MICROBIOLOGICAL ACTIVITY IN THE SOIL OF AN APRICOT ORCHARD

Oneț Aurelia, Oneț Cristian

University of Oradea-Faculty of Environmental Protection* aurelia_onet@yahoo.com

Abstract

In this paper we investigated the effect of differentiated fertilization and agrotechnical treatments on the number of microorganisms in the soil of an apricot tree orchard. The soil type was haplic luvisol. The number of aerobic mesophilic heterotrophs ranged from 957.55×10^3 to 19.6×10^6 CFU×g^{-1} dry matter soil, the number of Actinomycetes from 15.8×10^3 to 2.39×10^6 CFU×g^{-1} dry matter soil and the number of fungi from 21.71×10^4 to 1.72×10^6 CFU×g^{-1} dry matter soil. A lower number of bacteria from Azotobacter genus was recorded in the soil of apricot tree orchard.

Keywords: soil, microorganisms, apricot tree, orchard.

INTRODUCTION

Incorrect agrotechnical treatments and irrational application of fertilization may cause disturbances in the functioning of the whole agrosystem and contribute to the development in soil environments of different noxious compounds acting unfavourably on soil microorganisms, on the cultivated plants as well as on the fertility. The effect of fertilization on the microbiological status of soil is associated with the form of fertilizers (mineral or organic), their dose and type, as well as with the cultivation status. (K. Styla, 2010).

The objective of the present work was the investigation of microbiological activity by the determination of the total number of bacteria, number of *Actinomycetes*, fungi and bacteria from *Azotobacter* genus, in the soil of an apricot tree orchard depending on the application of fertilizers and agrotechnical treatments.

MATERIALS AND METHODS

The research was done in 2011 and 2012 in the haplic luvisol of an orchard with apricot tree. The experimental plots field is localized at 10 kilometers from Oradea, Bihor County.

The soil was collected from the depth of 0-20 cm in spring (March) and autumn (October) of years 2011 and 2012. In the laboratory plant material and soil macro fauna were removed and the soil samples were sieved (<2mm) and mixed. Bacterial and fungal population sizes were determined using the standard soil dilution plate method. Dilutions were

used for the determination of the number of culturable cells as colony forming units (CFU) and expressed on dry mass soil.

In the studied soil samples, the following microorganisms were estimated: the number of *Actinomycetes* on the Pochon medium, the number of bacteria from genus *Azotobacter* on Ashby's glucose agar and fungi on Sabouraud agar. Plate count method was used to estimate total number of microorganisms on a solid nutrient medium containing meat extract (Atlas, 2004).

RESULTS AND DISCUSSION

Agrotechnical treatments such as fertilization (including organic and mineral fertilization with nitrogen) have a significant effect on the activity of soil microorganisms.

The effect of fertilization on the microbiological status of soil is associated with the form of fertilizers (mineral or organic), their dose and type, as well as with the cultivation status (K. Styla, 2010).

In the table 1 and 2 are presented the main types of fertilizers and pesticides used in apricot tree orchard.

Table 1

The main types of pesticide used in apricot tree orchard

Year	Month	The trade name of the pesticides	Applied dose
2011	March	Topas	0,02%
		Score+Efcimetrin	0,02%+0,02%
	April	Folicur+Karate	0,1%+0,02%
		Folicur+Efcimetrin	0,1%+0,02%
	May	Bavistin+Karate	0,1%+0,02%
		Sisthane+Vantex	0,007%+0,007%
	June	Bavistin	0,1%
	November	Bordeaux mixture	1%
2012	March	Funguran	0,3%
	April	Dithane	0,2%
		Dithane	0,2%
		Score+Efcimetrin	0,02%
		Sisthane+Efcimetrin	0,02%
		Merpan	1,6 kg/ha
	May	Dithane+Vantex	0,2%+0,1%
		Score+Actara	0,012%
	November	Bordeaux mixture	1%

Table 2

The main types of chemical fertilizers used in apricot tree orchard

Year	Month	Fertilizers type	Concentration Active substance %	Applied dose
2011	March	Ammonium nitrate	33-34,5N	80 kg a.s./ha
2011	November	NPK	15 :15 :15	120 kg a.s./ha
2012	March	Urea	46% N	40 kg a.s./ha
2012	November	NPK+3%MgO+5% CaO	15:15:15	100 kg a.s./ha

Table 3

Quantity change of the main groups of microorganisms monitored in orchard soil

Vegetation period	Microorganisms groups	Total number of micro-organisms (cells×g^{-1} dry matter soil)
Spring 2011	Aerobic mesophilic heterotrophs	$17X10^6$
Autumn		$19.5X10^6$
Spring 2012		$957.55X10^3$
Autumn		$9.5X10^6$
Spring 2011	*Actinomycetes*	$2.39x10^6$
Autumn		$2.196x10^6$
Spring 2012		$15.8x10^3$
Autumn		$6.4x10^5$
Spring 2011	Fungi	$1.562x10^6$
Autumn		$2.3x10^6$
Spring 2012		$21.71x10^4$
Autumn		$1.72x10^6$
Spring 2011	*Azotobacter*	255
Autumn		0
Spring 2012		191
Autumn		0

The data in table 3 show that in the soil of an apricot tree orchard the agrotechnical treatments caused an increase of *Actinomycetes* and fungi number. These microorganisms have an important role in affecting the persistence of pesticides, having the capacity for rapid elimination of highly persistent or toxic chemicals. The yeast-mold uses the pesticides such as carbon and energy source.

The development in soil of microflora communities depends also on the type of the applied nitrogen fertilizer. Many authors confirmed in their studies the presence of the greatest number of fungi in soil fertilized with ammonium sulphate (K. Styla, 2010).

The treatments with pesticides and chemical fertilizers have inhibitory effect on the living conditions of the *Azotobacter*.

CONCLUSIONS

The microbiological analysis of soil samples from haplic luvisol of an apricot tree orchard showed that anthropogenic factors such as fertilization and treatments with pesticides caused an increase of *Actinomycetes* and fungi number.

The effect of fertilization and treatments with pesticides on the microbiological properties of soil are associated with the form of fertilizers and pesticides, their dose and type, as well as with the cultivation status.

The number of microorganisms was found higher in spring because the mineralization activity of microorganisms is more intense in spring.

Easily available organic substances of soil are significantly higher in spring than in autumn.

REFERENCES

1. Atlas, R.M., 2004, Handbook of Microbiological Media, 3rd edition, CRC Press, New York.
2. Onet Aurelia, 2010, Research on the influence of fertilizers and pesticides pollution on biological activity and other properties of soil in the plains Crisuri, PhD Thesis.
3. Onet Aurelia, Onet C, 2010, Study of biological activity of haplic luvisol, Natural Resources and Sustainable Development, University of Oradea Publishing House.
4. Onet Aurelia, 2010, Research on the influence of the use of chemical fertilizers and pesticides on the biological activity of the soils from Crisurilor plains, Forests Magazine.
5. Onet Aurelia, Domuța C., Brejea R., Onet C., 2011, Study of the dependence between seasonal variation of micro-organisms and chemical properties of haplic luvisol, University of Oradea Annals, Environmental Protection Section, vol. XVI, Year 16, University of Oradea Publishing House.
6. Onet Aurelia, Onet C., 2011, Numerical variation of the main groups of microorganisms monitored in haplic luvisol, University of Oradea Annals, Environmental Protection Section, vol. XVI, Year 16, University of Oradea Publishing House.
7. Rumberger, A., Merwin, I.A. & Thies, J.E., 2007, Microbial community development in the rhizosphere of apple trees at a replant disease site. Soil Biol. Biochem., 39, 1645–1654.
8. Rutkowski, K., Pacholak, E. & Sawicka, A. 2000, Evaluation of the microbiological state of the soil under varied conditions of fertilization and irrigation in a replanted orchard. Part I. Number of bacteria.. Prace Kom. Nauk Rol. i Kom. Nauk Leś. PTPN. 89, 175–183 (in Polish).
9. Styla K., 2010, Microbiological activity of soil against the background of differentiated irrigation and fertilization in apple (Malus domestica) orchard after replantation.