FARMING PRACTICE
MANURE PROCESSING TECHNIQUES

IMPACT: SOIL BIOLOGICAL QUALITY

Reference 6

Liu, SB; Wang, JY; Pu, SY; Blagodatskaya, E; Kuzyakov, Y; Razavi, BS 2020 Impact of manure on soil biochemical properties: A global synthesis SCIENCE OF THE TOTAL ENVIRONMENT, 745, 141003. 10.1016/j.scitotenv.2020.141003

Background and objective

Manure application mitigates land degradation and improves soil fertility. Despite the positive effects of manure on soil microbial indices, great variability in the response of soil biochemical properties after manure application exists, especially for enzyme activities. A comprehensive overview of responses of soil biochemical properties depending on climate factors, management, soil, and manure characteristics is lacking. The authors generalized studies worldwide that report the effects of manure application on soil organic carbon (SOC), Total nitrogen (TN), microbial C and N and activities of seven enzymes. Main objectives were to (1) comprehensively evaluate and quantify the effects of manure on soil biochemical properties, (2) verify the reliability of using the average extracellular enzyme activities as proxies of a specific substrate or nutrient acquisition and (3) clarify the influence of explanatory variables on manure impacts.

Search strategy and selection criteria

The database ISI Web of Science was used to search for primary literature that had been published prior to June 2019. The search terms were ("manure" or "poultry" *or* "*dairy*" or "swine*"), ("enzyme activity" or "enzyme activities") and "soil*". 1) the study involved application of manure to soil and the manure type was clearly stated; 2) control plots without manure application were included for comparison with the treatment that had received manure; 3) the literature investigated the activities of enzymes related to organic carbon (OC) or nutrient cycles; 4) the means, standard deviation (SD) and replicate numbers were reported.

Data and analysis

The weighted mean response ratio was determined by using a random-effects model. During the categorical moderators' analysis, the significance of the heterogeneities between groups (Qbetween) and within groups (Qwithin) was applied by using the Chi-square test. The meta-analysis was performed in MetaWin 2.1. Spearman's correlation coefficients were calculated to analyze the relationships between the effect sizes of enzyme activities, soil organic carbon (SOC), total nitrogen (TN), microbial C, microbial N and continuous explanatory variables.

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
92	Arable land	Fertilisation using composted/digested manure (Mixed, Cattle, Pig, Poultry)	Fertilisation using untreated manure (Mixed, Cattle, Pig, Poultry)	Metric: Soil microbial carbon; Soil enzymatic activity; Effect size: Logarithm of ratio of the considered metrics in the intervention to the considered metrics in the control	68.75

Results

- Composted/digested manure application, compared to non-composted, induced a significantly larger effect size on soil microbial carbon.
- Composted/digsted manure application, compared to non-composted, induced a significantly larger effect sizes on most enzyme activities.

Factors influencing effect sizes

- No factors influencing effect sizes to report

Conclusion

The addition of composted/digested manure had a significantly greater effect on soil microbial carbon and on most biochemical properties than non-composted manure.