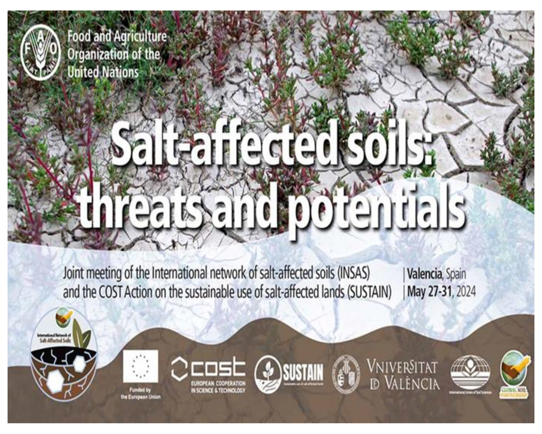

EFFECT OF APPLICATION OF RICE STRAW AND SEWAGE SLUDGE COMPOST ON THE SALINITY OF A CLAY LOAM SOIL DEDICATED TO CITRUS CULTIVATION

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INTRODUCTION

Soils are one of the most important factors in the overall balance of the biosphere. Ninety-five percent of the food we consume comes from our soils. It is a non-renewable natural resource and must be protected and used without exceeding its capacity to accept the different intended uses. Composting and the use of the compost obtained as an organic amendment, is a widely used process for the recycling and recovery of organic waste contemplated in the objectives of the circular economy. The application of compost produced from agricultural waste and sewage sludge is a widely used practice since, when applied under appropriate conditions, it can improve soil quality (Roca-Pérez et al., 2009; Liu et al., 2022). However, if not handled properly, undesirable effects can be triggered. One of the underestimated factors that can limit the agricultural use of compost is salinity (Fig. 1).

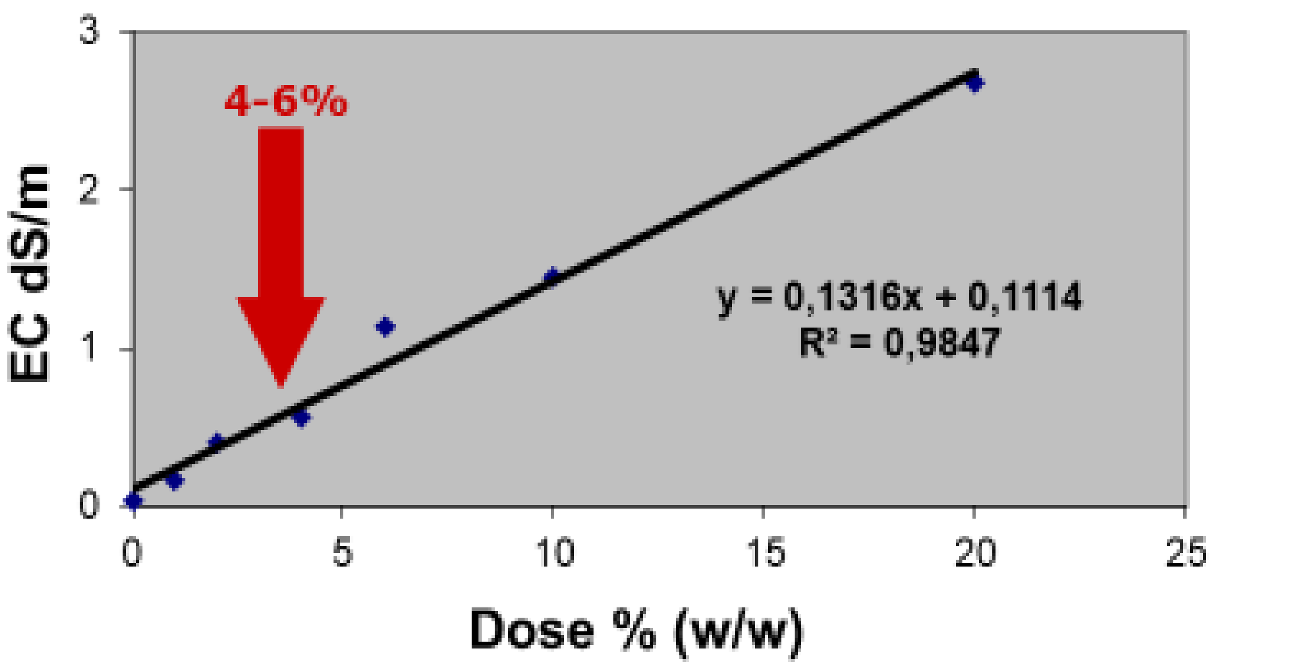

Fig. 1. Effect o compost application on soil salinity

OBJECTIVE

The purpose of this work was to study the effect produced by the application of a compost (class B) of rice straw (RS) and sewage sludge (SS) on a basic, calcareous, clay loam soil, dedicated to citrus cultivation, in order to evaluate the risks of salinization, alkalinization and sodification

MATERIALS AND METHODS

A field experiment was carried out in which three doses of compost (t ha-1) were applied to the soil: 6 (T1), 12 (T2) and 36 (T3). The experimental plot was divided into 8 subplots of 8.75 x 7.5 m (Control-C, T1, T2 and T3), four treatments by duplicate. In each one a random sampling was carried out obtaining two samples composed of eight subsamples; this was done at two depths (0-10 cm and 10-20 cm). The compost was spread manually and then scarified (Fig. 2; Fig. 3). Seven sampling during seven months were realized: before application and at 7, 11, 17, 28, 114 and 204 days. Irrigation and precipitation were controlled. The saturated paste was made and the saturation extract (Es) was obtained. The electrical conductivity (EC) was determined in the 1:5 w/v extract. In the Es following parameters were determined: pH, ECs, CO_3^{2-}, HCO_3^-, Cl^-, SO_4^{2-}, NO_3^-, BO_3^{3-}, Ca^{2+}, Mg^{2+}, K^+, Na^+. Sodium Adsorption Ratio (SAR) and Exchangeable Sodium Percentage (ESP) were calculated.

Fig. 2. Rice straw, sewage sludge, compost and soil amended with compost.

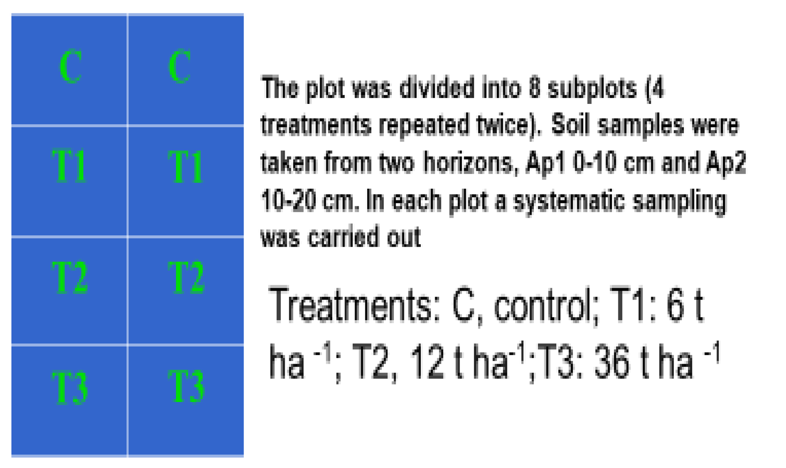

Fig.3. Experimental design

RESULTS

An increase in the value of all the parameters analyzed was observed, especially in T2 and T3 during the first days. However, with the exception of T3, these values normalized after 28 days (Fig. 4; Table 1). The most affected parameters were CEs, SAR and ESP. Increased salinity was mainly associated with NO_3^-, Ca^{2+}, Mg^{2+} and K^+ while HCO_3^-, Cl^-, SO_4^{2-}, BO_3^{3-} and Na^+ did not substantially influence (Fig. 5). This fact suggests that the risk of salinity is minimized. The pH in the Es did not exceed 8.5 in any case, and the concentration of bicarbonates present in the soil solution was not relevant either. ESP values were always below 3%.

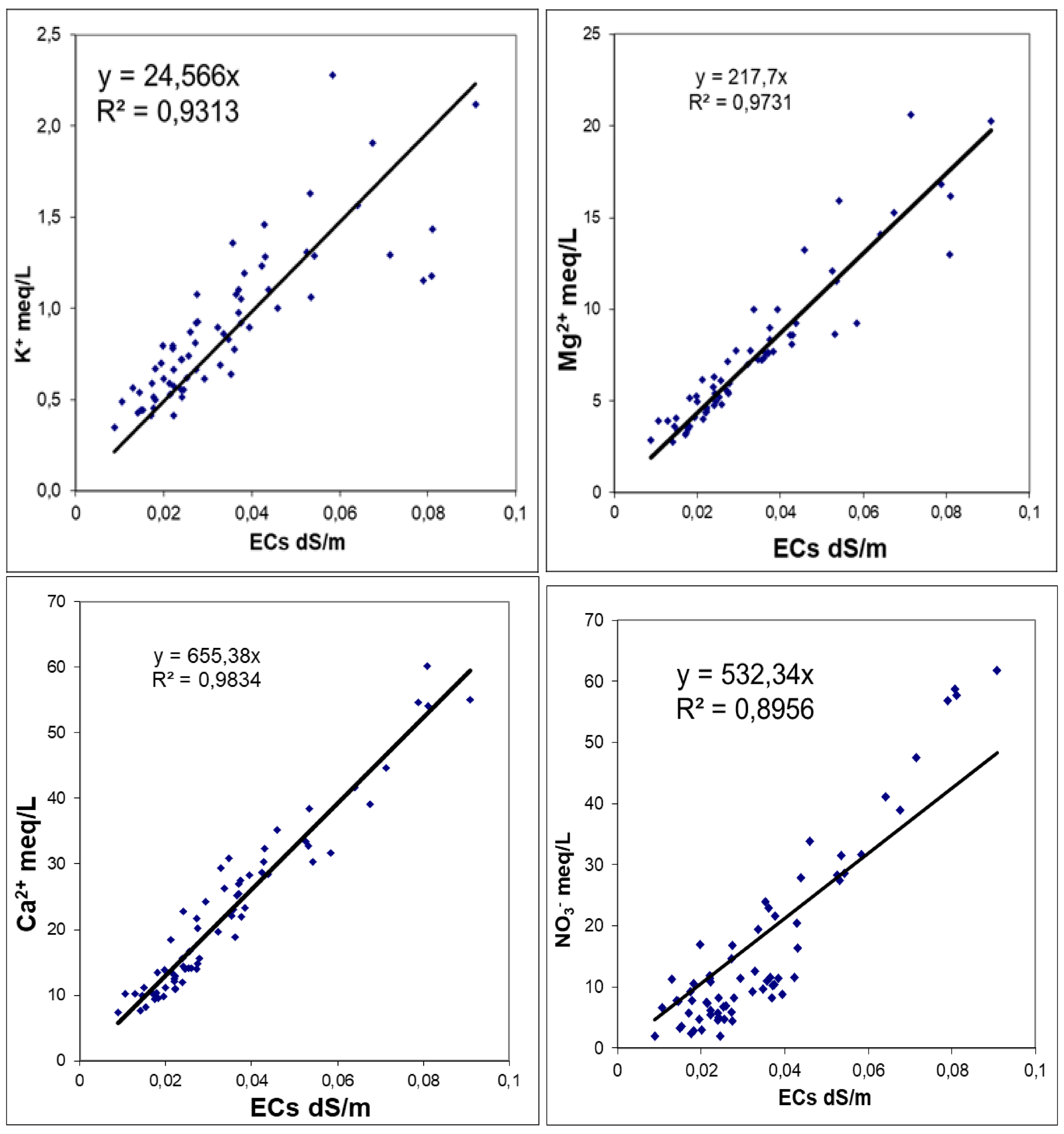

Fig. 5. Relationships between macronutrients and soil salinity

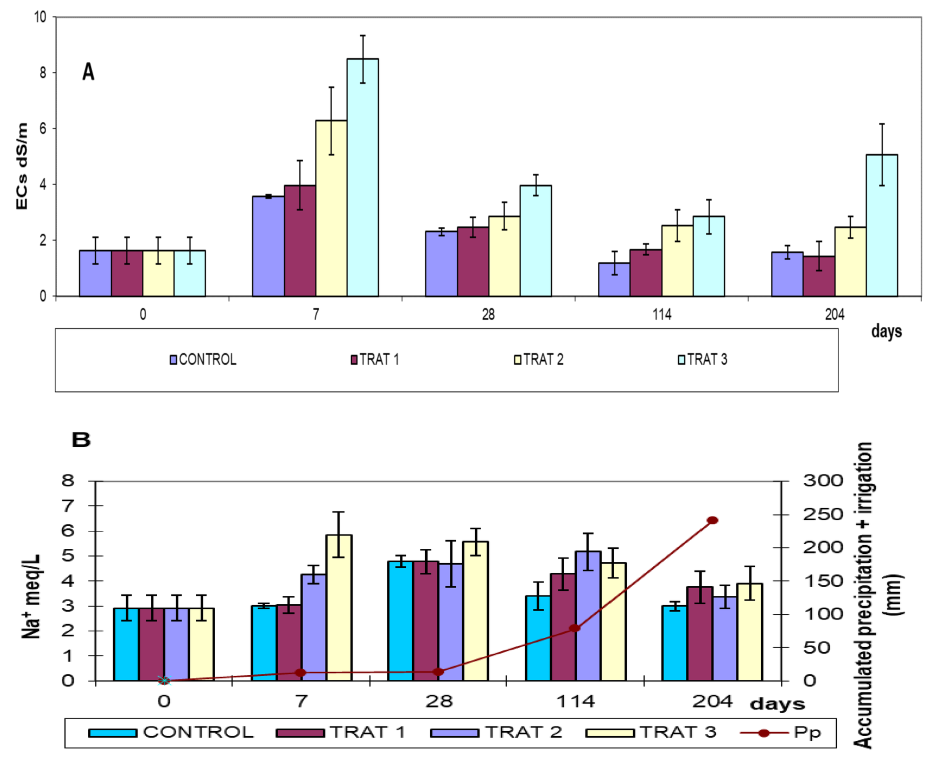

Fig. 4. Temporal evolution of the ECs (A) and Na^+ (B) in Ap1 (0-10 cm) soil horizon measured in saturation extract

Table 1. Statistical analysis - ANOVA between teratments in Ap1 (0-10 cm) soil horizon measured in saturation extract.

HORIZON 0-10 cm		Ca^{2+}		Mg^{2+}		HCO_3^-		CEs		pH	
Before application	Control. 1	13,85	ab	5,25	ab	1,10	a	1,98	ab	8,04	bc
	Control. 2	10,20	ab	3,88	ab	1,05	a	1,29	ab	7,95	bc
7 days	Control. 1	18,83	abcd	7,36	abc	1,88	a	3,61	abc	7,60	ab
	Control. 2	22,10	abcd	7,25	abc	1,00	a	3,54	abc	7,60	ab
	Trat 1.1	26,25	de	10,00	c	1,28	a	3,36	bcd	7,70	bc
	Trat 1.2	35,20	de	13,23	c	1,83	a	4,59	bcd	7,99	bc
	Trat 2.1	30,38	e	15,92	d	1,90	a	6,42	de	7,78	abc
	Trat 2.2	44,70	e	20,63	d	1,85	a	7,14	de	7,83	abc
	Trat 3.1	55,00	f	20,25	d	1,55	a	9,08	e	7,20	a
	Trat 3.2	54,65	f	16,83	d	1,25	a	7,89	e	7,35	a
28 days	Control. 1	10,96	ab	4,56	ab	2,05	a	2,22	ab	8,20	c
	Control. 2	11,93	ab	4,77	ab	1,60	a	2,40	ab	8,15	c
	Trat 1.1	11,03	abc	4,67	ab	1,55	a	2,22	ab	7,82	bc
	Trat 1.2	13,99	abc	5,57	ab	2,00	a	2,72	ab	8,03	bc
	Trat 2.1	14,15	abcd	5,21	ab	1,95	a	2,53	abc	8,13	bc
	Trat 2.2	19,70	abcd	7,00	ab	2,00	a	3,22	abc	8,04	bc
	Trat 3.1	25,50	cde	7,67	abc	2,00	a	3,71	bcd	7,96	bc
	Trat 3.2	28,65	cde	8,58	abc	2,45	a	4,24	bcd	8,10	bc

Different letters indicate significant differences (P < 0.05)

DISCUSSION

The results indicate that the soil responds directly to this type of compost, which is in agreement with previous studies (e.g. Roca-Pérez et al., 2009; Liu et al., 2022). However, if compost-soil management is not done properly, the increase in soil salinity can be a limiting factor for its use in agriculture. Proper information to manage compost according to soil conditions is necessary

CONCLUSIONS

Therefore, the application of this compost at doses between 6 and 36 t ha^{-1} does not pose any risk related to soluble salts for similar soils to those of this study, and represents a viable option for the valorization of RS and SS, contributing to minimize the harmful effect on health and the environment that occurs when rice straw is incinerated in the fields.

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