USE OF SEWAGE SLUDGE TO INDUCE SOILBORNE PATHOGENS SUPPRESSIVENESS

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Application of organic amendments interferes with the soil's physical, chemical and biological properties, and among the latter are those related to plant diseases. Agriculturalists have utilized different organic matters for centuries to maintain plant health. During the last decades, sewage started to be treated in order to revert the pollution of rivers, resulting in the production of a sludge rich in organic matter and nutrients, called sewage sludge, which needs proper final disposition. Among the alternatives for final discarding, the agricultural use is one of the most convenient, because it combines disposal and recycling. Thus, since we are dealing with a residue with potential for use in large scale in the Brazilian agriculture, it is necessary to identify what impacts its use might have on the occurrence of plant diseases. In this work, we evaluated its effect on the diseases caused by *Sclerotium rolfsii* in bean plants (*Phaseolus vulgaris* L.), gummosis caused by *Phytophthora nicotianae* in citrus, and corn stalk rot, caused by *Fusarium* spp.

The effect of sewage sludge at concentrations of 12.4 Mg/ha; 24.8 Mg/ha; 37.2 Mg/ha; and 49.6 Mg/ha on the severity of diseases caused by *Sclerotium rolfsii* upon the emergence, stand and plant dry matter weight, as well as on the soil's electric conductivity and microbial activity, was studied in beans grown under field conditions on a dystrophic Red Yellow Ultisol, previously infested with 100g of unhulled rice containing the pathogen. The sewage sludge reduced the incidence and the severity of the diseases caused by *S. rolfsii* and increased emergence and the final stand of the bean plants in three bean cropping seasons. The microbial activity, measured through the hydrolysis of fluorescein diacetate and the release of CO_2, was directly proportional to the concentration of sewage sludge, the same being true about the electric conductivity. For all cropping seasons, emergence and the final stand of plants were positively correlated with the microbial activity in the soil and with the soil's electric conductivity. The studied sludge concentrations did not influence survival of the

sclerodia for a 120-day period. No problem was detected with regard to plant development.

Experiments were conducted in the greenhouse and in the field with the objective of evaluating the effects of sewage sludge incorporation to the soil on suppressiveness induction against *Phytophthora nicotianae* in cravo lemon plants. Six sludge doses were tested per assay, ranging from 0 to 30% (v/v), in addition to plants at different developmental stages and with different pathogen inoculum levels. The increase in sewage sludge doses resulted in pH reduction, electric conductivity and soil microbial activity increases (evaluated by FDA hydrolysis and microbial respiration), and reduction in *P. nicotianae* recovery, both from the soil and from the plant's roots. The pathogen's recovery was significant and negatively correlated with soil microbial activity and electric conductivity. Better plant development was observed with sludge incorporation up to 20%. These results indicate a supressive effect of sewage sludge on *P. nicotianae*, explained by alterations in soil chemical and biological factors.

The effect of incorporation of sludge from sewage generated in STSs at Franca and Barueri, SP, on the incidence of corn stalk rot caused by *Fusarium* spp. was studied in a randomized block trial with three replicates, in 200 m^2 plots in a Red Distroferric Latosol (clayey texture). Sludges were incorporated into to the soil at concentrations of 0; 1; 2; 4; and 8 times the recommended rate based on their nitrogen content, in three consecutive corn cultivations: the 1999 minicrop or "safrinha" ('CATI AL 30') and the 1999/2000 ('AG1043') and 2000/2001 ('Savana 133S') crops. The sludge rates were compared to the recommended mineral fertilization for the corn crop. This paper presents data obtained in the second and third sludge application cycles, since the disease did not occur during the first cycle. For the 1999/2000 and 2000/2001 crops, the percentage of diseased plants was positively correlated with the concentration of sludges incorporated into to the soil. The coefficients of determination for the second corn cultivation were R^2=0.90 and R^2=0.84, while for the third cultivation they were R^2=0.77 and R^2=0.45, for sludges from Franca and Barueri, respectively. The sludge concentrations also showed positive correlation with the *Fusarium* population in the soil and with the electric conductivity (EC); on the other hand, they were negatively correlated with the pH. The correlation studies between the percentage of diseased plants and the soil's chemical attributes were significant and positive, for the two sludges and the two last cultivations, at the 5% level, for phosphorus content, CEC, N_{total}, $N_{nitrate}$, and EC; on the other hand, it was negatively correlated with the pH. For the second cultivation, the percentage of diseased plants was positively correlated with all micronutrients (Fe, B, Cu, and Zn), except for Mn. These results demonstrate that if sewage sludge is to be utilized in agriculture in a safe manner, there is a need for long-term interdisciplinary studies performed under the ecological conditions of cultivation.