

EDAPHIC ANTS INDICATORS OF QUALITY IN SOIL SUBMITTED TO THE APPLICATION OF SWINE WASTEWATER

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1 INTRODUCTION

The swine production has grown year by year in the domestic and international markets, and in Brazil, the contribution of the swine industry to the economy has affected the whole country as it is practiced with greater or lesser degree in all states (ABIPECS, 2008). However, as a consequence of this activity, there is a high amount of waste that ends up being used as organic fertilizer. Nevertheless, not all producers have sufficient farmland, so that these wastes are properly disposed without saturating the soil or expressing the adverse effects of this practice, such as nutrients and pathogens accumulation that can contaminate the soil and the water (Baretta *et al.*, 2003, Zhu *et al.*, 2004).

The addition of organic waste to the ground, according to Baretta *et al.* (2003), is a factor that may influence the soil biota, especially by providing food and changes in temperature and soil surface. Among these organisms, the invertebrate macrofauna, especially the ants (order Hymenoptera), play an important role as it occupies different trophic levels in the soil food chain, affecting the primary production directly and indirectly, and the populations of microorganisms which are responsible for mineralization (Silva *et al.*, 2006). In addition to that, the group operates in the fragmentation of plant material and redistribution of organic matter that favors the conditioning of the soil (Assad, 1997; Baretta *et al.*, 2007). Therefore, the management and use of soil are factors that are directly related to the macrofauna, so that the use of waste can have beneficial or harmful effects to the soil fauna, varying according to its type and composition.

Based on the foregoing, this study aimed to evaluate the effect of swine wastewater combined with chemical fertilizer on the density and diversity of macrofauna in Oxisol cultivated with corn.

2 MATERIALS AND METHODS

The experiment was conducted in Cascavel, PR, Brazil (24 ° 48 'S and 53 ° 26' W), with an altitude of 760 meters. The climate is humid and subtropical (Cfa), with average annual rainfall of 1800 mm, hot summers, average temperature of 20°C and relative humidity of 75% (IAPAR, 1998). The soil, according to EMBRAPA (2006), is classified as a Hapludox Typical with loamy soil, which since 2006 has received input of nutrients from the application of swine wastewater and chemical fertilizer.

The experimental design was a randomized block design in a 2x4 factorial scheme, in which two levels of chemical fertilizer were tested (0 and 100% of recommended for culture) and 4 doses swine wastewater (0, 100, 200 and 300 m³ ha⁻¹), making up 8 treatments with three replicates, totaling 24 experimental plots. The swine wastewater came from an integrated biosystem composed by biodigester followed by sedimentation tank and stabilization pond, and the chemical made according to the methodology of APHA, AWWA & WEF (1998).

The application of SW was performed in single step, 7 days before planting the corn, which was carried out on the remains of oat. Given the cultural needs of the culture, there was nitrogen fertilization on 80 kg ha⁻¹ of nitrogen in the form of urea.

The soil fauna was sampled by means of collecting using pitfall traps, a preservative solution containing 4% formaldehyde, placed individually in each of the plots. Samples were collected in three different moments of the trial: 7 days after sowing (7 DAS), the stage of 15 leaves (41 DAS), and after the issuance of the spikelet (72 DAS) where in each one of the collections, traps remained in the field for 7 days, and the contents identified in the laboratory to the taxonomic level of order.

Data were subjected to analysis of variance and where necessary we used the transformation $x^{0.5} + 0.5$ to normalize the data using free software SISVAR, version 4.2 (Ferreira, 2003), adopting the test F to 5 %, followed by Scott-Knott 5%.

3 RESULTS AND DISCUSSIONS

Table 1 presents the test results mean comparison for the density of ants at the three periods of the study.

TABLE 1 Medium density of ants - Hymenoptera order (organisms/trap/day), collected from the soil in the treatments applied at 7, 41 and 72 DAS.

TREATMENTS					
Chemical fertilizer (%)		Swine wastewater ($m^3 ha^{-1}$)			
0	100	0	100	200	300
FIRST SAMPLING – 7 DAS					
3.54 A	4.13 A	4.16 A	3.21 A	5.26 A	2.97 A
SECOND SAMPLING – 41 DAS					
3.86 A	3.19 A	2.54 A	2.80 A	6.14 B	2.61 A
THIRD SAMPLING – 72 DAS					
3.22 A	2.26 A	1.69 A	2.57 A	4.35 B	2.35 A

Capitalization in the same line do not differ according to the test of Scott-Knott in the 5% level of significance. DAS = days after sowing.

It is noteworthy that the density of organisms in the order Hymenoptera was influenced by the use of wastewater, with higher dose of $200 m^3 ha^{-1}$ at 41 and 72 DAS in relation to the other doses. Ants are the dominant taxonomic group in most ecosystems. According to Marino *et al.* (2002) and Andersen *et al.* (2002) ants are regarded as good indicators of areas affected by anthropogenic soil management, industrial pollution and the successful rehabilitation of degraded areas, thank to a strong relationship with the state of vegetation, soil and decomposition. Some characteristics of the group ensure them, in general, this status, such as high abundance, species richness, easiness of sampling, separation in morpho-species, and specialized taxon which are able to perceive the environmental changes. The results show that initially there were no differences between the rates of swine wastewater, probably due to high mobility group and similar quality of food among the areas examined have developed without vegetation, which the more complex, the greater the level of diversity of the group (Cordeiro *et al.*, 2004). However, from the second collection the predilection of the group as to the dose of $200 m^3 ha^{-1}$ was visible, with a gradual increase in the density of ants to the extent that the dose of SW was increased, up to $200 m^3 ha^{-1}$, followed by a sharp drop in higher dose, at levels close to those reported for the dose of $0 m^3 ha^{-1}$. This shows that within certain limits, the use of wastewater with the characteristics of the study, promotes improvement in soil conditions for this group, but becomes a limiting factor in high doses.

The response generated in this study is important because the structure of ant communities is essential in environmental impact assessment, once it maintains and restores soil quality and acts in the redistribution of particles, nutrients and organic matter, improving the infiltration of water in the soil through the increase of porosity and aeration (Lobry de Bruyn, 1999).

As for the chemical fertilization factor, it was observed that at the 41 and 72 DAS, there was a tendency for greater distribution of ants in plots that were not subjected to chemical fertilizer. Alves (2008) attributed this result to the low quality and quantity of food in the soil, which ends up favoring the order because other groups, more sensitive, and less mobile, do not compete for the area, unlike the plots receiving fertilizer in which the vegetation is developed and greater amount of organic matter provide better conditions for the establishment of other edaphic groups.

The results also showed that over time, after 41 DAS, there was a decrease in the density of these organisms. The above allows us to suggest that the systematic use of swine wastewater with these characteristics can lead to the depletion of the group, corroborating the view of Alves *et al.* (2008), which verified this behavior with doses of $50 m^3 ha^{-1}$, where such results were more relevant to the dose of $200 m^3 ha^{-1}$. Another factor that may have contributed to this behavior, was the long drought (30 days) coinciding with the period measured at 72 DAS.

4 CONCLUSIONS

Based on the foregoing, we may conclude that the application of swine wastewater produces significant positive effects on the order Hymenoptera with doses up to 200 m³ ha⁻¹.

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