Int. Agrophysics, 1993, 7, 99-116

GENERAL CHARACTERISTICS OF SOILS INCLUDED TO THE MULTILATERAL PROGRAMME

J. Gliński

Institute of Agrophysics, Polish Academy of Sciences, Doświadczalna 4, 20-236 Lublin, Poland

A b s t r a c t. The general characteristics of 19 soils of Austria, Czech-Republik, Hungary, Poland and Slovakia from which samples were taken to analyses on the assessment of structure in agricultural soils are presented.

K e y w o r d s: soil characteristics, Cambisols, Chernozems, Gleysols, Solonetz, Luvisols, Phaeozems

The location of investigated areas in Austria, Czech-Republic, Hungary, Poland and Slovak-Republic and profiles from which soil samples were taken to analyses are shown in Fig. 1. The results are collected in Tables 1-3.

AUSTRIA

The differentiation of the 2 investigated soil types as a result of different parent material, climate and pedogenesis was taken into consideration in order to distinguish the soil structure state and its importance for plant growth and agricultural production [3]. The soil profile Wieselburg is located in the western subalpine region of Lower Austria over loess and belongs to the oceanical climate type. The soil profile Fuchsenbigl is situated in the eastern Lower Austria (Moravian Field) over sandy sediments and influenced through pannonian climate. The 2 investigated sites represent very typical regions for the agricultural production of Lower Austria.

Site Wieselburg

The site Wieselburg is located about 2 km NE from the city of Wieselburg at 300 m a.s.l. in Lower Austria and is characterized thorugh the map 88-Ybbs of the Austrian Soil Mapping System. At the sampling time (Mai 1990) the soil was used as arable land, i.e., corn.

The investigated area belongs to the Molasse-zone with tertiary marine and lacustrine sediments. Above these tertiary materials eolian and fluviatile sediments were deposited during the Quaternary-Age and represents the parent material for soil formation. According to the Austrian Soil Mapping System, within the eolian sediments it can be distinguished between loess and covering loam. Loess is definited as a sediment with high content of carbonates and silty-sized material, whereas Covering Loam is a clay-sized material, free of carbonates. From the relatively high content on Ca-carbonate and silt fraction it can be deduced, that the parent material in Wieselburg should be loess.

Long-term average yearly temperature is: 8.3 °C, temperature extremes: -19 °C until +35 °C, freeze days (where temperature decreases daily at least once below 0°C): 60 days, long-term average precipitation per years: 859 mm.

Soil profile description

Ap 0-20 cm: dark brown (10 YR/4/3), silty loam, low (1%) skeleton content, free of carbonates, mediocre humus content, spheroidal fine strucutre (crumbs), common medium roots, plastic consistence, free of concretions, abrupt smooth boundary.

Fig. 1. Location of soil profile.

AB 20-40 cm: brown (10 YR/5/3), loamy silt/silty loam, low (1%) skeleton content, free of carbonates, mediocre humus content, moderate fine prismatic (subpolyhedra), few fine roots plastic consistence, free of concretions, gradual smooth boundary.

Bv 40-80 cm: yellowish brown (10 YR/5/4), loamy silt, low (1%) skeleton content, free of carbonates, mediocre humus content, prismatic fine structure (subpolyhedra), few fine roots plastic consistence, free of concretions, gradual smooth boundary.

BC 80-95 cm: yellowish brown (10 YR/5/4), silt, low (1%) skeleton content, rich on carbonates, weak humus content, packing structure (no aggregation, 'coherent'), porous, no roots, free of concretions, gradual smooth boundary.

C 95 +: yellowish brown (10 YR/5/6), silt, low (<1%) skeleton content, rich on carbonates, free of humus, packing structure (no aggregation, 'coherent'), with single Fe- and Mn- concretions.

Soil type: Brown Soil (Cambisol, according to FAO-system)

Site 'Fuchsenbigl'

The site 'Fuchsenbigl' is located in Marchfeld (Moravian Field) at 147 m a.s.l in Lower Austria and is characterized through the map 7-Groβenzersdorf of the Austrian Soil Mapping System. The soil is actually used as arable land, i.e., under wheat at the sampling time on May 1990.

The Marchfeld belongs geologically to the structural depression area of the Vienna basin. During the Tertiary age the earth surface between the Alps and the Carpatian Mountains setted here, the see transgressed and the basin was then fulled with marine clay-rich sediments (Tegel Clayey-Marl)). During the Quaternary age these marine sediments were then covered by gravel or at least by sand layers transported from the Danube river. The site 'Fuchsenbigl'

is located at the Prater-Terrace, formed during the last Ice Age, one of the various terraces which dominate the geomorphology of Vienna and its adjacent basine. The Prater-Terrace is a 5-7 m high gravel deposit above the Tertiary sediments. The parent material for soil formation is a silty/fine sandy-sized, carbonate-rich material, which was deposited by the Danube river over the gravel.

Long-term average yearly temperature: 9.3 °C. Temperature extremes: -30 °C until +35 °C. Freeze days (where temperature decreases dayly at least once below 0 °C): 70 days. Long-term average precipitation per year: 519 mm.

Soil profile description

Ap 0-15 cm: very dark gray (10 YR/3/1), loam, low (1 %) skeleton content, rich on carbonates, mediocre humus content, spheroidal fine structure (crumbs), very many medium roots, smooth sharp boundary.

Ah 15-23 cm: very dark gray (10 YR/3/1), sandy loam, low (1%) skeleton content, rich on carbonates, mediocre humus content, spheroidal fine structure (crumbs), common fine roots, smooth sharp boundary.

AC 23-40 cm: grayish brown (10 YR/5/2), sandy loam, low (1%) skeleton content, rich on carbonates, weak humus content, single grain structure (no aggregation), common fine roots gradual smooth boundary.

C1 40-70 cm: olive (5 Y/5/4), loamy sand, low (1%) skeleton content, rich on carbonates, free of humus, single grain structure (no aggregation), few fine roots, abrupt smooth boundary.

C2 70+: light yellowish brown (2,5 Y/6/4), silty sand, low (1%) skeleton content, rich on carbonates, free of humus, single grain structure (no aggregation), very few fine roots.

Soil type: Tschernosem (Chernozems, according to FAO-system)

CZECH-REPUBLIC

The experimental station is situated at Tišice, district Mélník, in Central Bohemia (about 20 km north-west from Prague). The field work has been done in cooperation with the Research Institute for Irrigation Management Bratislava, station Prague. The total area of about 0.5 ha is devided into 8 parcels, each 52 x 68 m. The experimental plots lie on a quaternary fluvial terrace of gravel sand, overlayed by sand. The landscape is practically plain.

From the climatological point of view the area belongs to the warm region, dry with moderate winter. The total mean annual precipitation is 518.8 mm, precipitation during vegetation season (from April to November) 343 mm. The mean annual temperature is 8.6 °C (vegetation season 14.8 °C).

In the soil survey, 5 pits were excavated by hand into the depth of 120-150 cm [2]. They were located so that the later infiltration and other experiments would not be influenced by the soil disturbance in the pits. The whole experimental area is occupied by the Arenic Chernozems of the carbonate variety (FAO). However, the thickness of the horizons and subhorizons is variable due to the fluvial influence upon the othervise homogeneous sands of the parent material of the C horizon.

Soil profile description

Pit No. 1 (T1)

A 0 - 30 cm: ploughed A-horizon, calcic-like with well decomposed organic matter, dark greyish brown sandy loam, weak crumb-granular structure, strongly compacted, small sporadic whitish patches of the secondary $CaCO_3$, moist.

A/Ck 30 - 50 cm: diffuse smooth boundary, lighter colour from greyish brown to pale brown increasing percentage of sand with the depth still sandy loam, very compacted, moist, small patches of $CaCO_3$ gradual smooth boundary.

CK 50 - 65 cm: brown loamy sand, with

increasing fraction of the coarse sand, small concretions of $CaCO_3$, dry.

C 65 - 100 cm: sand, in the top part the sand particles are coated by clay films, at the bottom slight admicture of fine gravel.

Pit No. 2 (T2)

Apk, 0 - 22 cm: see Pit No 1, weak angular blocky, individual $CaCO_3$ concreations.

Ak 22 - 35 cm: identical with Apk except of plough-disturbance, more compact.

C 35 - 100 cm: very dark greyish-brown sandy loam, coarse granular structure, common fine roots loose.

Pit No. 3 (T3)

Apk 0 - 25 cm: see Pit No. 2, but moderately compacted.

A/Ck 25 - 55 cm: see Pit No. 1, but with weak granular and with concretions of $CaCO_3$. In depth>150 cm is sand.

Pit No. 4 (T4)

Apk 0 - 20 cm: see Pit No. 2.

Ak 20 - 45 cm: see Pit No 2, instead of $CaCO_3$ concretions small $CaCO_3$ patches.

A/Ck 45 - 65 cm: with transition of colour up to pale brown, increasing content of sand with depth, frequent $CaCO_3$ concretions.

Ck 65 - 100 cm: pale brown up to brownish yellow, sand without compaction, wet, small concretions of $CaCO_3$ not frequent.

Pit No. 5 (T5)

Apk 0 - 25 cm: very dark greyish brown otherwise, see Pit No. 2.

Ak 25 - 45 cm: same as Apk but dry and without ploughing disturbance.

A/Ck 45 - 70 cm: gradual change of colour from greyish brown to pale brown, slight increase of sand with depth but still sandy loam, weak granular, with depth less distinct, moderate content of small $CaCO_3$ concretions.

Ck 70 - 100 cm: light brownish yellow, loamy sand with thin sublayers of light reddish brown sand, moderate content of small $CaCO_3$ concretions.

HUNGARY

The investigated soil profiles are located in the middle region of the Great Hungarian Plain in the Transtisza Region of Hungary.

The investigated area is one of the lowlands of the Carpathian Basin. According to Sümeghy only a small part of the parent materials is of Quaternary (Pleistocene) origin, most part is Holocene. The parent material of soil forming processes are there aelian, colluvial and fluviatile deposits. During the sedimentation processes in the basin heavy-textured materials were deposited. The sedimentation, lateral erosion and activity of the rivers was in progress also at the end of Pleistocene and river deposits mixed with falling loess material which was fallen on the surface. The loess material of Pleistocene was more or less altered by the wet hydrological conditions resulting in so called infusion loess.

As a consequence of these processes, the clay content in the parent material is high. The soil forming processes are closely connected with the surface and subsurface hydrological conditions. Considerable parts of the Hungarian Plain before the regulation of the Tisza River at the end of 19th century was permanently or temporarily inundated, and there were many small rivers which brought fine sediments into the area. After the completion of the water regulation of River Tisza and tributaries waist areas were freed from inundation and water logging conditions. As a consequence the water table was lowered but the effect of groundwater fluctuation can still be observed in many of the soil profiles. The groundwater fluctuates between 0.75 to 1.80 m in Karcag area and within 0.6 to 2.00 m under the soil profiles of Kisújszállás and Abádszalók area. The characteristic features of the groundwater for areas under this investigation is that it contains variable quantities of soluble salts of sulfates, chlorides and bicarbonates.

The investigated sites are situated within

the natural geographical region of Nagykunság (Great Kúnság) which is one of the warmest - but relating to the temperature fluctuation of the land - the most extreme and the most continental part of the Hungarian Plain. The average yearly precipitation amounts to 520-560 mm, most of which falls in June. The winter is dry and cold. The mean maximum temperature is up to 20.8 °C in June-August whereas the average minimum temperature may be as low as -2.9 °C, which is usually recorded in January. The yearly mean values of potential evapotranspiration are 680-700 mm.

Forming of different soil types is in close correlation with the geological, hydrological as well as climatic conditions of the region.

The soil cover of Great Kúnság - beginning from higher elevation to lower ones - consists of different soil types chernozem, salt affected, meadow and peat soils. The salt affected soils can be found around the Tisza region or on the ridges being on the deepest areas.

Soil profile description

Abádszalók: alluvial meadow soil, cultivated (Fluvic Gleysol)

A 0 - 30 cm: yellowish grey, moist, loamy clay, compact, strong crumb and subangular blocky, many small and large roots clear smooth boundary.

B 30 - 70 cm: black moist very strongly compacted, weak coarse subangular blocky, few iron and manganese mottling many pressure faces. Gradual boundary.

BC 70 - 90 cm: yellowish grey (10 YR 4/4), dry, compact, subangular blocky, clay, few roots, many Fe and Mn-mottles. Clear smooth boundary.

C 90 - 120 cm: yellowish grey (10 YR 4/4) moist, slightly compacted, structureless: silty loam, few roots, many blue Fe and Mn-mottles, gley lager.

Abádszalók: alluvial meadow soil, uncultivated (Fluvic Gleysol)

A 0 - 40 cm: dark grayish brown (2.5 Y 3/2) moist, strongly compact, crumb structure: heavy clay loam, many roots, clear smooth boundary.

B 40 - 70 cm: dark grayish brown (2.5 Y 3/1) but higher when compared with surface layer. Strong polyhedral peds, heavy clay, slickenside, clear smooth boundary.

BC 70 - 110 cm: dark grey (2.5 Y 3/2) moist, less compacted than the previous B horizon, clay loam, breaking into subangular blocky structure, few iron mottles, no roots.

C 110 - 140 cm: dark grey (2.5 Y 4/1) wet, strongly compacted silt loam, structureless, reddish mottling and bluish spots or mottles.

Kisújszállás: Meadow soil, deep loosened (Vertic Gleysol)

A 0 - 45 cm: very dark grayish brown, moist, fine subangular blocky, loam, many roots, clear smooth boundary.

B 45 - 75 cm: black (10 YR 3/1) moist, compact, fine subangular blocky, medium prismatic, clay loam, few roots, few slickensides, gradual boundary.

BC 75 - 100 cm: very dark grayish brown (10 YR 3/2) matrix, few mottled spots of yellowish red slightly moist, compact, coarse prismatic structure, clay loam, gradual boundary.

C 100 + cm: dark grey (5 Y 4/3), moist, slightly compact, structureless, clay loam, mottles of dark brown colour (10 YR 4/3).

Kisújszállás: Meadow soil, without loosening (Vertic Gleysol)

A 0 - 30 cm: very black (2.5 Y 3/0) ploughed layer, compact, crumb and subangular blocky, clay loam, many roots, gradual boundary.

B 30 - 60 cm: black (2.5 Y 2/0) moist, compact, moderate fine subangular blocky, clay, few roots, smooth boundary.

BC 60 - 90 cm: dark grayish brown (2.5 Y 3/2), few very dark mottles, moist,

compact clay loam, structureless, clear smooth boundary.

C 90 + cm: dark grey (5 Y 4/a) matrix, many dark mottle spots, moist, structureless, silt loam.

Karcagpuszta: salt affected crusty (meadow solonetz) soil, uncultivated (Orthic Solonetz)

A 0 - 3 cm: pale grey, moist, weak, many fine roots, solodized loam. Abrupt boundary.

B1 3 - 20 cm: grey, dry, extremely hard, distinctly columnar structure, clay loam. Many fine roots. Tops of columns, and at some places the sides are discolored. Abrupt boundary.

B2 20 - 60 cm: grey, somwewhat darker, dry, hard, prismatic structure, gradual boundary.

BC 60 - 78 cm: brownish grey, somewhat lighter in colour, dry, fine prismatic structure clay loam. Few roots. Iron mottles and iron concretions are more frequent with depth. White lime spots, fine lime concretions. Abrupt boundary in colour.

C 70 + cm: grayish yellow, moist, moderate hard, loess - like clay loam; white lime mottles and lime concretions.

Karcagpuszta: ameliorated and cultivated meadow solonetz soil (Orthic Solonetz)

AB1 0 - 20 cm: the original A and B1 horizons are mixed by tillage operations. Grey, dry, hard, coarse subangular blocky. Abrupt boundary.

B2 20 - 60 cm: grey, darker, hard, prismatic structure. Gradual boundary.

BC 60 - 70 cm: brownish grey, medium subangular blocky. Iron mottles and iron concretions, white lime spots, lime concretions. Abrupt boundary.

C 78 + cm: grayish yellow, moist, moderate hard loess like clay loam. White lime mottle and lime concretions.

POLAND

All the soil profiles studied are located at Czesławice (20 km Lublin, west) within the Nałęczów Plateau, about 215 m a.s.l. The Nałęczów Plateau consists the western part of a greater physiographic unit, called Lublin Upland, laying on the loessial belt. The soil cover is uniform as all the soils are derived from typical loess [1]. They are classified as soil lessivé (Orthic Luvisols). The landscape also shows a typical rolling configuration for the loessial belt. The profiles characterize 3 sites of the same soil unit Orthic Luvisols of different utilization: under forest, with extensive agriculture (private farm) and intensive agriculture (state farm).

First profile represented natural mostly deciduous oak-hornbeans forest habitat with pine admixture (*Querco-Carpinetum*). The second was located on a unmechanized private farm field where most of the field works is done using horses and the third on the state farm field of the Lublin University of Agriculture with heavy machinery use. All the soil profiles are located on hill tops.

Climate is moderate, with average annual air temperature +7.6 °C, and total precipitation about 510 - 550 mm.

Soil profile descriptions:

Forest

0 0+3 cm: leaves and twigs, partly decomposed.

Ah 0 - 6 cm: grayish yellow brown (10YR 6/2) dry, silt, angular blocky/coherent structure, many roots, clear boundary to:

E 6 - 27 cm: dull yellow orange (10YR 7/3) dry, silt, coherent structure, clear boundary to:

Bt1 27 - 57 cm: bright yellowish brown (10YR 6/6) dry, silt loam, coherent structure, gradual boundary to:

Bt2 57 - 103 cm: bright yellowish brown (10YR 6/6) dry, with lighter horizontal streaks (10 YR 7/4), silt loam,

coherent structure, gradual boundary to:

BC 105 - 136 cm: dull yellow orange (10YR 7/3), calcareous loess, silt, coherent structure, gradual boundary to:

Ck 136 + cm: dull yellow orange (10YR 7/3), calcareous loess, silt, coherent structure

Private farm

Ap 0 - 24 cm: dull yellow orange (10YR 6/3) dry, silt, angular blocky/coherent structure, clear boundary to:

E 24 - 35 cm: dull yellow orange (10YR 7/4), silt loam, coherent structure, gradual boundary to:

Bt1 35 - 75 cm: bright yellowish brown (10YR 7/6) dry, silt loam, coherent structure, gradual boundary to:

Bt2 75 - 127 cm: dull yellow orange (10YR 6/4) dry, with lighter horizontal streaks (10YR 7/4), silt loam, coherent structure, gradual boundary to: BC

State farm

Ap 0 - 28 cm: dull yellow orange (10YR 6/3) dry, silt, coherent structure, clear boundary to:

E 28 - 37 cm: dull yellow orange (10YR 7/4) dry, silt, coherent structure, clear boundary to:

Bt1 37 - 76 cm: dull yellow orange (10YR 6/4) dry, silt loam, coherent structure, gradual boundary to:

Bt2 76 - 126 cm: dull yellow orange (10YR 6/4) dry, with lighter horizontal streaks (10YR 7/4), silt loam, coherent structure, gradual boundary to:

BC 126 - 142 cm: dull yellow orange (10YR 7/4) dry, silt, coherent structure, gradual boundary to: Ck

SLOVAK-REPUBLIC

The territory under investigation (Žitný ostrov, SW Slovakia) is built by quaternary alluvial sediments of Pleistocene and Holocene. In the nucleus of island, there are gravely-sandy sediments overlayed by later Pleistocene alluvial loam to sandy-loam sediments, less frequantly sandy clays and clay sediments. Late holocene sediments form mainly zones in Danube and Little Danube adjacency and substantial part of middle and lower Žitný ostrov. Gravel bedrocks comes near to the surface (50-70 cm) in middle and mainly in upper part of the island and then have an influence on the soil cover character.

Groundwaters of Žitný ostrov are permanently watered by Danube water. Their level reaches very different values during the year. Also in long-term average it varies within 4-7 m in the upper part, 2-4 m in the middle part (up to Dunajská Streda) and 0-2 m in lower part of the island. Groundwaters are changed by passing through solid phases. In connection with these changes geochemical influence of groundwater on soils is changed, too. Geochemical processes in soils are of carbonate character, usually in the whole profile. It is also in the cases in which gleying processes formed in these soils due to hydromorphism.

Climatic factors take an important part in forming of soil cover character specifications in this region. The region is very warm, dry. The average year temperature is +9.5 °C and a long-term average of precipitations does not exceed 570 mm. Potential evapotranspiration to which real evaporation approximates is for the same period 832 mm. It means practically that a considerable part of groundwater is evaporated directly by evaporation, but mainly through plants (transpiration) and so evaporative soil regime is permanently created.

From geochemical point of view the whole region represents supraaquatic landscape. Groundwater laying near the surface contain Ca^{2+}, Mg^{2+}, Na^{+}, HCO_3^{-} ions. They are typomorphic ions migrants which determine the geochemical migration environment. In capillary zone, conditions of enrichment to calcite (or other carbonates, respectively) origin due to water evaporation. Carbonates, therefore, precipitate in soils and sediments.

Soil cover of Žitný ostrov [3] is relatively variable and depends on:

a) height of ground water level,

b) duration of period of hydromorphic influence,
c) duration of period of automorphic influence,
d) mechanical composition of soils and sediments which modificate water regime at the same groundwater level as well character of hydromorphic or automorphic influence, respectively.

In upper Žitný ostrov with the deapest ground water levels automorphic Chernozems are mostly represented (Calcaro-haplic Chernozem, Haplic-Phaeozem). These soils are characterized by mollic humus horizon, through transition horizon becoming to substrates, predominantly carbonate alluvial sediments of loamy and sandy-loam character. These soils occur on gravel overlayers in upper part of Žitný ostrov (Most na Ostrove, Lehnice). Gravels rising relatively near to the surface. These soils are dried and rather hazardeous as far as they suffer from shortage of moisture.

Haplic-Phaeozems are the transition to Phaeozems: Fluvi-haplic Phaeozem, Fluvi-calcaric Phaeozem to Fluvi-mollic Gleysol. These soils are mostly presented in the region of Žitný ostrov. They represent semi-hydromorphic soils, characteristic feature of which is the presence of mollic humus horizon. The degree of hydromorphic influence varies. For Fluvi-haplic Phaeozems, slight characters of hydromorphic influence in the humus horizon (slight ferric spots) are of relict nature. But by turns to gleyey subtypes characters of hydromorphic influence are more clear. Especially Fluvi-mollic Gleysol has clear characters of hydromorphic development, gley horizons included. Gleying processes are more expressive in depressions and in the lower part of island, where the groundwater levels are near the surface.

Gleysols, or Histosols (peats) occur on the places expressively water-logged (old river arms, marshes). The latter are characterized by organic horizon thicker than 50 cm.

On young Holocene alluvia, the youngest and mostly undiferentiated soil types - Fluvisols - are present. Their origin is connected with places especially in the past subjected to inundation. Fluvisols are of calcareous character, they originated on the fluvial carbonate sediments of the Danube, or Little Danube, respectively. They are layered soils with irregular widespread of humus content in profile as far as its amount also depends on fact whether soil sediments were transported with inundation. The interesting feature of the region studied is that new alluvial sediments overlayed older soils in the past. These older ones came to different depth and now they form buried (fossil) soil horizons.

In depressions as well as on fine textured substrates gleyey subtypes of these soils are present.

In the lower part of Žitný ostrov region of salt affected soils occur mostly in complexes with other soils (Fluvi-mollic Gleysols). These salt affected soils come in association with Phaeozem as well as Fluvi-mollic Gleysol subtypes with the presence of Ca-Mg-Na-HCO_3 groundwater.

Soil profile descriptions:

Macov 1

Akp 0-38 cm: 10 YR 3/3 moist matrix colour, firm, coarse angular to subangular blocky weak grade structure, loam, calcareous, common very fine to fine roots, some gravels (5 %, Φ2 cm), clear smooth boundary to:

Ak 38 - 48 cm: 10 YR 3/3 moist matrix colour, friable, fine subangular to angular blocky weak grade structure, loam, calcareous, common very fine to fine roots, gradual boundary to:

A/Ck 48 - 65 cm: 10 YR 5/4 moist matrix colour, friable, fine subangular to angular blocky weak grade structure, loam calcareous, few very fine roots, gradual boundary to:

Ck 65 - 85 cm: 10 YR 7/4 moist matrix colour, very fine, structurless, loam, no roots, gradual boundary to:

Cgk 85 + cm: 10 YR 7/4 moist matrix colour with 10 % Fe^{3+} mottling, firm, structurless, loamy sand, calcareous, without roots.

Soil unit - M.S.C.S. : Černozem čiernicová

karbonátová
- F.A.O. : Calcaro-haplic Phaeozem

Macov 2

Akp 0 - 32 cm: 2.5 Y 3/2 moist matrix colour, very friable, crumb moderate grade structure, loam, calcareous, common fine to medium roots, clear boundary to:

Ak 32 - 68 cm: 2.5 Y 3/2 moist matrix colour, friable, subangular blocky to prismatic very weak grade structure, loam calcareous, common very fine roots, gradual boundary to:

A/Cgk 68 - 88 cm: 2.5 Y 5/3 moist matrix colour with Fe^{3+} mottling, very firm, subangular blocky to prismatic very weak grade structure, loam, calcareous, common very fine roots, gradual boundary to:

Cgk 88 + cm: 2.5 Y 6/4 moist matrix colour with Fe^{3+} mottling, firm, structurless, loam, calcareous, none roots

Soil unit - M.S.C.S.: Čiernica černozemná karbónátová
F.A.O. : Fluvi-calcaric Phaeozem

Zemianska Olča

Agkp 0 - 33 cm: 10 YR 2/1.5 moist matrix color with Fe^{3+} mottling, very firm consistence, moderately developed coarse angular to subangular blocky structure, silty clay loam, calcareous, few fine roots, abrupt boundary to:

A/Cgk 33 - 47 cm: 10 YR 5/2 moist matrix colour with Fe^{3+} mottling, firm, moderately developed medium angular to subangular blocky structure, silt loam, calcareous, few fine roots within 35 cm, gradual boundary to:

Cgc 47 - 100 cm: 10 YR 7/4 + 6/2 moist matrix colour with rusty and grey mottling, firm, weak developed blocky structure, silt loam, calcareous, with accumulation of hard nodules of lime in 50 to 60 cm and 85 to 100 cm, none roots, abrupt boundary to:

Abgrk 100 - 117 cm: 10 YR 2/1.5 moist matrix colour with rusty and dark-grey mottling, very firm, medium to coarse prismatic structure, silt loam, calcareous, none roots, gradual boundary to:

A/Crgk 117 + cm: 10 YR 5/1 moist matrix colour with Fe^{3+} mottling, very firm weak prismatic structure, silt loam, calcareous.

Soil unit - M.S.C.S. : Čiernica typická karbonátová
F.A.O. : Calcaro-gleyic Phaeozem

REFERENCES

1. **Dębicki R., Gliński J., Lipiec J., Pukos A., Turski R.:** Soil strength, stability and structural state of Orthic Luvisols under different land use. Int. Agrophysics, 7(2-3), 155-161, 1993.
2. **Rajkai K., Zsembeli J., Blaskó L., Várallyay G.:** Use of tension infiltrometer and water retention characteristics in the assessment of soil structure. Int. Agrophysics, 7(2-3) 141-154, 1993.
3. **Rampazzo N., Blum W.E.H., Strauss P., Čurlik J., Słowińska-Jurkiewicz A.:** The importance of mineralogical and micromorphological investigations for the assessment of soil structure. Int. Agrophysics, 7(2-3), 117-132, 1993.

Table 1. Physical soil parameters

Profile	Horizon (cm)	Particle size distribution			Bulk density (Mg/m^3)	Particle density (Mg/m^3)	Total porosity (%, v/v)
		Sand (2000-50 μm)	Silt (50-2 μm)	Clay (< 2 μm)			
				Austria			
Wieselburg	Ap (0-20)	20.0	46.6	33.4	1.46	2.65	44.7
	AB (20-40)	25.0	50.3	24.7	1.55	2.70	42.5
	Bv (40-80)	24.0	52.0	24.0	1.49	2.69	44.7
	BC (80-95)	25.0	55.1	19.9	1.53	2.74	44.4
	C (95 +)	27.0	57.2	15.8	1.54	2.74	43.8
Fuchsenbigl	Ap (0-15)	42.0	31.5	26.5	1.34	2.69	50.2
	Ah (15-23)	43.0	34.4	22.6	1.45	2.69	46.1
	AC (23-40)	41.0	37.1	21.9	1.41	2.76	49.0
	C1 (40-70)	63.0	31.0	6.0	1.42	2.78	48.9
	C2 (70 +)	75.0	23.6	1.4	1.43	2.78	48.6
				Czech Republic			
Tišice T1	20	63	23	14	1.59	2.64	39.8
	80	97.8	1.0	1.2	1.56	2.64	40.9
T2	15-20	59	23	18	1.64	2.63	37.6
	50	63	23	14	1.44	2.65	45.7
T3	15-20	60	24	16	1.59	2.60	38.8
	40	47	37	16	1.24	2.63	52.9
	90	41	44	15	1.33	2.64	49.6
T4	15	60	25	15	1.65	2.64	37.5
	55	67	22	11	1.44	2.63	45.2
T5	15-20	62	26	12	1.67	2.60	35.8
	85	76	16	8	1.36	2.63	48.3

Table 1. Continuation

Profile	Horizon (cm)	Particle size distribution			Bulk density (Mg/m^3)	Particle density (Mg/m^3)	Total porosity (%, v/v)
		Sand (2000-50 μm)	Silt (50-2 μm)	Clay (< 2 μm)			
				Hungary			
Abádszalók-cult.	A (0-20)	15.6	36.6	47.8	1.15		
	B (21-60)	13.9	32.3	53.8	1.28		
	BC (61-80)	17.6	29.8	52.6	1.39		
	C (81-120)	43.6	24.6	31.8	1.45		
Abádszalók-uncult.	A (0-20)	13.7	33.9	52.4	1.21		
	B (21-60)	11.7	31.7	56.6	1.29		
	BC (61-80)	19.2	28.2	52.6	1.48		
	C (81-100)	41.9	23.7	34.4	1.43		
Kisújszálás-loos	A (0-30)	20.2	35.2	44.6	1.32		
	B (31-50)	12.2	42.8	45.0	1.41		
	BC (51-80)	10.6	47.6	41.8	1.49		
	C (81-130)	28.2	25.8	46.0	1.49		
Kisújszálás-no loos	A (0-30)	18.6	35.4	46.0	1.27		
	B (31-50)	15.8	32.6	51.6	1.35		
	BC (51-110)	13.2	30.8	56.0	1.48		
	C (91-110)	11.2	45.4	43.4	1.50		
Karcagpuszta-uncult.	A (0-20)	24.2	34.0	41.8	1.41		
	B (21-40)	13.4	35.2	51.4	1.58		
	BC (41-70)	16.0	32.2	51.8	1.61		
	C (71-85)	5.4	52.4	42.2	1.61		
Karcagpuszta-cult.	A (0-20)	20.8	34.0	45.2	1.42		
	B (21-50)	14.0	29.2	56.8	1.53		
	BC (51-70)	12.4	33.2	54.4	1.53		
	C (71-95)	11.4	49.2	39.4	1.55		

Table 1. Continuation

Profile	Horizon (cm)	Particle size distribution			Bulk density	Particle density	Total porosity
		Sand (2000-50 μm)	Silt (50-2 μm)	Clay (< 2 μm)	(Mg/m^3)	(Mg/m^3)	(%, v/v)
				Poland			
Forest	Ah (3-8)	73	23	4	1.03	2.50	58.8
	E (11-16)	63	27	10	1.35	2.64	48.9
	E-Bt1 (28-33)	61	23	16	1.36	2.65	48.7
	Bt1 (42-47)	62	18	20	1.45	2.68	45.9
	Bt2 (72-77)	68	17	15	1.48	2.66	44.4
	BC (112-117)	65	23	12	1.43	2.64	45.8
	Ck (142-147)	66	23	11	1.51	2.63	42.6
Private farm	Ap (0-24)	66	27	7	1.23	2.62	53.0
	E (25-35)	65	26	9	1.48	2.65	44.1
	Bt1 (45-50)	60	21	19	1.49	2.67	44.2
	Bt2 (85-90)	61	22	17	1.56	2.66	41.3
State farm	Ap (3-8)	65	29	6	1.39	2.61	46.7
	Ap-E (26-31)	66	24	10	1.48	2.65	44.1
	E (30-35)	65	28	7	1.41	2.66	47.0
	Bt1 (41-46)	64	25	11	1.49	2.67	44.2
	Bt1 (56-61)	60	20	20	1.55	2.68	42.2
	Bt2 (82-87)	60	20	20	1.56	2.64	40.9
	BC (136-141)	67	26	7	1.47	2.62	43.9
				Slovakia			
Macov 1	Akp (0-38)	38.0	40.7	21.3	1.46	2.69	45.7
	Ak (38-48)	37.3	40.6	22.1	1.30	2.72	52.2
	A/Crk (48-65)	37.9	44.7	17.4	1.30	2.62	50.3
	Ck (65-85)	33.4	55.2	11.4	1.31	2.74	52.1
	Cgk (85+)	63.8	32.6	3.6	1.44	2.75	47.6
Macov 2	Akp (0-38)	42.6	39.0	18.4	1.36	2.62	48.1
	Ak (38-68)	37.3	40.7	22.0	1.28	2.67	52.0
	A/Cgk (68-88)	16.2	60.2	23.6	1.38	2.70	48.8
	Cgk (88+)	52.1	36.7	11.2	1.40	2.72	48.5
Zem. Olča	Agkp (0-33)	12.8	52.5	34.7	1.28	2.62	51.1
	A/Cgk (33-47)	5.4	69.9	24.7	1.32	2.75	52.0
	Cgk (47-100)	3.7	78.1	18.2	1.37	2.76	50.4
	Abgrk (100-120)	6.6	75.2	18.2	1.51	2.73	44.7

Table 2. Chemical soil parameters

Profile	Horizon (cm)	pH H_2O	pH KCl	O.M. (%)	$CaCO_3$ (%)	Surface area (m^2/g)	CEC (me/100g)	Exchangeable cations (me/100g) Ca	Mg	K	Na	El. cond. (mS/cm)
						Austria						
Wieselburg	Ap (0-20)	7.4	6.9	2.2	0.6	47.5	173.1	135.1	28.0	8.0	1.8	0.136
	AB (20-40)	7.5	6.8	2.0	0.3		163.7	129.6	26.0	6.3	1.6	0.121
	Bv (40-80)	8.0	7.2	1.2	2.4	48.4	161.4	129.8	28.1	1.5	1.9	0.245
	BC (80-95)	8.5	7.4	0.7	19.2		153.9	126.7	23.7	1.4	1.9	0.251
	C (95+)	8.7	7.4	0.5	29.8		128.5	104.2	20.9	1.3	1.9	0.246
Fuchsenbigl	Ap (0-15)	8.5	7.3	2.5	21.6	34.1	204.7	179.6	20.2	2.9	1.9	0.266
	Ah (15-23)	8.5	7.5	2.7	20.2	84.3	204.2	179.1	20.7	2.2	2.0	0.284
	AC (23-40)	8.6	7.7	1.0	35.0	29.0	134.4	112.4	18.8	0.8	2.2	0.297
	C1 (40-70)	8.9	7.8	0.5	27.5		103.6	78.2	22.2	0.5	2.6	0.288
	C2 (70+)	9.1	7.8	1.0	23.0		84.7	64.7	17.4	0.5	2.0	0.254
						Czech Republic						
Tešice T1	A (15-20)	8.8	7.9	3.6	0.7		87.9	64.0	20.4	2.8	0.7	0.07
	A/Ck (35-40)	8.9	8.0	2.2	1.7		90.8	69.6	18.0	2.5	0.6	0.07
	Ck (55-60)	9.0	8.2	1.2	1.2		83.7	70.1	11.4	1.6	0.5	0.07
	C (80+)	8.6	7.6	-	0.2		73.2	57.8	12.5	2.2	0.6	0.05
T2	Apk (15-20)	8.3	7.4	3.6	0.4	T 20 cm	71.5	54.1	14.3	2.5	0.6	0.06
	C (50)	8.6	7.6	2.7	0.2	38.0	83.1	60.2	19.6	2.4	0.9	0.06
	C (100)	7.8	7.3	1.9	0.1		95.6	73.4	18.4	3.1	0.7	0.08
T3	Apk (15-20)	8.5	7.5	3.2	1.9		147.8	123.5	20.5	3.0	0.8	0.08
	A/Ck (40)	9.0	8.3	1.2	12.3	T 40 cm	139.9	111.1	24.2	3.6	1.0	0.12
	C (90-100)	8.9	8.2	-	11.0	33.4	140.7	114.5	21.4	3.6	1.2	0.13
T4	Apk (10-15)	8.4	7.5	3.4	1.3		86.3	63.6	19.8	2.4	0.6	0.06
	Ak (35)	8.6	7.8	2.5	2.4		79.5	58.8	17.4	2.6	0.5	0.07
	A/Ck (55)	8.7	7.9	0.8	8.8		80.5	59.6	18.2	2.0	0.6	0.07
T5	Apk (15-20)	8.2	7.3	3.6	0.7		83.6	60.7	19.9	2.3	0.7	0.06
	A/Ck (50-55)	8.8	8.5	1.9	7.8		84.7	63.4	17.8	2.7	0.8	0.07
	Ck (85)	8.4	7.3	0.5	14.0		93.1	67.7	22.1	2.6	0.6	0.07

Table 2. Continuation

Profile	Horizon (cm)	pH		O.M. (%)	$CaCO_3$ (%)	Surface area (m^2/g)	CEC (me/100g)	Exchangeable cations (me/100g)				El. cond. (mS/cm)
		H_2O	KCl					Ca	Mg	K	Na	
						Hungary						
Abádszalók-cult.	A (0-20)	5.9	4.8	3.3	-	115.7	31.0	25.5	5.0	0.9	1.2	0.331
	B (21-60)	6.3	5.1	1.6	-	133.8	41.6	27.9	6.0	0.8	1.4	0.317
	BC (61-80)	6.7	5.4	0.8	-	109.8	36.6	22.6	4.0	0.7	1.8	0.415
	C (81-120)	7.2	6.1	-	-	67.3	24.8	21.9	4.0	0.5	2.7	0.168
Abádszalók-uncult	A (0-20)	6.2	5.2	2.5	-	118.3	34.3	25.4	5.0	1.2	1.4	0.268
	B (21-60)	6.4	5.2	1.3	-	138.9	40.1	30.9	7.0	1.0	1.8	0.232
	BC (61-80)	6.7	5.5	1.0	-	131.1	33.6	25.5	6.0	0.6	2.2	0.188
	C (81-100)	6.9	6.0	-	-	110.1	31.5	20.7	4.0	0.6	2.7	1.114
Kisújszállás-loss	A (0-30)	6.4	5.8	3.2	-	97.7	39.4	25.9	3.0	2.5	1.2	0.331
	B (31-50)	7.5	6.7	0.3	-	110.1	29.4	20.8	5.0	0.9	3.1	0.293
	BC (51-80)	7.7	7.1	0.5	4.9	103.7	27.1	25.0	5.0	0.8	2.9	0.331
	C (81-130)	6.7	5.7	-	-	77.0	38.1	27.3	6.0	0.6	2.7	0.063
Kisújszállás-no loss	A (0-30)	6.4	5.8	3.2	-	103.0	38.7	25.3	3.0	2.3	1.6	0.287
	B (31-50)	6.6	5.8	1.9	-	107.5	36.4	28.9	5.0	1.6	1.4	0.361
	BC (51-90)	7.3	6.3	0.7	-	87.8	37.4	24.7	5.0	1.3	2.3	0.668
	C (91-110)	7.4	7.0	-	4.2	84.9	27.6	22.3	4.0	0.8	2.7	0.432
Karcagpuszta-uncult.	A (0-20)	7.4	6.9	1.5	-	88.7	35.6	14.7	8.0	0.9	15.1	1.278
	B (21-40)	9.0	7.4	0.6	-	-	34.1	14.9	9.0	0.9	19.3	-
	BC (41-70)	8.1	6.9	1.2	-	68.1	32.9	13.3	8.0	0.8	17.1	0.840
	C (71-85)	9.0	7.8	-	-	50.6	27.6	12.3	7.0	0.7	18.0	0.699
Karcagpuszta-cult.	A (0-20)	7.8	6.9	1.4	-	105.5	31.6	17.9	7.0	1.0	13.8	0.656
	B (21-50)	8.4	7.1	0.5	-	75.3	35.1	13.6	7.0	0.8	20.8	0.922
	BC (51-70)	8.7	7.5	0.4	-	65.7	31.3	13.1	9.0	0.9	24.2	0.929
	C (71-95)	9.0	8.0	-	-	53.2	24.0	9.2	4.0	0.5	21.7	0.930

Table 2. Continuation

Profile	Horizon (cm)	pH		O.M. (%)	$CaCO_3$ (%)	Surface area (m^2/g)	CEC (me/100g)	Exchangeable cations (me/100g)				El. cond. (mS/cm)
		H_2O	KCl					Ca	Mg	K	Na	
						Poland						
Forest	Ah (3-8)	4.6	4.1	1.9	-	26.2	260	35	5	41.2	54.4	0.146
	E (11-16)	4.6	4.1	0.7	-	24.5	188	20	5	28.7	55.8	0.143
	Bt1 (42-47)	5.4	4.4	0.3	-	44.3	224	40	25	33.6	49.8	0.121
	Bt2 (72-77)	5.7	4.9	0.1	-	32.5	160	35	30	26.5	54.0	0.126
	BC (112-117)	6.0	5.3	0.1	-	30.7	176	35	25	26.8	40.4	0.114
	Ck (142-147)	7.9	7.3	0.1	6.9	23.5	200	80	30	21.8	66.3	0.298
Private farm	Ap (0-24)	4.9	4.5	1.4	-	20.9	148	20	20	32.6	33.4	0.150
	E (24-35)	5.9	5.3	0.4	-	20.8	168	30	15	29.0	58.6	0.212
	Bt1 (45-50)	6.1	5.6	0.4	-	31.8	260	60	90	34.3	60.1	0.150
	Bt2 (85-90)	6.6	5.7	0.1	-	35.7	192	30	60	28.5	51.1	0.246
State farm	Ap (3-8)	6.2	5.5	1.5	-	21.5	196	60	45	35.0	34.6	0.433
	E (30-35)	6.6	5.8	0.3	-	34.0	156	45	10	24.4	48.9	0.526
	Bt1 (41-46)	6.7	5.8	0.3	-	43.9	200	70	20	28.5	72.0	0.375
	Bt2 (56-61	6.4	5.7	0.1	-	29.0	190	60	20	25.6	49.0	0.399
	BC (82-87)	6.6	6.2	0.1	-	28.4	158	40	20	39.8	63.6	0.647
	Ck (136-141)	7.7	7.1	0.1	5.7	25.2	132	75	30	24.8	41.1	0.462
						Slovakia						
Macov 1	Akp (0-38)	8.3	7.8	2.0	15	38.4	342	295	40	4.5	3.0	0.510
	Ak (38-48)	8.4	8.1	2.0	40	32.6	195	152	28	13.0	2.2	0.685
Macov 2	Akp (0-38)	8.0	7.6	2.9	12	42.8	289	236	46	4.7	2.8	0.630
	Ak (38-68)	8.2	7.8	2.2	35	39.8	190	151	23	14.0	2.4	0.473
Zem. Olča	Agkp (0-33)	8.4	7.5	4.6	10	61.8	323	270	44	4.0	5.0	1.988
	Akgkp (33-47)	8.6	7.8	0.7	33	49.7	185	158	22	11.0	4.0	1.182

Table 3. Moisture characteristics (%, v/v) of soil samples

Depth (cm)	Horizon	kPa	0	0.24	0.98	3.1	6.19	9.8	19.6	31	49	98	245	310	492	981	1471	15548
		pF	0.0	0.4	1.0	1.5	1.8	2.0	2.3	2.5	2.7	3.0	3.4	3.5	3.7	4.0	4.2	6.2
											Wieselburg							
0-20	Ap		43.9							37.1	36.9	34.8		26.7	24.9	21.6	17.6	
20-40	AB		42.4							32.6	31.7	28.6		18.9	15.8	15.6	15.4	
40-80	Bv		42.8							32.1	31.7	29.6		20.1	17.7	17.5	17.3	
80-95	BC		43.7							32.6	31.8	28.9		19.5	16.0	15.7	15.7	
95+	C		41.4							30.7	30.0	24.6		14.4	13.8	12.0	11.4	
											Fuchsenbigl							
0-15	Ap		40.8							24.6	23.5	21.7		17.0	13.0	13.0	13.0	
15-23	Ah		40.7							25.7	24.8	23.4		18.5	14.5	14.5	14.5	
23-40	AC		42.2							23.2	22.2	17.1		12.3	-	-	-	
40-70	C1		45.3							14.8	13.4	6.9		2.4	-	-	-	
70+	C2		42.9							7.5	5.5	3.7		0.6	0.0	0.0	0.0	
											Tišice (T) A*							
15-20	A		38	37.6	37.5	35.3	33.6	31.9	28.5	26.0	24.9	23.0	20.0	19.0	18.5	17.8	15.6	14.5
45	A		52.7	51.3	47.1	44.4	42.9	31.8	27.7	24.9	23.5	22.0	19.4	19.2	18.0	17.8	16.6	14.5
65	C		48.2	47.5	45.5	37.0	30.5	26.4	20.7	18.2	15.5	14.1	12.7	11.6	11.3	10.9	10.6	-
											Tišice (T) B							
20	A		38.4	37.5	34.9	32.3	29.5	27.6	25.9	25.0	23.2	22.2	20.6	19.7	19.2	18.7	17.8	15.0
100	C		35.6	34.9	33.1	28.9	24.3	21.8	16.9	15.0	13.1	10.5	8.1	6.8	5.8	4.8	4.3	1.4

Table 3. Continuation

Depth (cm)	Horizon	kPa	0	0.24	0.98	3.1	6.19	9.8	19.6	31	49	98	245	310	492	981	1471	15548
		pF	0.0	0.4	1.0	1.5	1.8	2.0	2.3	2.5	2.7	3.0	3.4	3.5	3.7	4.0	4.2	6.2
											Abádszalók							
20-25	A		60.4	58.4	55.2	48.7		42.5	40.2		37.7		27.2				21.2	6.1
60-65	B		49.2	46.7	44.4	41.7		38.4	36.6		33.0		24.6				19.1	5.2
90-95	BC		48.0	45.5	42.8	40.3		47.2	33.1		28.7		22.6				16.9	4.3
125-130	C		49.1	46.0	43.4	42.4		41.4	40.6		38.1		21.5				16.0	4.1
											Karcagpuszta							
0-3	A		54.2	51.3	47.3	45.3		44.3	43.4		40.1		37.3				29.4	10.2
3-15	B_1		51.9	50.2	50.0	49.6		48.4	47.8		45.0		42.2				36.3	12.6
15-31	B_2		58.4	55.7	55.4	55.2		54.0	53.8		51.0		48.4				40.4	13.4
31-55	B_3		59.6	56.9	56.6	56.3		55.8	55.2		52.4		49.0				40.6	13.4
55-93	C_1		53.5	50.4	50.4	49.5		48.2	47.6		45.3		42.3				36.5	10.0
93-110	C_2		-	-	-	-		-	-		-		-				-	-
											Kisújszállás							
10-15	A		51.2	48.0	45.3	42.3		39.8	48.8		37.1		34.3				25.7	4.4
40-45	B		50.9	47.1	45.2	44.1		43.4	43.7		42.1		44.0				33.3	6.4
65-70	BC		52.7	49.0	46.6	43.3		44.7	44.3		43.3		41.4				42.7	5.8
105-110	C		51.0	47.1	44.3	43.4		43.1	42.9		41.9		36.8				28.3	5.8
											Forest							
3-8	Ah		58.8	55.9	52.0	48.6	47.2	46.0		43.5	41.6		9.8		7.4		6.0	
11-16	E		48.8	46.5	43.9	42.0	40.8	40.0		38.0	36.6		8.0		6.1		5.2	
25-35	E-Bt1		48.4	44.1	41.0	38.2	37.2	36.5		34.6	32.8		12.5		10.0		8.1	
42-47	Bt1		46.0	42.2	40.4	38.8	37.8	37.0		35.2	34.0		15.2		12.8		11.0	
72-77	Bt2		44.8	41.0	40.3	39.8	39.0	38.5		37.0	35.8		13.3		11.0		10.5	
112-117	BC		45.8	41.6	40.7	39.7	38.8	38.0		36.4	35.2		9.8		7.2		6.5	
142-147	Ck		42.5	42.3	42.1	42.0	41.8	41.0		39.0	37.5		9.2		7.4		6.2	
											Private farm							
2-7	Ap		52.5	49.8	47.2	44.5	43.0	41.5		37.7	35.6		9.2		7.4		5.6	
25-30	E		47.5	45.4	43.2	40.2	38.3	37.0		33.5	31.8		11.5		9.1		66.6	
45-50	Bt1		48.4	46.1	43.3	39.6	37.4	36.0		32.6	31.2		17.4		15.0		11.5	
85-90	Bt2		45.2	43.3	41.7	39.7	38.0	37.0		34.6	33.4		13.6		11.5		8.8	

Table 3. Continuation

Depth (cm)	Horizon	kPa	0	0.24	0.98	3.1	6.19	9.8	19.6	31	49	98	245	310	492	981	1471	15548
		pF	0.0	0.4	1.0	1.5	1.8	2.0	2.3	2.5	2.7	3.0	3.4	3.5	3.7	4.0	4.2	6.2
										State farm								
3-8	Ap		46.4	42.6	42.0	41.8	41.5	41.0		39.3	38.0		10.6		8.7		5.9	
26-31	Ap-E		44.2	41.6	41.2	41.0	40.5	40.2		38.9	37.8		10.0		7.9		7.9	
30-35	E		47.0	42.0	40.3	39.0	38.0	37.0		35.4	34.5		8.0		6.5		6.5	
41-46	Bt1		44.0	39.2	38.0	37.7	36.8	36.0		34.0	33.5		10.8		8.8		8.8	
56-61	Bt1		42.0	38.6	37.6	37.2	36.9	36.3		35.5	35.0		14.9		12.1		12.1	
82-87	Bt2		41.0	39.0	39.8	38.5	38.3	38.0		37.2	36.7		16.8		13.0		13.0	
136-141	BC		43.8	43.0	42.4	41.0	39.8	39.0		38.0	37.5		10.5		8.4		8.4	
										Macov 1								
0-38	Akp						41.5			37.5							15.9	
38-48	Ak						39.8			34.6							14.6	
48-65	A/Ck						39.0			33.8							11.5	
65-85	Ck						37.2			33.9							10.3	
>85	Cgk						35.6			29.2							6.7	
										Macov 2								
0-32	Akp						43.0			39.9							17.1	
32-68	Ak						40.2			36.1							14.9	
68-88	A/Cgk						39.5			36.7							13.4	
>88	Cgk						36.3			32.3							9.3	
										Zem. Olča								
0-33	Agkp						48.9			45.6							21.4	
33-47	A/Cgk						47.0			44.5							18.5	
43-100	Cgk						48.1			42.8							15.3	
100-120	Abgrk						40.3			38.4							14.0	