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THE ALTERNATION OF VARIOUS TILLAGE METHODS AND MAINTENANCE OF SOIL UNDER ORCHARDS

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Abstract

A special importance in terms of maintaining soil fertility in orchards it has maintenance method. The different methods were investigated in orchards. The experience included 3 variants: 1. Black field between rows (witness); 2. Mulching the soil through coating; 3. Temporary revegetation with perennial grasses. Alternation in time and space of these methods allows to minimize the expenses and environmental protection as well as the premises to recommend the soil maintenance method that lead to the improvement of physical properties and increase organic matter content when the soil is maintained covered by grass and moisture preservation in the case of temporary use of the coating.

Key words*: soil, degradation, apparent density, porosity, structure.*

INTRODUCTION

Soil work in orchards is particularly important as regards to the maintenance of soil fertility, that depends on the type of maintenance use. Aimed to highlight this issue have been studied diffrent methods of soil maintenance in orchards. Soil work for a long time in orchards contribute to the worsening of soil physical proprities as a result that is acting negatively on growth and fruitfulness of fruit trees. Yield losses due to physical degradation of soil proprities, through its compaction is equal to production increases due to irrigation and close to same as those obtained from the use of fertilizers. As a result of preparatory work of the land before planting (subsoiling, compaction, leveling) and taking into account that fruit plants cover the land for 15-20 years, the soil are strongly modified in terms of the reversal horizons and improvement of aerobic regime, thermal and nutritional (The complex program of valorisation of degraded lands and increasing soil fertility, 2004).

MATERIALS AND METHODS

The researches aim to highlight the changes of agrophysical proprieties of the soil in the fruit orchards in long term: control variant for all experiments has served black field maintained free of weeds through mechanical works between rows and manual hoeing in rows. Depending on the conditions of moisture and soil conditions were used disc harrow, cutter or cultivator. There have been carried out 4-5 works during the growing season as required. The experience includes 3 variants: 1. Black field in the intervals between rows (withness); 2. Mulching the soil through coverage layers (pellicle) on the strip along the row width of 1.0 m; 3. Revegetation with perennial grasses on the strip along the row width of 1.0 m (fallow). Alternation in time and space of these methods allows minimizing the expenses and contributing to environmental protection. The research was conducted in plum tree plantations on the typical chernozem weak hummus sloppy loamy, which is located in the pedogeographic district Forest Hills Codrii. To characterize the soil cover on experimental polygons this were arranged in the main profiles and samples were collected from genetic horizons.

RESULTS AND DISCUSSIONS

State of soil settlement is determined in general by the bulk density, substantially influenced by the growth and development of agricultural crops, since they depend on airhydric regimes and various chemical processes and

microbiological. The porosity depends on the water retention capacity, permeability and aeration. This in its turn depends on texture, structure and bulk density. In the soils moderately loose, the total porosity component proprieties are favorable, concomitantly providing good conditions for water retention accessible to plants, aeration and rapid circulation of excess water. The compacted soils, except coarse texture, on the contrary the ratio of components in total porosity is often less favorable (Canarache Andrei, 1990). In the orchards space of arable layer and in the layer 20-30 cm occurs a differentiation of the parameters of total porosity according to the increase of apparent density.

Table 1. The bulk density and total porosity

Black field			Pellicle		Revegetation	
Depth, cm	ad, g/cm^3	T.p. %	ad, g/cm^3	T.p. %	ad, g/cm^3	T.p. %
0-10	0.99	62	1.09	58	1.08	59
10-20	1.26	52	1.16	56	1.03	61
20-30	1.28	52	1.28	52	1.21	57
30-40	1.28	52	1.28	52	1.17	57
40-50	1.24	53	1.25	53	1.18	57
50-60	1.20	56	1.20	56	1.19	57
60-70	1.25	52	1.30	51	1.25	52
70-80	1.30	51	1.30	51	1.30	51

The data obtained (Table 1) shows that the upper layers of soil (0-10 cm) in all three variants of soil maintenance the apparent density parameters are extremely low, these comprising values of 0.99-1.09 g/cm^3 characterizing the soil as loose which demonstrated the total porosity values 58-62%. In the 10-20 cm layer is observed an increase in apparent density in black fields and pellicle variants compared with revegetation that characterize weak compacted soil as 1.26 g/cm^3, moderately compacted loose 1.16 g/cm^3 and very loose 1.03 g/cm^3. The 20-40 cm layer is characterized by higher parameters of apparent density in comparison with 0-20 cm layer as well with the underlying layer or 40-50 cm which corresponds to the lower part of the sloppy layer. At the same time the formation of this layer with higher values of apparent density are evident, in the case of soil maintained as black field and under pellicle where de soil is characterized as weak loose and in the revegetation the soil is moderately loose. This proves that the soil maintenance covered by grass lead to the improvement of physical proprieties namely to decease of apparent density and porosity increase maintaining an optimal airhydric regime compared to black field.

Table 2. Structure

Depth, cm	The diameter of aggregates, mm			k_{st}
	>10	10-0.25	>0.25	
Black field				
0-10	33.20	51.70	84.90	1.07
10-20	41.30	56.60	97.90	1.30
20-30	33.80	61.20	95.00	1.58
30-40	33.80	61.60	95.40	1.61
40-50	30.00	62.30	92.30	1.65
Pellicle				
0-10	21.90	64.60	86.50	2.54
10-20	25.20	70.40	95.60	2.38
20-30	24.20	69.30	93.50	2.26
30-40	26.50	69.50	96.00	2.28
40-50	29.50	68.80	98.30	2.21
Fallow				
0-10	15.10	73.00	88.10	2.70
10-20	23.50	74.50	98.00	2.92
20-30	23.40	72.70	96.10	2.66
30-40	25.00	71.20	96.20	2.52
40-50	25.50	71.50	97.0	2.51

Characterizing the soil structure (Table 2) we observed moderate clods structure in the black field soil and lower in fallow soil and in the pellicle. Fallow soil and under the pellicle has a more stable structure characterized by a Ks in the upper layer 0-20 cm from 2.72-2.92 and from 2.38-2.54 while to black field corresponding 1.07-1.30. In the covered by grass soil as well as the pellicle are not observed degradation of the structure while the degradation of clouds structure in black field layer is present on throughout sloppy layer. Hydrostability aggregates through which is also appreciated the structure is reduced in the case of fallow soil. Hydrostability aggregates amount higher than 0.25 mm constitute only 26-27% and the bottom which proves the depth of subsoiling up to 50 cm where he was returned to the surface layer. In the covered by grass soil is observed a good hydrostability in the entire sloppy layer, where amount of hydrostability aggregates are higher than 25 mm and is 44-62%.

Under anthropic regime the state of aggregate structure is also influenced by the changes in the processes of pedogenesis: changes in the decomposition process and transformation of organic debris under arable regime; changes in the process of humification caused by its realization under airhydric regime respectively, redox displaced; the process under arable regime flows more accelerated up to the final product, which cause deficiency of organic substances participating in the aggregation; changes in the organic substances system in the soil; reducing content of labile organic substances; the drastic reduction of fauna (mesofauna in the soil); the specified factors determined sprying structure (Soil degradation and desertification, 2000).

Determination of the chemical proprieties of typical hummus weak chernozems sloppy demonstrated (Table 3) that is characterized by medium content of humus in the surface horizons (2.50-2.87%) and lower content in the underlying horizons (1.50%). However both humus content and mobile forms of N, P and K were higher even though are not essential parameters in the revegetation and in pellicle variants. These indices are below the statistical mean for typical hummus weak chernozem (3.83%). The decrease of organic matter content is due to daily occurrence through subsoiling of a part of transitional horizon B. Should be noted that the upper soil horizons unsloppy from adjacent land (at a distance of 35-50 m), humus content ranges from 3.29 to 4.20%. Moisture content was largely influenced by rainfalls that have been unsystematic in recent years. The high degree of moisture was maintained at 19.6% in pellicle variant and lowest 16.2% in the black field.

The water reserve in the layer 0-60 cm is determined by roots of the plants and constitute 131.6 mm in the black field, under variants with vegetation as a result of clearing grass on the soil surface layer is formed mulch through which is reduced evaporation and water reserve constitute 156.8 mm and the soil water reserve under covered with pellicle is higher 159.3 mm.

Table 3. Chemical characteristics

Variants	Depth., cm	Moisture, %	Humus, %	NO_3 mg/100g	P_2O_5 mg/100g	K_2O mg/100g
1.	0-20	13.24	2.76	1.74	2.72	24.0
	20-40	15.16	2.83	1.43	1.98	20.0
	40-60	18.86	1.70	1.30	1.60	17.0
2	0-20	19.23	2.50	1.43	2.90	26.0
	20-40	21.18	2.65	1.59	2.40	25.0
	40-60	20.79	1.58	1.30	2.20	18.0
3	0-20	19.05	2.87	1.82	2.75	27.0
	20-40	21.05	2.85	1.70	2.40	24.0
	40-60	19.83	1.78	1.37	1.85	17.0

In conclusion may be added that all the variants in comparision with the control variant have accumulated a larger amount of water in the soil. In terms of physical proprities and chemical, fallow soil variant is most beneficial but with regard to conservation and more reasonable use of soil moisture in maintaining soil the most successful is pellicle.

Table 4. Harvest

Black field		Pellicle		Fallow	
Harvest. tree, kg	Harvest. ha, ton	Harvest. tree, kg	Harvest. ha, ton	Harvest. tree, kg	Harvest. ha, ton
24.4	16.1	28.3	18.7	27.4	18.1

CONCLUSIONS

The work and maintenance of soil in orchards is particularly important in terms of maintaining soil fertility. Based on the research we can say that through grassing maintenance as well soil mulching through the pellicle temporarily lead to the improvement of physical proprieties and increase organic matter content and appropriately to the preservation of moisture. In the case of maintenance as black field the soil is subjected to physical degradation and it also refer to the crop.

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