Progres	64,1	92,9	48,5	47,3	63,6	67,0	12,7	10,3
Average	67,3	92,5	46,7	44,5	62,4	65,5	11,6	10,2

MICROBIAL BIOMASS AND ACTIVITY IN APPLE ORCHARD SOILS

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Summary

This study compared microbial biomass and activity in soils of the two different treated apple orchards. Microbial biomass carbon (C_{mic}), respiration activity and dehydrogenase activity (DHA) were measured at three depths of 0.0-0.1; 0.1-0.2; 0.2-0.3 m. The all parameters were especially influenced by the sampling depth and organic matter content in the soil layers. Values of C_{mic}, DHA and respiration activity were the highest in top layer (0.0-0.1 m) in both apple orchards. Value of the sum of CO_2 production during 14 days measurement dropped down with a depth. Differences among the variants were high significant ($\alpha = 0.01$). Relationship between dehydrogenase activity and organic matter was statistically confirmed by the high correlation coefficient ($r = 0.95$). High potential microbial activity was found in soil of the all variants after an addition of carbon substrate (glucose).

Key words: orchard, organic matter, microbial biomass, respiration activity, dehydrogenase activity

Introduction

Microorganisms in association with animals perform whole series of the processes which condition and directly influence the state of soil fertility. Therefore, quantitation, i.e. determination of the microbial biomass which is participating in these processes and, also informations about the rate of its turnover in soil have great importance. The microbial biomass is a potential source of nutrients for plants especially of their ability to bind temporally the nutritions to microbial cells. The microbial biomass and its activity are important indicators of changes in content and vertical distribution of the organic matter in a soil profile. The choice of suitable parameters of microbial activities which will by capable to respond sensitively to the changes of soil properties is discussed (Šantrůčková, 1993; Mäder et al., 1995; Vakula et al., 1997; Bujnovský et Juráni, 1999).

Material and methods

Soils from the two apple orchards from locality Ladzany (30-years old since 1993 untreated apple orchard and new, 4-years old apple orchard registered as a genetic resources of fruit-trees) were sampled in October 1999 to evaluate the biological activity. Soil samples were taken from a depth of 0.02-0.1; 0.1-0.2 and 0.2-0.3 m from three randomly chosen sites, i.e. in three replications. These replications for each layer were mixed, sieved through 2 mm screen and stored at 5 ºC ± 1 ºC for 5 weeks. Percentage of oxidizable carbon ($\%C_{ox}$) was determined according to Tjurin (Arinuškinova, 1961). Percentage of total nitrogen ($\% N_t$) was determined by Jodlbauer distillation method (Peterburskij, 1963). Actual $pH_{(H2O)}$ and exchange $pH_{(KCl)}$ were determined potentiometricaly.
The used variants: old apple orchard (OO): $I._O$ (0.02-0.1 m); $II._O$ (0.1-0.2 m); $III._O$ (0.2-0.3 m)
new apple orchard (NO): $I._N$ (0.02-0.1 m); $II._N$ (0.1-0.2 m); $III._N$ (0.2-0.3 m)
The following microbiological parameters were determined:

1. soil microbial biomass carbon (C_{mic}) by fumigate extraction method according to Vance et al., 1987.
   - in soil prior to establishment of the experiment and after finishing of basal mineralization activities
   - in soil with glucose addition after finishing of measurement of potential mineralization activities
2. soil respiration (CO_2 production) by titration method according to Bernat et Seifert (Kopčanová et al., 1990)
   - basal respiration
   - potential respiration (addition of glucose: 2,2 mg $C.g^{-1}$ dry soil mass)
3. dehydrogenase activity of microorganisms according to Casida et al., 1964
   - in soil prior to establishment of the experiment and after finishing of measurement of basal mineralization activities
   - in soil with an addition of glucose after finishing of measurement of potential mineralization activities

All observation parameters were determined in three replications.
CO_2 production was statistically evaluated by ANOVA; the relationship between DHA and organic matter was evaluated by regression analysis according to Stehlíková et Škulecová, (1999).

Results and discussion

Soil characteristics:Soil type of both orchards is cambisol characteristic by the highest soil organic carbon content (% C_{ox}) in top soil layer. % C_{ox} decreased with decreasing depth from maximum value 2.07 % ($I._O$) and 1.6 % ($I._N$) to minimum value 0.64 % ($III._O$) and 0.96 % ($III._N$). Also, the total nitrogen (%N_t) was decreased with the depth. In old apple orchard from 0.224 % to 0.085 %, in new apple orchard from 0.158 % to 0.096 %. Soil reaction (pH_{KCl}) in OO ranged from pH 6.25 at depth of 0.0-0.1 m to pH 5.18 at depth of 0.2-0.3 m; pH in NO ranged from pH 4.13 at depth of 0.0-0.1 m to pH 4.62 at depth of 0.2-0.3 m.
Microbiological characteristics: The highest C_{mic} values (with no carbon substrate addition) were found in top soil layer in OO ($I._O$ = 315.69 µg.g^{-1} dry soil mass) and in NO ($I._N$ = 151.05 µg.g^{-1} soil dry mass). Also, there was measured the highest organic carbon content. Correlation between the organic carbon content and the biomass amount was not statistically confirmed. Zeller et.al (2000) recorded increasing of the total organic carbon and of microscopic fungal biomass at a depth of 0.02-0.1 m in soil under untreated meadow in comparison with intensively managed meadow.
The highest CO_2 content in top layers and its decreasing with a depth reflected on intensity of mineralization activity in individual layers. Value of the sum of CO_2 production during 14 day-measurement in variant $I._O$ achieved 1022.13 mg.kg^{-1} soil dry mass, while in variant $I._N$ achieved only 68% of that value. Differences among the variants and days were significant (α = 0.01) (tab. 1). The results confirming increased activity at a depth of 0.02-0.1 m are in accordance with results of Lavahum et al. (1996), that found out the highest values of cumulative CO_2 production (2661 µg C.g^{-1} soil dry mass) just at the same depth in soil under grassland. CO_2- C dropped down with the depth. In our experiment, the potential respiration activity was high in the all variants in both apple orchards, especially in layers with the lowest basal respiration.
The highest DHA values were found in top layers of both orchards, as follows: $I._O$ = 28.15 and $I._N$ = 27.52 µg TPF.g^{-1} soil dry mass.h^{-1}. Potential microbial ability to decompose and to utilise easily decomposable substrates was especially attained by addition of glucose (tab. 2). However, the most intensive reactions on supplied glucose were observed in deeper layers (0.2 – 0.3 m) in soil of both orchards.

Table 1 Analysis of variance for basal respiration (P<0,01)

Source of variation Main effects	Sum of squares	d.f.	Mean square	F-ratio	Sig. Level
Variants	100957,82	5	20191,564	202,394	0,0000++
Replication	17,66	2	8,831	0,089	0,9153
Days of measure	64957,29	13	4996,715	50,086	0,0000++
Residual	22746,06	228	99,763423		
Total	187392,7	248			

Table 2 Dehydrogenase activity (DHA) µg TPF. g^{-1} soil dry mass . h^{-1}

Assessment period	**Variants**					
	$I._O$	**$II._O$**	**$III._O$**	**$I._N$**	**$II._N$**	**$III._N$**
Prior to experiment	28.15	5.42	3.12	27.52	6.87	3.73
After 14 - day incubation	16.38	5.72	3.89	13.46	4.51	3.11
After 14 – day incubation with glucose addition	29.57	6.28	3.60	24.94	9.43	6.48

TPF – trifenyl formazan

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THE INFLUENCE OF FERTILISATION AND IRRIGATION ON SENSORIAL AND CHEMICAL QUALITY OF APPLES

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Summary

Two varieties – Gala and Idared – and their 4 cultivated variants A, B, C, K were monitored a refrigeration room with modified storing conditions (storing temperature +1,5°C, relative atmospheric humidity 90%, gases 1% O_2, 3% CO_2 and 96% N_2) from September to March (Gala), and up to June (Idared). The total content of carbohydrates ranged between 300-930 $g.kg^{-1}$ dry matter (DM) for Gala apples and 780-910 $g.kg^{-1}$ DM for Idared apples. The total organic acid content was from 30 to 87 $g.kg^{-1}$ DM for Gala apples, whereas Idared apples had a higher content (80-180 $g.kg^{-1}$ DM). The total content of vitamin C ranged between 0-22,3 $mg.100g^{-1}$ fresh matter for Gala and for Idared from 3,25 to 15,56 $mg.100g^{-1}$ fresh matter. The content of calcium ranged between 3,21 and 5,69 $mg.100g^{-1}$ for Gala and Idared.

Keywords: sensorial analyse, chemical analyse, quality of apples, Gala, Idared

Introduction

The storage potential of different cultivars of apples is determined genetically but for any given cultivar storage life can be extended by the use of refrigeration and controlled atmosphere (CA) storage (Johnson, 1994). The conditions under which apples grown have a major influence on the duration of storage and the quality of fruit available to the consumer.
Fruit harvested before or during the climacteric period achieved better quality retention during long-term storage than those harvested at the post-climacteric storage (Lau, 1985).
The aim of this study was to find out, if there exists contrasts among samples - variants in organoleptic facilities, in total sensorial quality and determined their chemical composition.

Material and methods

Apples „Gala" and „Idared", and their cultivated 4 variants on grounds of VPS Most in homogeneous environment, were harvested in the autumn of 2000. Climatic conditions of the experiment has been monitored at meteorological station located approximately 1 km away from grounds. After harvest the apples were put in a storage with conditioned atmosphere. The quality of apples of individual variants has been defined after their gathering and storage in a model storage with conditioned atmosphere (storing temperature +1,5°C, relative atmospheric humidity 90%, gases 1% O_2, 3% CO_2 and 96% N_2).
The first evaluation was made immediately after harvest and next evaluations were made in month-intervals. Certain suitable methods and test have been chosen for a sensorial evaluation. A "triangle test" has been used in differential method to find out whether there exists a difference between varieties and variants. Results have been statistically verified by chi-squared method. A pointed test has been used in a scale system created by Kopec and Horčin. The quality of panelists and results has been monitored by the so called "number NVR" (number of a rating reliability), by the interval of reliability and some distribution-free tests (Kramer test, Friedman test for file, Friedman test for pairs, Page's method).
Difficult methods presented the profiled method, where a classic complete profile (smell, taste, texture) and polarity profile texture were applied, by which chosen intensities were compared to polar texture components. In terms of research chosen chemical indices (dry matter, fibre, organic acids, sugar, vitamin C, calcium) were examined and firmness was measured by penetrometrical measurement and statistic dependency was studied by means of regressive responsibly correlation counts.

Results and discussion