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THE EFFECT OF DIFFERENT MULCHING MATERIALS ON QUANTITATIVE CHANGES OF MICROBES IN THE SOIL OF AN INTEGRATED APPLE PLANTATION

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Abstract

The purpose of our experiments was to discover the effect of different soil cover materials (agroszövet and black polyethylene) on the number of certain microbiological groups (total bacteria, fungi, aerobic cellulose decomposing bacteria, aerob nitrogen-fixing bacteria) occuring in soil. Soil samples were taken from a Cider apple plantation 4 times a year from March to September. The total number of bacteria and fungi number was determined by plate dilution. Physiological groups was determined on specific liquid culture medium according to POCHON-TARDIEUX (1972). Based on one-way ANOVA of our results it could be said that in soil covered by agroszövet (porous black polyethylene) number of all the examined microbes was significantly higher than in case of black polyethylene covering or control. Although conventional black polyethylene proved better than control, this difference was significant only in case of total bacteria number.

Keywords: *mulching, soil covering, fungi, totalbacteria, cellulose decompposing, N-fixing*

1. INTRODUCTION

It is well-known that the use of soil coverings has an important role mainly in the conservation of soil moisture content and realizes weed control without herbicides. We are also familiar with soil protecting (drying, erosion, deflation) and microclimate changing effect of mulching. So in case of integrated production this solution, which reduces the pesticide application, takes care of environment and meet the demand of the integrated production that has been applied in Hungary, too.

Beside the aforementioned advantages, mulching has a stimulating effect on soil microbes and through this on soil fertility. On the other hand many environmental factors influence the soil fertility. Thus, we determined the number of soil microbes in order to examine the effect of certain cultivation practices, such as mulching on soil microbes. There are many reliable, readily executeable methods to measure the soil physical and chemical parameters, but soil biological parameters could not measured so easily, because they are influenced by the complex effect of soil physical and chemical factors.

Although numerous methodological handbooks were published and soil biological research methods are under improvement (ANGERER et al., 1998), problem of research methods and practical evaluation is the weakiest point of the soil biological research activities (FEHÉR, 1954) up to the present day.

Hereby, we aimed to figure out the influencing effect of different mulching materials on soil microbes divided into different physiological groups.

MATERIAL AND METHODS

Our soil microbiological experiments were carried out within the scope of T-016471 OTKA project. The experimental field was two different apple plantations of Újfehértói Gyümölcstermesztési Kutató és Szaktanácsadó Kht. The soil type of the plots was slightly acid humus sand with a pH_{H2O} of 5.77 (4.93 measured in KCl) and 1,08 % humus content Before planting 70 t/ha livestock manure was corporate into the soil. 5x3 m growing area and 14 different Cider apple species were applied in this experimental field. The applied soil covering matters were the followings: conventional black polyethylene and porous black polyethylene called ‘agroszövet’ in a width of 120 cm, and hoe-cultivated plots were established to compare the effect of soil covering matters. Experimental plots (each was 60 m^2) contained 5 trees.

The total number of bacteria on Bouillon agar and of microscopic fungi on peptone-glucose agar (UBRIZSY-VÖRÖS, 1968) was determined by plate dilution method. The number of nitrogen fixing and cellulose decomposing bacteria was determined on special liquid culture medium according to POCHON-TARDIEUX (1972). Each examination was carried out in three repetition and the results was conversed into absolutely dry soil.

The effect of mulching experiments were statistically evaluated by one-way ANOVA. Kolmogorov probe was applied to determine the homogeneity of variations. Calculations were carried out with MICROSOFT EXCEL and SPSS.

RESULTS AND DISCUSSION

Total bacteria number was the highest in agroszövet treatment and the lowest in the control (Figure 1). It was the highest only in September 2001 under conventional black polyethylene covering followed by agroszövet and control treatments. Culminating point of total bacteria number was detected in May.

In case of microscopic fungi a peak was observed in May and July, and a minimum point in March and September. Tendency in number of microscopic fungi was the same than in case of total bacteria number (Figure 2).

Number of cellulose decomposing bacteria was the lower in control than in agroszövet treatment in all cases (Figure 3). However number of cellulose decomposing bacteria was the highest under conventional black polyethylene covering in some cases.

Most nitrogen fixing bacteria was found in plots covered by agroszövet in all cases and the less in control treatment (Figure 4). In some cases, conventional black polyethylene covering stimulated the propagation of nitrogen fixing bacterias less than the control treatment.

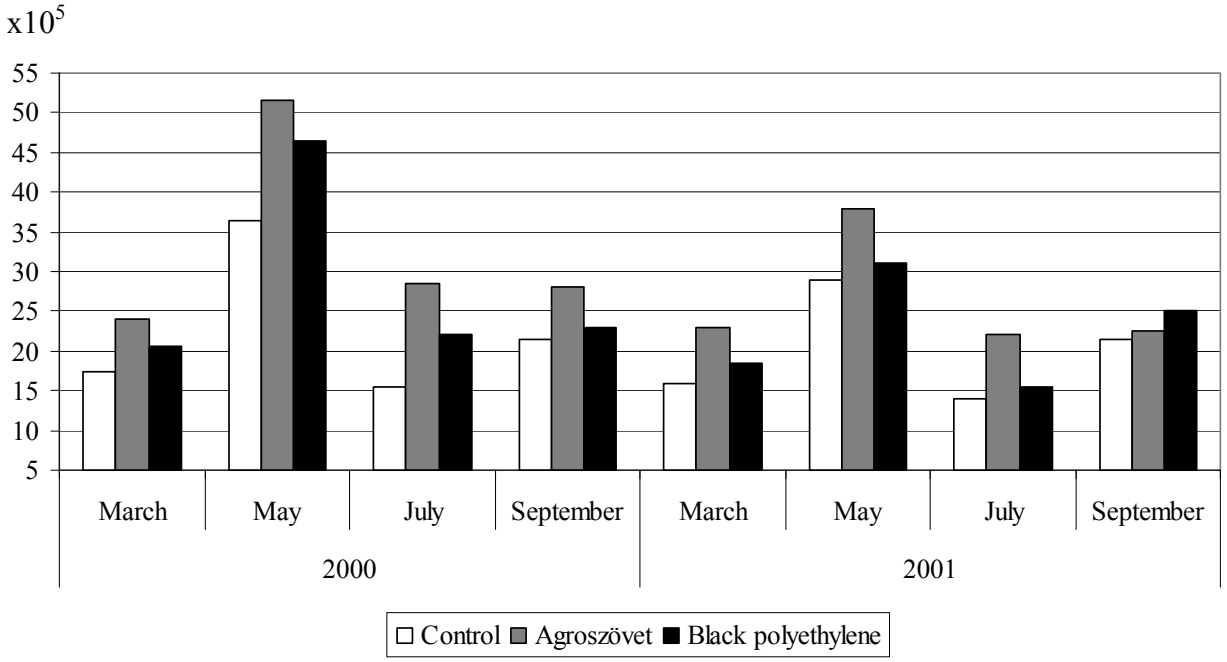

Fig. 1 *Effect of mulching on changing of total bacteria number*

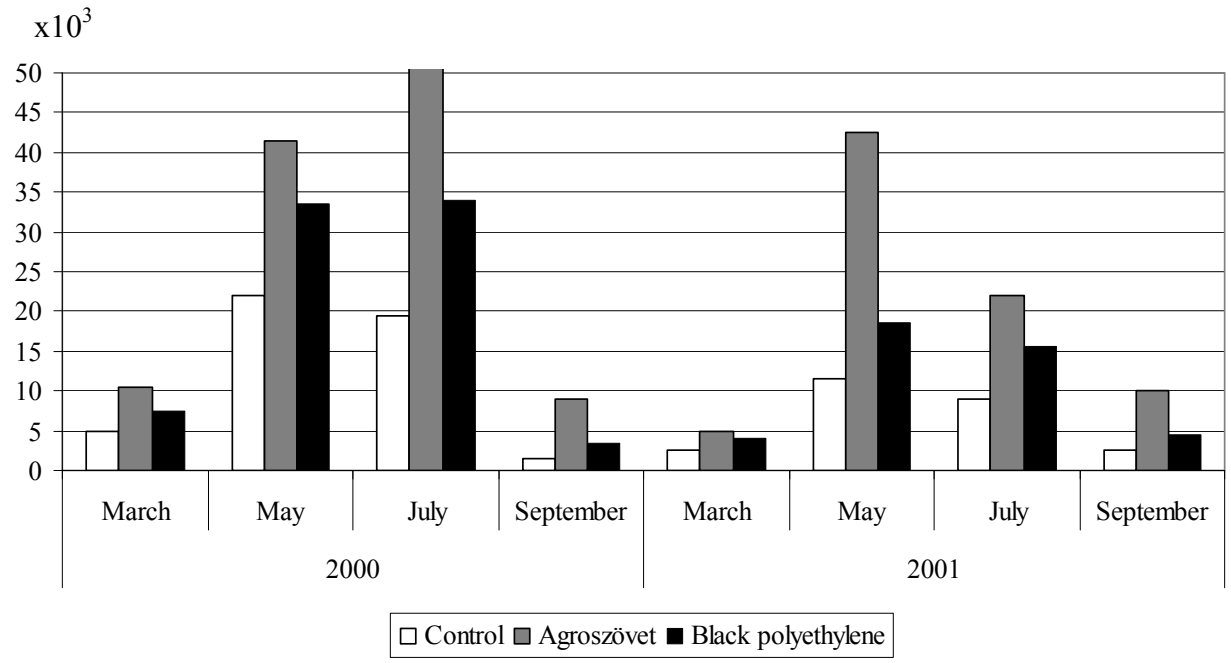

Fig. 2 *Effect of mulching on changing of fungi number*

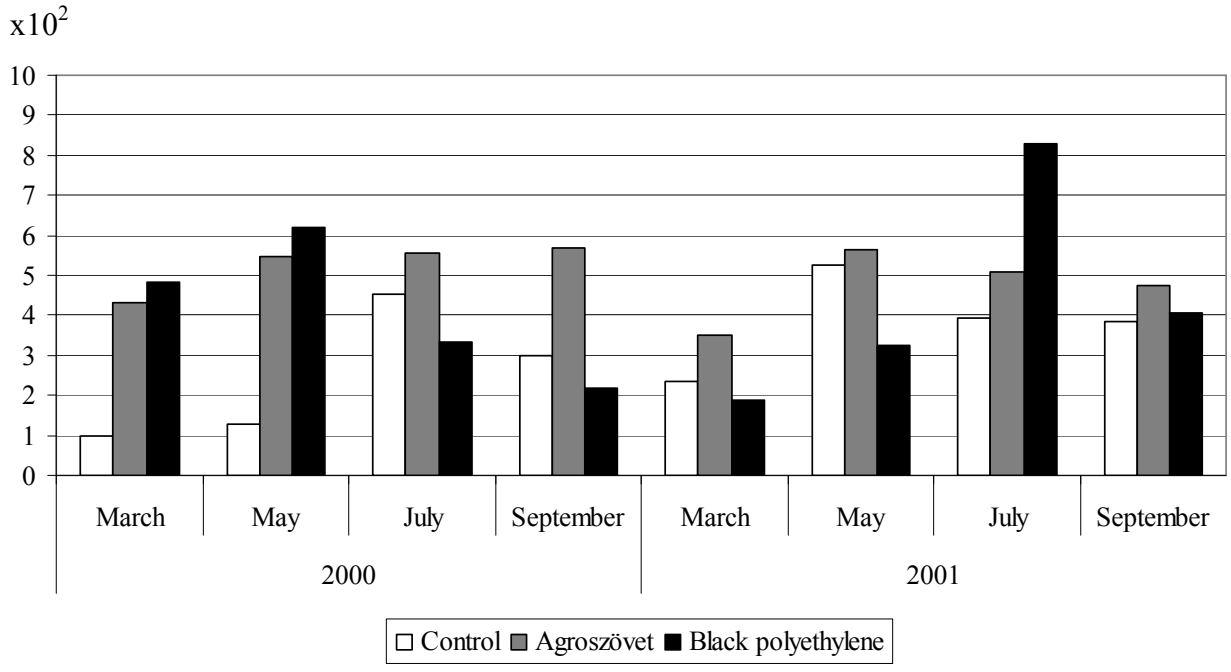

Fig. 3 *Effect of mulching on changing of number of cellulose decomposing bacteria*

Number of the examined microbes were the significantly the highest in agroszövet treatment followed by black polyethylene and control. Difference between the two applied mulching materials were not significant in every cases, but it was between the agroszövet and control treatment (Table 1).

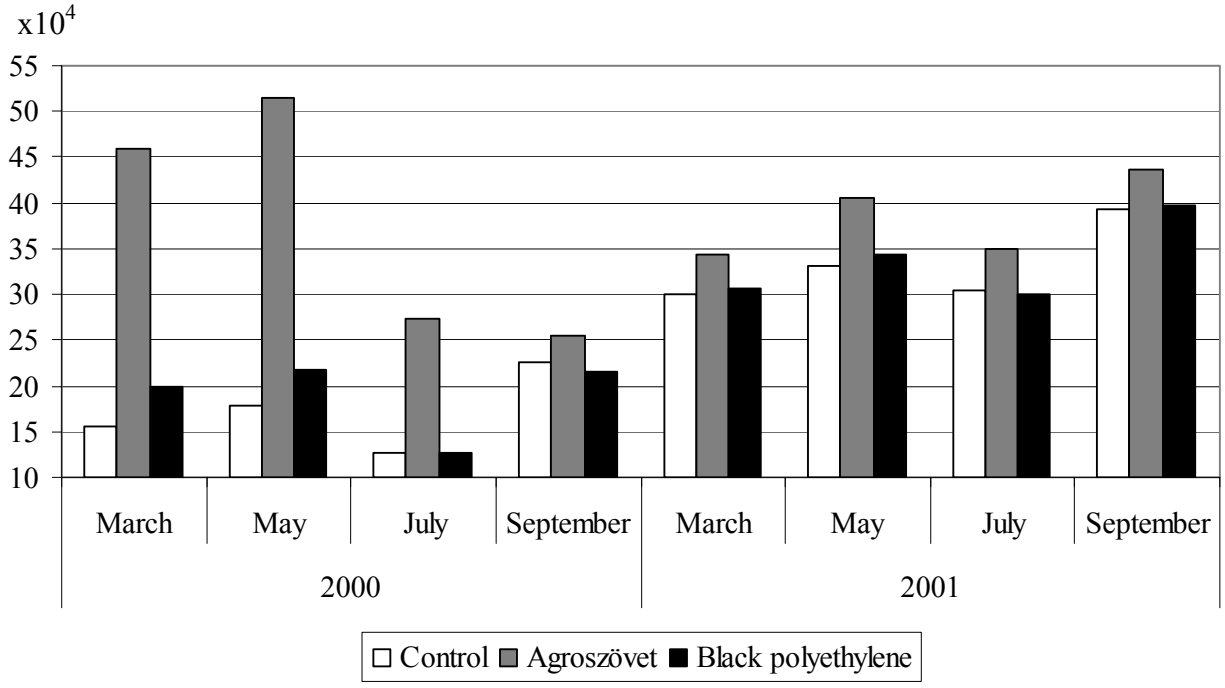

Fig. 4 *Effect of mulching on changing of number of nitrogen-fixing bacteria*

Table 1. Changes of number of microorganisms by trials in average of two years

Trials	Number of		Aerob	
	Total bacteria (10^5)	Microscopic fungi (10^3)	Cellulose decomposing bacteria (10^2)	Nitrogen fixing bacteria (10^4)
Control	21.437 a	9.187 a	3.163 a	25.191 a
Agroszövet	30.937 c	24.937 b	5.000 bc	37.997 b
Black polyethylene	25.187 b	15.125 a	4.275 ab	26.375 a
$SZD_{P=5\%}$	**3,751**	**8,495**	**1,575**	**7,122**

Means within the columns followed by the same letter are not statistically significant at P=0.05.

Effect of different mulching practices on soil microbes was examined only in few papers but it was considered to be fair for microbe propagation in case of cellulose decomposing and nitrogen fixing bacterias, alike (LAKATOS et al.; 2001). It is supported by our field experiment of several years related to all the examined microbe group. Different authors interpret the importance of different microorganisms in different way. TÓTH (1978) regards the

number of aerob total bacteria, microscopic fungi, and actinomyces and aerob cellulose decomposers as the 'most important microbe groups'. BALICZKA et al. (1957) found that in spite of number of total bacteria amount of Azotobacters indicates well the soil biological activity in sand soils. Nevertheless, BÍRÓ et al, (1995; 1999; 2000); and TSIMILLI-MICHAEL et al, (2000) reported that nitrogen fixing bacterias are the most responsive to the environmental changes. According to our results explicit peak in case of nitrogen fixing bacteria could not attached to a certain month that seems to reinforce the above cited papers.

CONCLUSION

Comparing the two different covering material it could be concluded that number of total bacteria, microscopic fungi, cellulose decomposing bacterias and N-fixing bacterias were significantly higher under agroszövet (porous black polyethylene) than under control treatment or under conventional black polyethylene, excluding the number of cellulose decomposing bacterias where the difference was not significant.

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