INFLUENCE OF ORGANIC FERTILIZATION WITH OR WITHOUT MINERAL FERTILIZER ON SOME CHEMICAL CHARACTERISTICS OF EUTRIC FLUVISOLS

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Abstract
Manure from cattle was composted and used as fertilizer in a field experience organised on Eutric Fluvisols. There were studied the changes of chemical characteristics of soil under the influence of organic fertilization with or without mineral fertilization. Organic fertilization did not resulted in significant changes in soil reaction but mineral fertilization produced significant decreases of pH values. There was also observed a slight increase in organic carbon content in variants fertilised with composted manure, and after mineral fertilization also, but the increases were not statistically significant. Considering total nitrogen content were observed statistically significant increases after mineral fertilization with high doses ($N_{100}P_{100}$). The combination of the two fertilization systems has led to best results at highest doses both for organic and mineral fertilizers. Ratio C/N did not lead to statistically significant changes after organic or mineral fertilization. The highest values of mobile phosphorus in the soil were recorded in variants fertilized with high doses of compost plus mineral fertilizer. Mobile potassium values were statistically significantly increased compared to the control under the influence of fertilization with compost made from cattle manure at a dose equivalent to 400 kg N/ha

Keywords: compost, mineral fertilization, nutrients

1. INTRODUCTION

The process of converting organic waste into compost is becoming increasingly widespread across Europe, thereby reducing the use of mineral fertilizers and the quantities of waste deposited on land [1].
Obviously, these organic fertilizers are cheap and available to each farmer and, in addition, they can be supplemented with chemical fertilizer to achieve optimal nutrient requirements for crops.
The soils conservation and their fertility in balance with natural processes is an essential requirement for ensuring food security for an ever-increasing population [2].

2. MATERIALS AND METHODS

The experiments were organized on an experimental field at Caransebeş using subdivided parcels method, studying the two gradients: A factor - organic fertilization with compost made from cattle manure, in 5 doses and B Factor – mineral fertilization with nitrogen and phosphorus, in 3 doses. The experiments were organized on a Eutric Fluvisols. The experimental field was not very homogenous.
Before organic fertilization there were determined the physical and chemical characteristics of soil and the characteristics of composted manure.
Processing of experimental data was performed using analysis of variance and Tukey test.

3. RESULTS AND DISCUSSIONS

The chemical and physical characteristics of soil samples from experimental field showing a high degree of fertility obtained by anthropogenic influences, fertilization with organic fertilizers each year. The chemical characteristics of compost show that it is properly homogenized, coefficients of variation values were low, but it was extended the period of composting to reduce humidity.
There were studied the changes of chemical characteristics of an Eutric Fluvisols from experimental field from Caransebeş under the influence of the two systems of fertilization.
After the first year of experimentation, the effects of organic and mineral fertilization on soil reaction are presented in *Table 1*. Data show the effect of acidifying fertilizers and lack

of statistically significant changes after fertilization with compost. Mineral fertilization with $N_{50}P_{50}$ and $N_{100}P_{100}$ resulted in statistically significant decreases compared with control variant of soil reaction.

There was observed (*Table 2)* a clear trend of increasing soil organic carbon contents after organic fertilization. The mineral fertilization led to a tendency of increasing the soil organic carbon content, the highest value was obtained in the version which applied high doses of organic and mineral fertilizers (400 kg N/ha associated with $N_{100}P_{100}$) .

Ross et al. [3] also found an increasing in soil organic carbon content by fertilization with compost made from organic residues from the second year of experimentation.

The same situation can be observed from the analysis of changes in total nitrogen content under the influence of fertilization (*Table 3).*

In this case, the total nitrogen content increase under the influence of mineral fertilization ($N_{100}P_{100}$) is statistically significant. The best results were achieved in variants that have applied high doses of organic and mineral fertilizers.

Eghball et al. [4] determined the accessibility of organic nitrogen in the first year of application of up to 18% from composted manure and in the case of phosphorus the bioavailability varies from 73% to 85% from fresh manure.

As it was expected, under the treatments influence, the similar changes of total organic carbon and nitrogen led to an unchanged C/N ratio (*Table 4).*

Table 1. Effects of fertilization with composted cattle manure and mineral fertilization with nitrogen and phosphorus, on pH value of Eutric Fluvisols

Mineral fertilization	Compost fertilization					Mean value mineral fertilization
	Unfertilized with compost	Compost fertilization equivalent to a nitrogen rate of:				
		100 kg N / ha	200 kg N / ha	300 kg N / ha	400 kg N / ha	
Unfertilized	*6.89* a[(1)]	6.84 a	6.81 a	6.82 a	6.71 a	**6.81 A**[(2)]
N_{50} P_{50}	6.72 a	6.75 a	6.74 a	6.73 a	6.64 a	**6.72 B**
N_{100} P_{100}	6.75 a	6.73 a	6.71 a	6.65 a	**6.60** a	**6.69 B**
Mean value compost fertilization	**6.79 W**[(3)]	**6.77 W**	**6.75 W**	**6.73 W**	**6.65 W**	

[(1)], [(2)] or [(3)] - Values followed by the same letter (A,B,C or W,X,Y) are not significantly different at the p=0.05 level (Tukey's honestly significant procedure)

Table 2. Effects of fertilization with composted cattle manure and mineral fertilization with nitrogen and phosphorus, on soil organic carbon content in soil

Mineral fertilization	Compost fertilization					Mean value mineral fertilization
	Unfertilized with compost	Compost fertilization equivalent to a nitrogen rate of:				
		100 kg N / ha	200 kg N / ha	300 kg N / ha	400 kg N / ha	
	%					
Unfertilized	*2.46* a[(1)]	2.53 a	2.71 a	2.80 a	2.78 a	**2.66 A**[(2)]
N_{50} P_{50}	2.73 a	2.76 a	2.80 a	2.83 a	2.99 a	**2.82 A**
N_{100} P_{100}	2.78 a	2.81 a	2.91 a	2.91 a	*2.99* a	**2.88 A**
Mean value compost fertilization	**2.66 W**[(3)]	**2.70 W**	**2.81 W**	**2.85 W**	**2.92 W**	

[(1)], [(2)] or [(3)] - Values followed by the same letter (A,B,C or W,X,Y) are not significantly different at the p=0.05 level (Tukey's honestly significant procedure)

Table 3. Effects of fertilization with composted cattle manure and mineral fertilization with nitrogen and phosphorus on total nitrogen content in soil

Mineral fertilization	Compost fertilization					Mean value mineral fertilization
	Unfertilized with compost	Compost fertilization equivalent to a nitrogen rate of:				
		100 kg N / ha	200 kg N / ha	300 kg N / ha	400 kg N / ha	
	%					
Unfertilized	*0.255* a[1]	0.259 a	0.266 a	0.264 a	0.269 a	**0.263 A**[2]
N_{50} P_{50}	0.261 a	0.264 a	0.268 a	0.273 a	0.285 a	**0.270 A**
N_{100} P_{100}	0.283 a	0.286 a	0.304 a	0.305 a	*0.307* a	**0.297 B**
Mean value compost fertilization	**0.266 W**[3]	**0.270 W**	**0.279 W**	**0.281 W**	**0.287 W**	

(1), (2) or (3) - Values followed by the same letter (A,B,C or W,X,Y) are not significantly different at the p=0.05 level (Tukey's honestly significant procedure)

Table 4. Effects of fertilization with composted cattle manure and mineral fertilization with nitrogen and phosphorus on carbon : nitrogen ratio in soil

Mineral fertilization	Compost fertilization					Mean value mineral fertilization
	Unfertilized with compost	Compost fertilization equivalent to a nitrogen rate of:				
		100 kg N / ha	200 kg N / ha	300 kg N / ha	400 kg N / ha	
Unfertilized	*11* a[1]	11 a	12 a	12 a	12 a	**12 A**[2]
N_{50} P_{50}	*12* a	12 a	12 a	12 a	**12** a	**12 A**
N_{100} P_{100}	12 a	12 a	11 a	11 a	11 a	**11 B**
Mean value compost fertilization	**12 W**[3]	**12 W**	**12 W**	**12 W**	**12 W**	

(1), (2) or (3) - Values followed by the same letter (A,B,C or W,X,Y) are not significantly different at the p=0.05 level (Tukey's honestly significant procedure)

Mineral fertilization in high doses ($N_{100}P_{100}$) increased statistically significant the average value of mobile phosphorus content in soil compared to control (*Table 5*).
Organic fertilization led to statistically significant increases compared to the unfertilized variant, only at a dose of compost application of 400 kg N/ha. The highest values of mobile phosphorus in the soil were recorded in variants fertilized with high doses of compost plus mineral fertilizer. The combination of organic and mineral fertilization led to increased levels of mobile phosphorus in the soil.

Since no potassium fertilizer was applied, but only with nitrogen and phosphorus, have not found any changes in mobile potassium content under the influence of mineral fertilization. Mobile potassium values were statistically significantly increased compared to the control under the influence of fertilization with compost made from cattle manure at a dose equivalent to 400 kg N/ha (*Table 6*).
Research results obtained after the first year of experimentation on Eutric Fluvisols from Caransebes reveals that fertilization with compost increases the soil organic carbon content and nutrients

Table 5. Effects of fertilization with composted cattle manure and mineral fertilization with nitrogen and phosphorus on available phosphorus content in soil

Mineral fertilization	Compost fertilization					Mean value mineral fertilization
	Unfertilized with compost	Compost fertilization equivalent to a nitrogen rate of:				
		100 kg N / ha	200 kg N / ha	300 kg N / ha	400 kg N / ha	
	mg / kg					
Unfertilized	*15* a[1]	19 abc	22 abcd	23 abcd	23 abcd	**20 A**[2]
N_{50} P_{50}	18 ab	21 abcd	24 abcd	25 bcd	28 cde	**23 A**
N_{100} P_{100}	24 abcd	25 bcd	27 bcde	30 de	**36** e	**28 B**
Mean value compost fertilization	**19 W**[3]	**22 WX**	**24 WX**	**26 WX**	**29 X**	

(1) , (2) or (3) - Values followed by the same letter (A,B,C or W,X,Y) are not significantly different at the p=0.05 level (Tukey's honestly significant procedure)

Table 6. Effects of fertilization with composted cattle manure and mineral fertilization with nitrogen and phosphorus on available potassium content in soil

Mineral fertilization	Compost fertilization					Mean value mineral fertilization
	Unfertilized with compost	Compost fertilization equivalent to a nitrogen rate of:				
		100 kg N / ha	200 kg N / ha	300 kg N / ha	400 kg N / ha	
	mg / kg					
Unfertilized	*253* a[1]	276 a	296 a	342 a	*370* a	**307 A**[2]
N_{50} P_{50}	241 a	280 a	328 a	313 a	342 a	**301 A**
N_{100} P_{100}	238 a	266 a	281 a	319 a	318 a	**284 A**
Mean value compost fertilization	**244 W**[3]	**274 WX**	**302 WX**	**325 WX**	**343 X**	

(1) , (2) or (3) - Values followed by the same letter (A,B,C or W,X,Y) are not significantly different at the p=0.05 level (Tukey's honestly significant procedure)

4. CONCLUSIONS

It requires the full exploitation of all sources of organic matter to minimize loss of soil humus content.
How the manure is collected and stored before being used in the field, affects the stabilization and conservation of nutrients and organic matter. Composting is a good alternative of manure recovery.
Fertilization with compost creates the possibility of a higher recovery of mineral fertilizers.

5. REFERENCES

[1] Ros, M., Klammer, S., Knapp, B., Aichberger, K. & Insam, H., 2006 − Long-term effects of compost amendment of soil on functional and structural diversity and microbial activity, Soil use and Management, 22, 209-218.
[2] Sussmuth Rita, 1998 − Protecting the Soil and Preserving it for Future Generations, p.I-II, ISCO Proceedings ‘’Towards Sustainable Land Use’’. Advances in Geoecology, 31, Catena Verlag, 35447, Reiskirchen.
[3] Ros, M., Garcia, C. & Hernandez, T., 2003b − Soil microbial activity after restoration of a semiarid soil by organic amendments, Soil Biology & Biochemistry,35, 463-469.
[4] Eghball, B., B.J. Weinhold, J.E. Gilley, and R.A. Eigenberg, 2002 – Mineralization of manure nutrients, J. Soil Water Conserv. 57:470–473.