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Assessment of Agrochemical Characteristic of Turf-Podzolic Soil In Chernigoskaya Forest Region, Ukraine

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Abstract
A study was conducted in the laboratory of the Kharkov state agrarian University, in Ukraine to evaluate the soil physico-chemical characteristic of turf-podzolic soil of the Ukrainian forest region. Soil samples for analysis were collected using the agreed method of exposing a vertical section of the soil profile to the depth of 120 cm, and the soil samples were taken from 40-60 cm, however for all the properties analyzed there was decrease with increase in depth. The results obtained indicates that fertility status of the soil in this region can be determined by agrochemical and agro-physical analysis without considering other important biological factors that influence the most important process of humification and other soil properties.

Keywords: Agrochemical, agro-physical, turf-podzolic soil, forest region

Introduction

More than 70 percent of the arable land forest region of Ukraine is made of poor buffered turf-podzolic soils, which naturally have low fertility status. This forest region differs having very low content of humus just about 1%. The soils have low pH high acidity rate and very little content of major plant nutrients. More than 28 percent of this arable land is characterized by very low content of available phosphorus and more than 46 percent with very low content of potassium. Fertility status in this region can be determined simply by chemical and physical analysis of the soil without even considering other important biological factors that influences the most important process of humification. However, in a condition of intensive agricultural production is necessary to know exactly the changes in microbiological and biochemical process in order to determine the agro-technical and agro-chemical effect for the improvement of water, nutrients circulation in order to enrich organic and mineral substances of the soil.

The Chernigobskaya forest area of Ukraine is characterized with distinctive forest topography. The study area is within the bounds of lowland. The geological composition of the area is made up of two different structures: Ukrainian crystalline rock mass and Dneprobski-Doneski basin (Vernander, 1951,). Both of these evolved due to the tectonic accumulation process of two different overlapping rocks of the parent material, which have different expansion. The characteristic of contemporary relief of the Ukraine forest region exhibits, river valley, plain and moraine level land. (Dmitry, 1969). Chernigobskaya forest area is located in Dneprobska-Doneskoi basins in-between Dnepro and middle Russian upland, which represent a terrace like province river of Dnepra, and its numerous tributaries. The essential soil formation parent materials on this territory are moraine, aqueoglacial deposit of alluvium (modern and ancient). The forest territory is situated in moderate belt. The climate is moderately Warm and humid, the precipitation exceeds the overall evapotranspiration, The annual rainfall is 506-650mm. Annual average temperature is 6.2-6.6°C; January is the coldest month with temperature of -5.5-6.0°C. July is the warmest month of the year when average temperature reaches +18-19°C. Continuous period without frost is about 150-170 days. The vegetation cover of the Ukrainian forest is densely populated forest. Bondarchuk 1959. Significant changes in the vegetation cover were as a results of human activities. Man influences the vegetation by felling of the forest and changing the area into the agricultural and grassland. The natural vegetation of this forest zone is very diverse and includes more than 1500 species: Pine tree (Pinus Sp.), as the main species occupied 57% of the forest, 21% Oak tree (Quercus Sp), 10% Birch (Betula Sp), 6% Black alder (A. glutinosa), 3% and 2% (Carpinus sp). Grassland vegetation in this forest is that of the dry valley and bottomland. Among the grassland of the dry valley, the predominant are f. cork's-foot (Dactylis glomerata), m clover (Trifolia sp.), f. fesue (festuca sp), m meadow grass (Poa sp), f beat grass (Agrostis), and Small reed (calamogrostic sp) The physical and chemical characteristic of the soil was determined using the agreed methods of Gedroisa (1932), Gorednebo (1986) Mushistina E.N. and others.

Materials and Methods

Selection of the individual soil sample for analysis was determined following the all agreed method used by exposing section of the soil profile to the depth of 120cm, and the soil samples were taken up to 40-60 cm. Granulometric substance were determined using method of Kachinski, the exchange and absorption cations were determined by oxalate methods. Ca^{+}, Mo^{2+} were determined using complex metric extract, Na^{+} and K^{+} were determined by using Flame photometer method, acidity of the soil was analyzed both in water 1:5 and in alkaline solution of 1:2.5(1N KCl) extract using pH meter. Hydrological acidity was determined using the method of Kappenu. Mobile phosphorus and potassium were determined using the method of Kirsanob.

Results and Discussion

Low content of exchange cations in the soil arises due to the lack of Clay fraction. Typically, this kind of soil has low saturation of colloidal exchange bases, more especially calcium. The eluvial horizon has the most saturated Ca^{2+} cations about (26, 30%). Hydrological acidity reduces with depth. The soil has a low content of humus; in the top horizon the humus content is about 0.7%, the quantity of humus content reduces faster as we go along the depth. Tables. Indicates the lowest soil provision of the major plant nutrient more especially nitrogen. One of the most important indexes of soil fertility is its absorption capacity and the composition of the exchange cations. Among the composition of the exchange cation in the soil the predominant is the H^{+} cation. Their content is about 1.4 times more than the content of Ca^{2+} (Table 3.). The water-physical substances of the soil are not satisfactory because the volume mass of the cultivated layer varies at the interval of 1.58-1.67 g/cm³ . The overall porosity is 35.7%, and the least field water capacity layer is 133.4 mm/min, with this kind of water-physical substances of a soil as in the case of soil erosion the actual decomposing product of plant residues and applied fertilizer on the top horizons will be loss there by reducing the rate of soil fertility.

Table1. Physical and chemical characteristic of turf-average-podzolic soil in the Chernigobskaya research institute farm, Ukraine

Depth (cm)	The composition of exchange cation Mg-eq/100g soil				pH		Soil acidity in water Mg-eq/100g soil
	Ca^{2+}	Mo^{2+}	Na^{+}	K^{+}	In water solution	Alkaline	
0-27	0.70	0.30	0.13	0.16	5.1	4.0	2.1
27-55	0.60	0.20	0.18	0.15	5.3	4.3	2.3
55-70	0.80	0.30	0.09	0.11	5.1	4.2	1.9
70-85	0.60	0.10	0.05	0.07	5.1	4.2	1.6
85-100	0.30	0.40	0.05	0.06	4.5	4.0	1.5

Table 2. Agronomical characteristic of turf-average-podzolic soil In the Charnigobskaya research institute farm, Ukraine

Depth (cm)	Total N%	Mobile mg/kg		
		P_2O_5	K_2O	N
0-27	0.045	9.9	6.5	2.3
27-55	0.034	7.1	3.2	1.4
55-70	0.018	5.4	5.8	1.1
70-85	0.005	4.0	4.8	0.8
85-100	-	2.1	2.3	-

Table 3. The composition of exchange-absorption cations in the Turf-podzolic soil in the Chernigobskaya forest area

Depth Cm	Exchange-absorption cations Mg-eq/100g soil					Total	Degree of saturation Ca^{2+},%
	Ca^{2+}	Mo^{2+}	K^{+}	Na^{+}	H^{+}		
0-27	0.86	0.44	0.08	0.03	2.41	3.82	22.55
27-55	0.74	0.30	0.08	0.05	2.25	3.42	21.63
55-70	1.20	0.58	0.08	0.04	1.90	3.80	32.00
70-85	0.90	0.37	0.11	0.06	1.55	2.99	30.00
85-100	0.79	0.33	0.09	0.06	1.61	2.88	27.00

Conclusion

Base on the result obtained from analysis of the soil, the low content of the entire physical and chemical properties of the soil arises due to the lack of substantial amount of Clay fraction; as such the soil has low saturation of colloidal base fractions, more especially calcium, whereas the eluvial horizon has the most saturated exchange base of calcium. The soil has a low content of humus that indicates low content of organic matter accumulation. The low level of the major plant nutrient more especially nitrogen could be because of low-level of organic matter content. This is because nitrogen content is dependent upon the concentration of organic matter in the soil as reported by William (1988). Among the composition of the exchange cation in the soil the predominant is the H^{+} this is an indication of surplus acidity of the soil, which indicate that if adequate soil management measures are not use, the soil will deteriorate and may not even support crop production. It is therefore important to use systematic application of organic fertilizers with organic manure and liming material to regulate the level of soil acidity.

Declaration of conflicting interests

The author declared no potential conflicts of interest

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