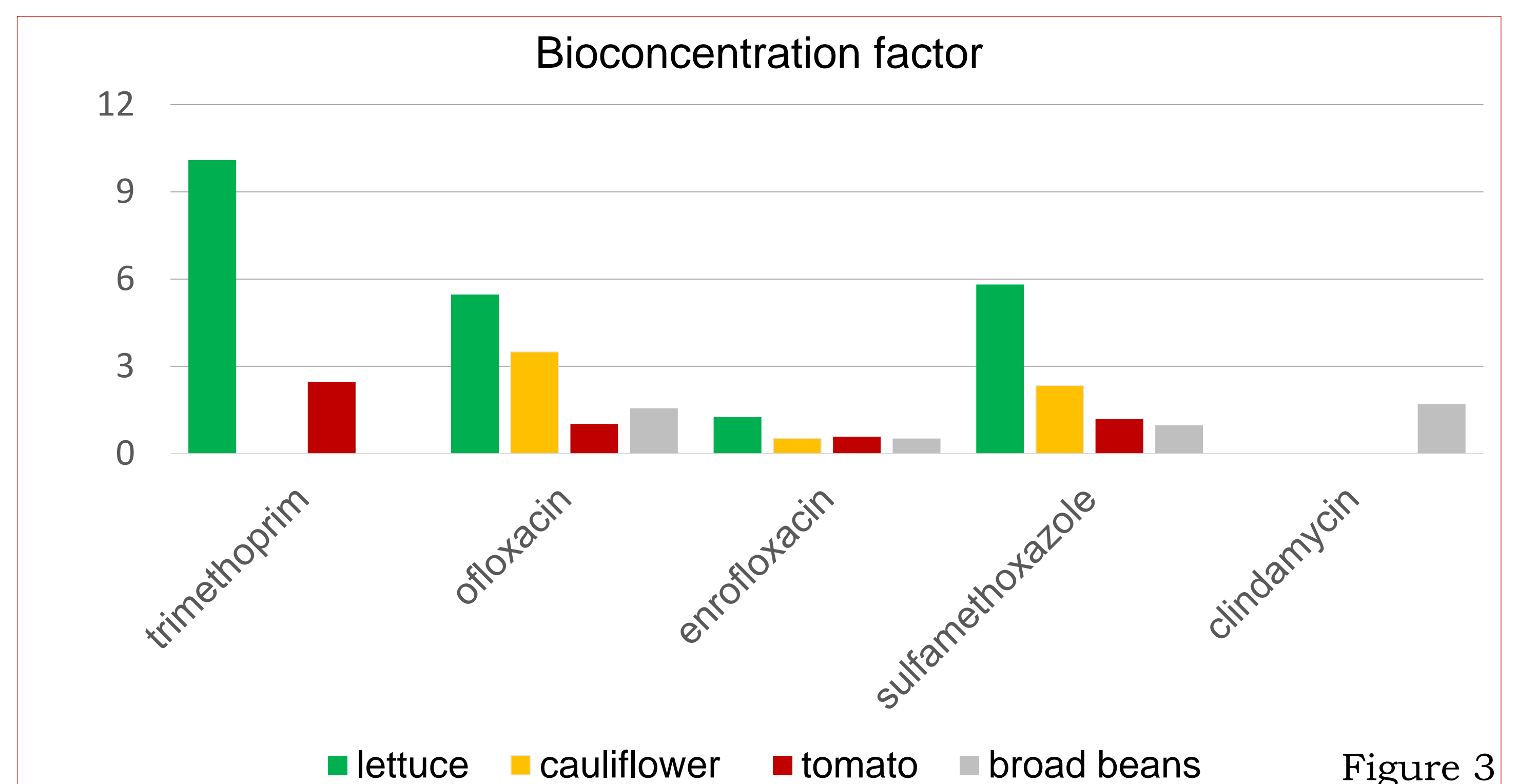


Figure 3

DISCUSSION

Trimethoprim, ofloxacin, enrofloxacin, sulfamethoxazole and clindamycin among tested antibiotics were detected in vegetable (Figure 1) and soil (Figure 2) samples.

Ofloxacin, enrofloxacin and sulfamethoxazole were detected in all studied vegetables in range of 4.5-27.7 ng/g dw, 4.4-15.9 ng/g dw and 1.2-11.6 ng/g dw, respectively. Trimethoprim was found in lettuce, tomato and cauliflower in range between 0.9 and 6.6 ng/g dw, while clindamycin was identified only in broad beans at concentration 1.5 ng/g dw.



ACKNOWLEDGEMENTS

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