STRATEGIES TO REDUCE THE ENVIRONMENTAL IMPACT CAUSED BY THE POTENTIAL LOSSES OF N IN SOIL AMENDED WITH ORGANIC RESIDUES

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INTRODUCTION

For many years, nitrogen mineral fertilization has been regarded as a most highly productive and profitable farming practice. The downside, however, is represented by the negative environmental repercussions of its use. A potential source of N is found in organic residue, which has increased dramatically due to human activity. For instance, organic debris generated in urban areas and resulting from intensive livestock breeding. This field study analyzes N transformation using different sources of nitrogen (organic and mineral) in an almond tree plantation.

MATERIALS

All the organic residue used in this study had previously undergone aerobic transformation through composting.

TREATMENTS

Three types of compost **(O)** were compared (table 1).

E: A mix of manure and plant residue from a green (organic) farm.

S: sewage sludge and pruning waste compost.

X: a mixture of composted sewage sludge and swine slurry and manure.

Dose
- **H**: High dose → 210 KgN/ha
- **L**: High dose → 105 KgN/ha

(O+M) Other plots also treated with an **L dose** of compost and a **mineral fertilizer** (5:15:15), which was applied at a dose of 0.45 t/ha

METHODOLOGY

The soil characterization was carried out according to the Spanish soil methodology (M.A.P.A.) Respirometry was performed using BacTrac equipment.

OBJECTIVES

It aims at evaluating three types of organic residue as sources of N as well as their short-term impact on soil quality in an almond tree plantation.

RESULTS

Chemical variations in the soil were analyzed two months after applying both the organic and mineral fertilizers (table 1).

- C, N and P levels increased in all the treatments with respect to the control treatment (unamended). There was no significant differences among treatments and doses.
- Supplementary mineral N did not affect the chemical characteristics of the organically amended soils studied, such as pH, electrical conductivity, organic matter content, as well as N and P levels.
- Electrical conductivity, however, increased significantly in soils treated with mineral fertilizer and compost E (table 2).

	pH	E.C. (dS/m)	% N	% MOox	C/N	P (mg/Kg)
Soil	*8,58*	*0,2*	*0,11*	*1,43*	*7,2*	*21,8*
E	7,85	1,41	1,58	18,63	6,8	767
S	7,32	13,74	2,1	29,52	8,2	566
X	7,74	10,9	2,04	28,25	8	740

TABLE 1. SOIL AND COMPOST CHARACTERISTICS
EC: Electric conductivity; N: Nitrogen Kjeldahl; P: Phosphor; MOox: Organic matter; C/N: Ratio Carbon/Nitrogen.
E: Ecologic agriculture Compost; S: Sewage sludge compost; X: Sewage sludge and pig slurry and pig manure compost.

- Nitrate content increased between twofold and sevenfold (E to L) with respect to the control treatment (figure 2).
- Respiration increased in all those soils treated with compost (figure 3).
- The mineral N supplement along with the organic amendments caused a decrease in soil activity, which resulted in lower CO_2 production, with lower N and O.M. contents (figure 1).
- These soils also showed lower nitrate concentration when compared to soils that did not receive a N supplement.

Organic treatments			E.C. (dS/m)	pH	% N	% MO	C/N	P (mg/Kg)	$N-NO_3$ (mg/Kg)
C			0,15	8,22	0,12	1,48	7,1	25,54	10,52
			0,02	*0,17*	*0,02*	*0,23*	*0,46*	*2,67*	*4,85*
S	***L***		0,4	7,95	0,16	2,07	7,5	74,56	68,75
		Desviation	*0,18*	*0,2*	*0,04*	*0,41*	*0,22*	*25,21*	*14,45*
	H		0,48	7,8	0,19	2,41	7,49	79,1	75,53
		Desviation	*0,16*	*0,16*	*0,02*	*0,34*	*0,32*	*19,96*	*46,85*
E	***L***		0,34	8,08	0,16	1,96	7,22	70,03	22,19
		Desviation	*0,08*	*0,14*	*0,02*	*0,27*	*0,26*	*19,86*	*6,76*
	H		0,42	8,07	0,21	2,28	7,24	88,47	52,42
		Desviation	*0,06*	*0,07*	*0,06*	*0,26*	*0,26*	*33,79*	*8,15*
X	***L***		0,33	7,91	0,16	2,06	7,53	75,72	37,3
		Desviation	*0,11*	*0,21*	*0,01*	*0,24*	*0,3*	*30,09*	*12,12*
	H		0,41	7,96	0,16	2,09	7,58	96,84	65,64
		Desviation	*0,17*	*0,12*	*0,03*	*0,42*	*0,41*	*38,54*	*27,76*
Organic + Mineral vs. Organic treatments									
C			0,15	8,22	0,12	7,1	1,48	25,54	10,52
		Desviation	*0,02*	*0,17*	*0,02*	*0,46*	*0,23*	*2,67*	*4,85*
S+M			0,32	7,95	0,13	7,39	1,6	58,39	25,49
		Desviation	*0,06*	*0,15*	*0,01*	*0,15*	*0,14*	*15,5*	*9,91*
E+M			0,38	7,95	0,12	7,89	1,66	62,64	19,11
		Desviation	*0,19*	*0,11*	*0,02*	*0,84*	*0,07*	*40,99*	*2,85*
X+M			0,28	7,97	0,12	7,76	1,64	61,34	15,79
		Desviation	*0,06*	*0,22*	*0,01*	*0,36*	*0,17*	*16,84*	*4,72*

TABLE 2. Chemical characteristics of amended soils
EC: Electric conductivity; N: Nitrogen Kjeldahl; P: Phosphorous; MO ox: Organic matter; C/N: Ratio Carbon/Nitrogen; $N-NO_3$: Nitrates.

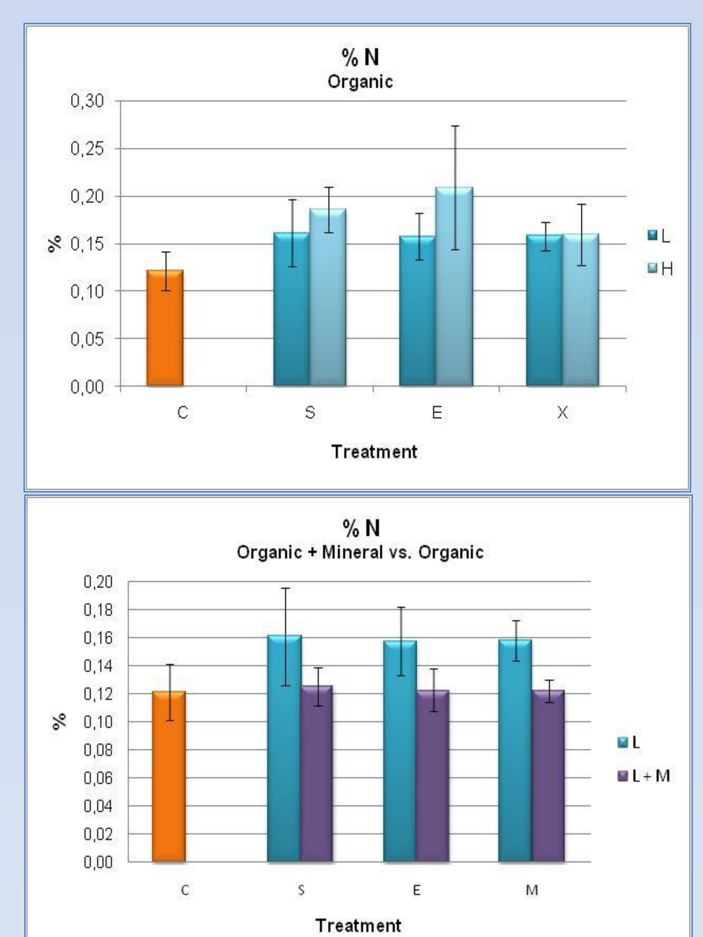

Figure 1

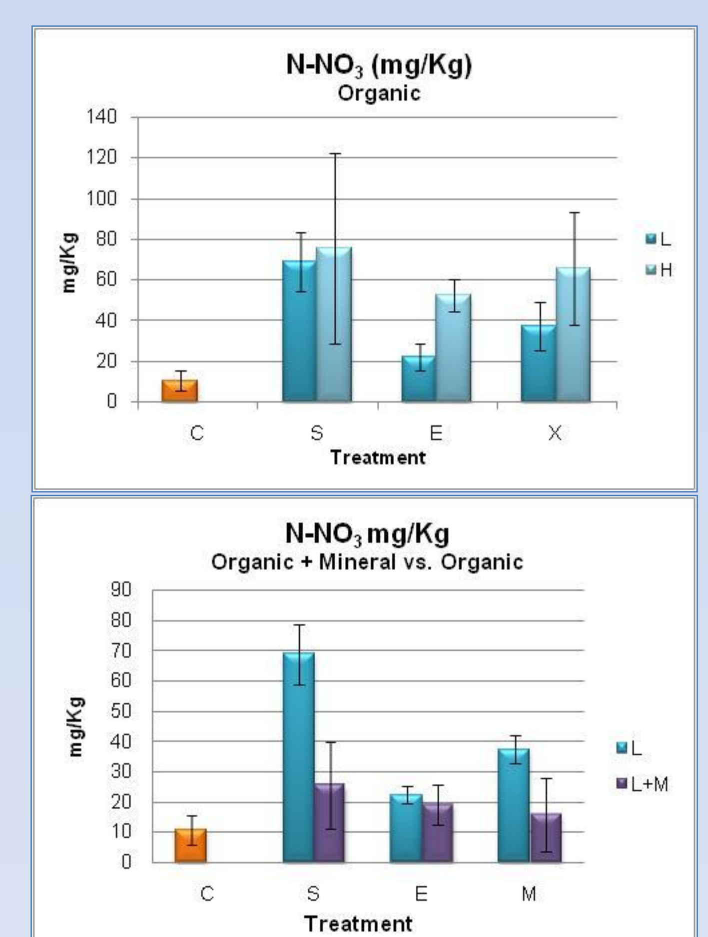

Figure 2

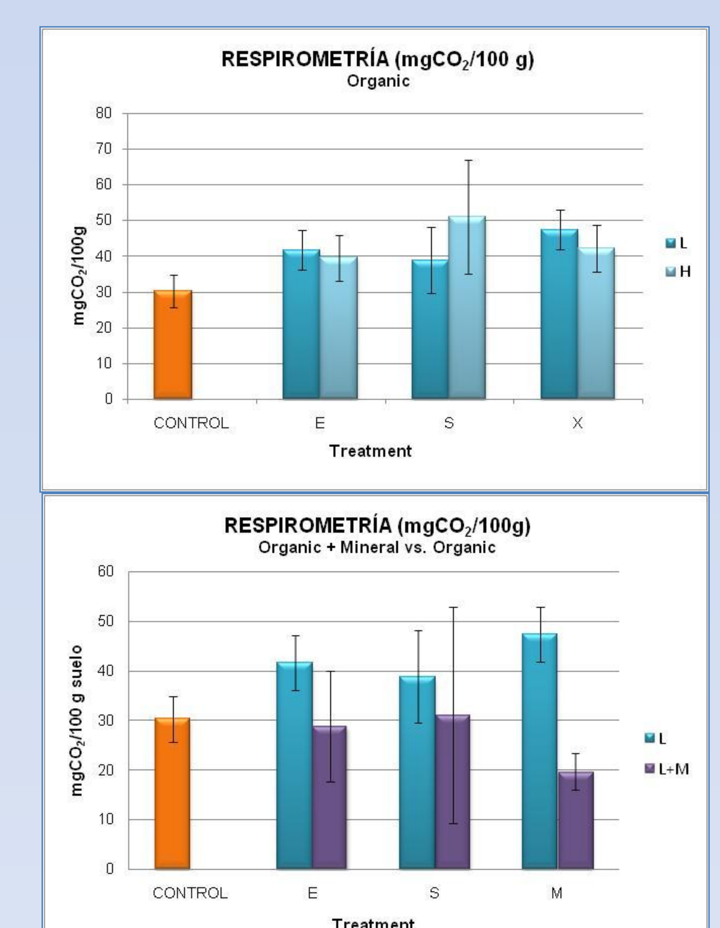

Figure 3

CONCLUSIONS

The short-term nature of the study limited the possibility of determining the exact balance between soil quality and the environmental impact of nitrogen transformation caused by mixed fertilization (organic-mineral). The mineral nitrogen supplement in organically amended soils seems to have led to a decrease in biological activity with respect to the same soils when only treated organically. This may be due to an environmental unbalance caused by a competition over N-substrate

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