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Long-term experiment of peat soil conservation by technology of German sand-mix culture in Belarus

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The German method of sand-mix culture (SMC) of peat soils was developed for the conservation of organic matter. Its essence consists of shallow peat soils are subjected to a special meliorative tillage at a depth of 0.8 - 1.2 m. At that depth of tillage a shift of soil horizons takes place, namely: the layers of peat and sand to a thickness of 40 - 50cm and they alternate with each other within the ploughed area. The soil surface is disked several times after such tillage and as a result a new soil profile is formed with the arable layer, consisting of peat and sand to a volume ratio of 1:1, and subsurface layer with the inclined layers of peat and sand situated under the newly created arable layer. It is assumed that the peat layers buried below the upper sand peat arable layer are conserved.

A field experiment of SMC was organized on the Polessian Experimental-Meliorative Station covering an area of 7 ha. Deep meliorative tillage was carried out in the autumn of 1979 by Haggen's plough. The depth of peat layer before the fulfillment of special meliorative tillage was 50 - 80 cm grounded by fluvioglacialic sand. A new arable layer with the depth of 20 - 22 cm was carried out by repeated disking of the surface. This layer consisted of approximately equal volumes of peat and sand.

The first sowing of agricultural crops was implemented in April 1980. The prepared area was divided into two parts named as eastern and western. Crop rotation with barley, maize, potato and perennial grasses was cultivated in the eastern area and the same crop rotation but without perennial grasses was cultivated in the western area in 4 repetitions. Mineral fertilizer $N_{120}P_{80}K_{200}$ was used on the both areas, but addition

20 t/ha of straw manure was used only on the western area in period from 1986 to 1990. The total amount of experimental plots with the size 30x6 m was equal 36 on each area. Soil samples were collected at a distance of 2 m from the middles of short boards and in a very centre of every plot to the depth of 0…20 cm and namely, 108 samples were collected from the eastern area and the same quantity from the western one, in total – 216 samples. The quantitative content of organic carbon was estimated in every sample by Turin micro chromium method. Similar investigations were implemented in 1990 and 2005 but soil sampling was made at the depth of 0 - 15 cm because of the tillage by disking was carried out at the depth of 15 - 16 cm.

Peat soil cultivated under conditions of the usual black culture was used as a control variant on the experimental area created in 1971. Soil profile on this area has been changed very much from 1971 till 2005, namely: the average depth of peat layer was decreased from 97.0 till 47.2 cm, the store of organic substance has been decreased from 1309 t/ha till 1045 t/ha. The total loss of organic substance made up 264 t/ha during 35 years, or in average 7.5 t/ha per 1 year. The color of peat is black-brown and the peat particles have lost their fibrous structure. The arable layer has kept its depth about 25 ± 2 cm, but the thickness of the subsurface layer of peat was decreased from 72.0 till 21.8 cm because of every tillage takes its part about 1…2 cm and includes it into arable layer in order to replenish the lost organic substance. Soft consistence of peat which locates under arable layer allows to cat off some part of it by plough and to include in arable layer.

In contrast to that, the soil profile on the SMC area has been changed small. Organic substance in arable layer has been distributed uniformly between the sandy particles. Peat, conserved in

Table 1. The stock of organic carbon and humus in the layer of 0–15 cm on the experimental area of SMC

underground upper arable layer, has kept its primary morphology, and namely – biscuit color and fibrous structure. Peat of upper layer has no possibility to pass to arable layer because of the inclined layers of sand do not allow to settle the soil and the plough has no possibility to cut off some part of upper peat layer and to include it to arable layer. Tat is very important difference of SMC from black culture of peat soils, which guarantee the conservations of peat under arable layer.

Organic substance in arable layer on SMC area forms only from those part of peat, which was included in it in 1980 by primary formation of new soil profile, and of course from the rests of cultivated agricultural crops. The share of peat in arable layer decreases gradually, but the amount of the fresh organic substance grows every year. Fractional-group analysis and physical-chemical properties of humic acids

Year	The content of C_{org}., % to dray masse	Stock of C_{org}., t/ha	Stock of humus, t/ha
East experimental area			
1980	2,02 $\pm$ 0,31	41,60 $\pm$ 4,20	71,80 $\pm$ 7,20
1990	1,83 $\pm$ 0,18	40,06 $\pm$ 2,64	69,60 $\pm$ 4,55
2006	1,91 $\pm$ 0,25	40,41 $\pm$ 2,61	69,71 $\pm$ 4,50
West experimental area			
1980	2,68 $\pm$ 0,39	54,20 $\pm$ 4,10	93,40 $\pm$7,10
1990	2,50 $\pm$ 0,26	50,10 $\pm$ 3,30	86,30 $\pm$ 5,70
2006	2,36 $\pm$ 0,21	47,68 $\pm$ 2,12	82,25 $\pm$ 3,66

have shown that quality of humus in arable layers on SMC and black culture differs very much. These characteristics testify that soil humus on SMC area much younger, than humus on black culture.

The main conclusion of this long-term balance experiment consists in that German SMC technology allows to conserve a bigger part of peat and to prolong the use of peat soils for indefinably long time in contrast to black culture, which leads to the increased degradation of such soils.