Effects of different fertilization treatments on the antibiotic concentrations and resistance in the paddy soils

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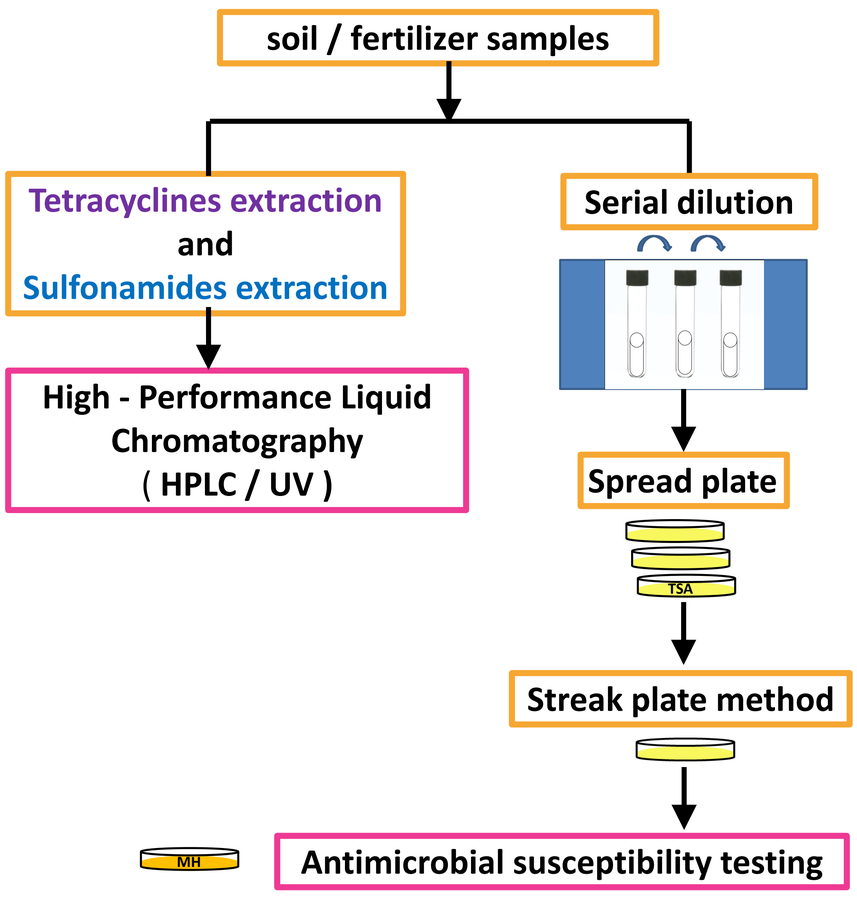
INTRODUCTION

Tetracyclines (TCs) and sulfonamides (SAs) are widely used in livestock production to serve as disease prevention and growth promotion. Because these compounds are not completely metabolized in animals, substantial amounts of TCs and SAs are excreted in feces and urine. These antibiotics are released either directly to the environments without any treatments or indirectly to the edible soils while applying TCs and SAs-containing manure or sludge as fertilizers. Once the antibiotics enter the environments, they may alter the populations and normal functions of pristine microbes. Even worse, the antibiotic resistance genes may be induced and spread out that can be a potential hazard to the ecosystems or human health.

OBJECTIVE

The aim of this study was to investigate whether TCs (tetracycline, oxytetracycline, chlortetracycline) and SAs (sulfadiazine, sulfadimethoxine, sulfaquinoxaline) residues in organic fertilizers selects for tetracycline-resistant and sulfonamide-resistant bacteria in paddy soils.

MATERIALS AND METHODS



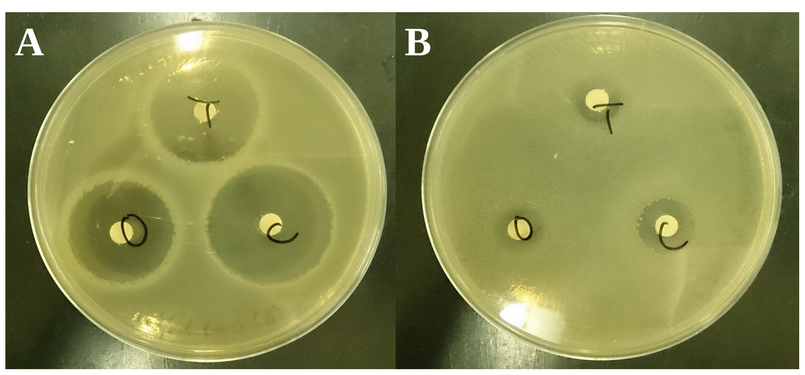


Fig. 1. Inhibition zone diameter to nearest (mm) (A) sensitive (B) resistance.

Table 1. Different fertilization treatments in paddy soils.

Name	Condition
FT1-0	organic paddy ridge soil (no using organic fertilizer)
FT1-1	organic paddy soil
FT2-F	organic fertilizer
DD1-1	organic paddy soil (no using any fertilizer for 3 years)
DD2-0	chemical paddy ridge soil (no using chemical fertilizer)
DD2-1	chemical paddy soil

Table 2. Inhibition zone diameter to nearest (Kirby-bauer Method).

Antibiotic	Disc potency	Inhibition zone diameter to nearest (mm)		
		Resistant	Intermediate	Sensitive
Chlortetracycline (CTC)	30 ug	14	15-18	19
Tetracycline (TC)	30 ug	14	15-18	19
Oxytetracycline (OTC)	30 ug	14	15-18	19
Sulfadiazine (SDZ)	300 ug	12	13-16	17
Sulfadimethoxine (SDM)	300 ug	12	13-16	17
Sulfaquinoxaline (SQ)	300 ug	12	13-16	17

RESULTS

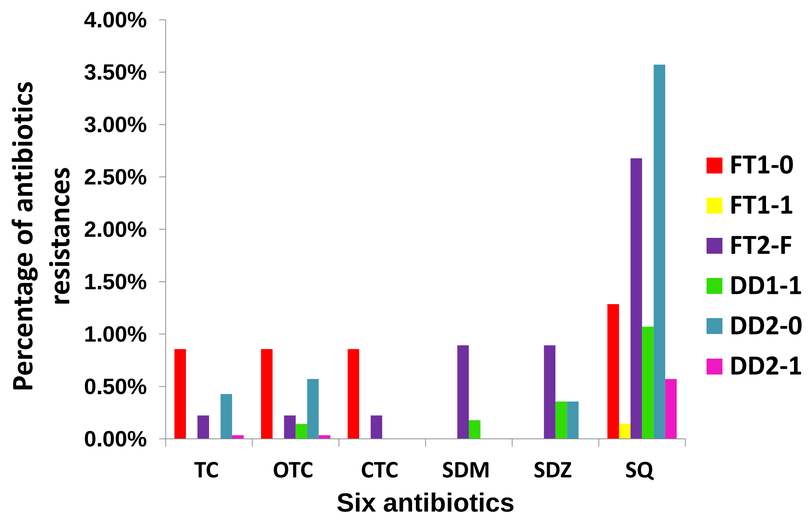


Fig. 2. Percentage of resistances of bacteria, isolated from organic fertilizer, organic paddy soils and chemical paddy soils in six antibiotics.

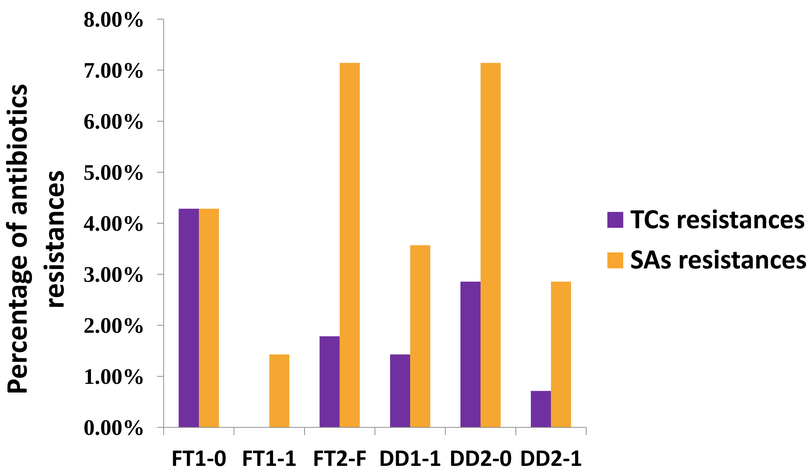


Fig. 3. The antibiotic resistances of bacteria, isolated from organic fertilizer, organic paddy soils and chemical paddy soil at 35℃.

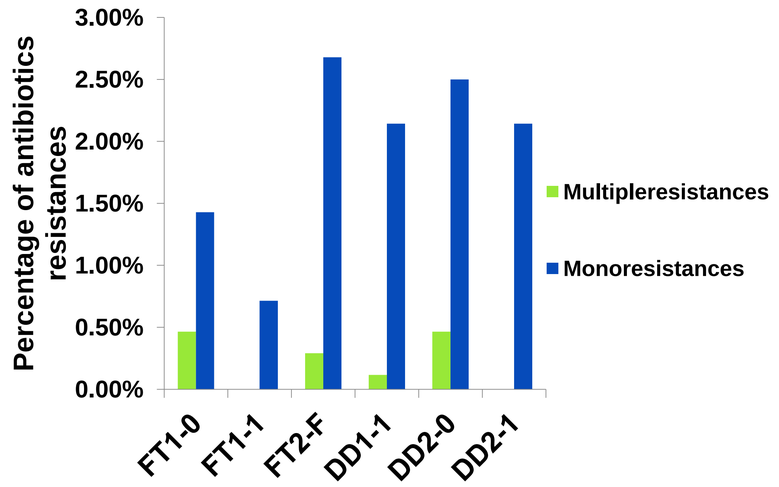


Fig. 4. The mono-resistances and multiple-resistances isolated from organic fertilizer, organic paddy soils and chemical paddy soils.

CONCLUSIONS

1. The results showed that no antibiotics were detected in these paddy soils.
2. The resistances of bacteria in the tested paddy soils are less than 4% for these antibiotics.
3. The SAs resistances of bacteria are higher than TCs resistances.
4. The multiple-resistances and mono-resistances of bacteria to the six antibiotics were less than 1% and 3%, respectively.
5. The preliminary results suggested that the antibiotic residue and resistance were low even if the soil was applied manure-based organic fertilizers. Because of the presence of only trace amount of antibiotics in the fertilizers, it was not surprised that no antibiotics were accumulated in the paddy soils.

REFERENCES

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