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SUITABILITY OF LAND FOR FORESTRY USE IN GALAŢI COUNTY, TECUCI-MATCA AREA

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Abstract

In addition to being deficient in terms of the forestry sector, the studied territory presents pedoclimatic conditions less suitable for agricultural crops, because the rainfall is quantitatively reduced and the land is poor quality and prone to deflation. In order to reduce the effects caused by climate change, biodiversity conservation and implicitly the protection of agricultural land, it is intended to establish a forest on an area of 150.76 hectares, with forest species suitable from a pedoclimatic point of view. A complex pedological study was carried out, in different plots, by performing a soil profile and several control surveys, in order to establish the suitability of the land for forestry facilities. The soil type identified is typical arenosols, formed in the Tecuci Plain, due to the deposition of coarse and fine sand. The surface of land is a relatively flat configuration, loamy-sandy texture in the bioaccumulative horizon and sand on the depth of the soil profile, with contrasting distribution. For these pedoclimatic conditions with local specificity, the formula for afforestation with adapted species, with fast growth and low requirements in terms of soil trophicity was established.

Key words: *shelterbelts, windbreaks, mixed forest, species composition, typical arenosols.*

INTRODUCTION

The purpose of the forest protection curtains is to protect the agricultural lands against the prevailing wind, because by stopping or reducing it, the evaporation of water from the soil surface is reduced, the transpiration of plants is reduced and implicitly the conservation of water in the soil is achieved. At the same time, the capillary rise of the soil is reduced, maintaining a uniform layer of snow, preventing soil erosion, etc. besides these advantages, a specific microclimate is created, beneficial to cultivated plants, household centers and of course the restoration of the ecological balance.

By setting up protective forest curtains, it reduces about 4% of the land area but compensates by increasing production by up to 35% or more in some years.

A complete network of forest curtains (main and secondary), determined the reduction of wind speed by up to 50 %, the significant decrease of evapotranspiration and the conservation of water in the soil (Andreu et al., 2008).

Worldwide, Russia is considered the pioneer in combating extreme drought, since the first forest curtains with a protective role, were established in 1696 in southern Ukraine, planted at the ordinal of Tsar Peter the Great.

In 1883, 80 hectares with protective forest curtains were established, on the N-S direction, in the Kamennaya steppe (Vasilescu, 2004).

Based on the scientific assessment of the great scientist Dokuchaev, agroforestry systematically expanded in the steppe zones (Chendev et al., 2015).

These models of forest curtains have expanded in European countries, such as: Denmark, Germany, Italy, Hungary, Bulgaria, then in the USA, Canada, Japan, etc., but with much smaller dimensions (Vasilescu, 2004).

Afforestation as a forest management practice can be usefully applied to degraded lands unsuitable for agricultural crops to transform them into productive stands (Reyer et al., 2009; El-Beltagy, 2000).

In our country, the need to establish forest curtains was first mentioned by the great agronomist and politician I. I. de la Brad in 1866, who established the first forest curtains on the land of his farm in Roman, Neamt County, in the years 1870-1872 (Mușat et al., 2024).
Later, according to the same model, they were founded in 1880 in Mărculești, Ialomita County, then in Brăila County, in the period 1933-1937 on about 90 hectares (Vasilescu, 2004).
In 1960, the forest curtains protected a million hectares of land in Dobrogea and Bărăgan, and in 1961 it reached 7000 km of forest curtains that protected the fields and 1400 km that protected the communication routes (Costachescu et al., 2012).

MATERIALS AND METHODS

The studied area is a land area of 150.76 ha, framed in several soles with relatively flat relief, belonging to the Romanian Academy, located in the Tecuci-Matca area, Galati County. The lithological substrate in the studied area is represented by sandy eolian deposits of different geographical granulations, the area being framed in the Tecuci Plain (Figure 1).

Figure 1. Tecuci-Matca, Galati county

The research methods used in this study were those practiced according to the ICPA methodology, 1987, vol. I, II and III.

Soil analysis

Analysis methods used to determine chemical properties:
- Organic matter (humus): determined volumetrically by the wet oxidation method according to Walkley-Black, in the Gogoaşă modification – STAS 7184/21-82;
- CaCO3 (carbonates): gasometric method using the Scheibler calcimeter, according to SR ISO 10693:1998 (%);
- Nitrogen content was determined indirectly (by calculation) based on the humus content and the degree of base saturation.

$$IN = humus \times V / 100$$

- Accessible phosphorus (mobile P): according to the Egner-Riehm-Domingo method and dosed colorimetrically with molybdenum blue, according to the Murphy-Riley method (reduction with ascorbic acid);
- Accessible potassium (mobile K): extraction according to the Egner-Riehm-Domingo method and dosage by flame photometry;
- pH: determined potentiometrically, with a combined glass and calomel electrode, in aqueous suspension at a soil/water ratio of 1/2.5 - SR 7184/13-2001;
- Hydrolytic acidity - extraction with sodium acetate at pH 8.2;
- Sum of bases - Kappen Schoffield Chiriță method by extraction with 0.05 n hydrochloric acid.

Analysis methods used to determine physical properties

Determination of particle size fractions:
- pipette method for fractions ≤ 0.002 mm;
- wet sieving method for fractions 0.002-0.2 mm and dry sieving method for fractions > 0.2 mm;
- Bulk density (AD): method of metal cylinders of known volume (100 cm^3) at the current soil moisture (g/cm^3);
- Total porosity (PT): by calculation (% volume -% v/v);
- Aeration porosity (PA): by calculation (% volume -% v/v);
- Degree of compaction (GT): by calculation GT = [(PM – PT)/PMN] x 100 (% volume -% v/v), where: PMN – minimum total porosity required, varied depending on the clay content of the respective sample, is calculated with the formula PMN = 45+0.163 A (% volume -% v/v); PT = total porosity (% v/v); A – clay content (% g/g);
- Wilting coefficient (CO): by calculation, by multiplying the hygroscopicity coefficient by 1.5;
- Field water capacity (CC): by estimation based on texture and apparent density, according to "Methodology for Elaborating

Pedological Studies", ICPA, 1987, vol. I, page 101 (% by weight - % g/g).

RESULTS AND DISCUSSIONS

A soil profile and three surveys were carried out in different soils, which were morphologically and physico-chemically characterized, according to the guide for the field description of the soil profile and specific environmental conditions. (Munteanu et al., 2009).

Profile 1 Typical Arenosols (Figure 2)
Coordinates: *45.838295 - N and 27.479516 - E*
Rocks: *eolian deposits (sandy)*
Relief: *wavy landscape*
Use: *arable*
Groundwater: *over 10 m*

Figure 2. Profile 1 Typical Arenosols

Morphological characterization of the profile
Horizon Ao (0-34 cm), fine sandy loam, dark brown (10 YR 3/3 when wet and 10 YR 4/4 when dry), moderately developed grain structure, small and medium aggregates, moist, frequent fine roots, weakly adhesive, weakly plastic, moderately compact at the base, gradual wavy transition;
Horizon A/C (34-62 cm), medium loamy sand, light brown (10 YR 4/4 when wet and 10 YR 5/6 when dry), poorly formed grain structure, visible sand grains on the surface of the aggregates, rare fine roots, non-plastic, non-adhesive, clear wavy transition to the lower horizon;
Horizon C1 (62-104 cm), fine, yellowish-brown loamy sand (10 YR 4/6 when wet and 10 YR 6/6 when dry), unstructured, very friable, gradual transition;
Horizon C2 (104-126 cm), medium, yellowish loamy sand (2.5 Y 5/4 when wet and 2.5 Y 6/6 when dry),unstructured, very friable;
Horizon C3 (126-178 cm), coarse, olive-yellowish loamy sand (2.5 YR 4/6 when wet and 2.5 YR 6/6 when dry), unstructured, very friable.
The soil samples were analyzed physical and chemical, the results being shown in Table 1.

Table 1. Physical and chemical analyses for Typical Arenosols

Soil horizon	Ao	AC	C_1	C_2
Depth (cm)	0-34	34-62	62-104	104-146
Coarse Sand (2-0.2 mm)	14.6	27.1	24.6	31.8
Fine Sand (0.2-0.02 mm)	36.5	32.9	37.8	32.6
Dust (0.02-0.002 mm)	30.6	29.7	28.4	26.9
Clay (< 0.002 mm)	18.3	10.3	9.2	8.7
Texture	SF	UM	UF	UM
Soil reaction (pH)	5.36	5.84	6.28	7.14
Humus content (%)	1.78	1.42	0.53	0.12
Bulk density (g/cm^3)	1.31	1.54	1.58	1.51
Total porosity (%)	50	41	40	42
Degree of compaction (%)	non-compacted	mod. compacted	mod. compacted	slightly compacted
Nitrogen index (IN)	1,35	1.1	0.43	0.1
Base saturation (V%)	76	78	82	86
Mobile phosphorus (ppm)	16	11	7	-
Mobile potassium (ppm)	134	96	68	-
Wilting coefficient (%)	7.8	7.2	5.5	4.8
Field capacity (%)	14.2	13.1	10.1	8.7
Available water capacity (%)	6.4	5.9	4.6	3.9
Total water capacity (%)	38	27	25	28
Humus reserve (t/ha)	79	61	35	7.6

Secondary profile 1 Typical Arenosols (Figure 3)
Coordinates: *45.835706 - N and 27.485576 - E*
Rock: *eolian deposits (sandy)*
Relief: *wavy landscape*
Use: *arable*
Groundwater: *over 10 m*

Figure 3. Secondary profile 1

Morphological characterization of the secondary profile 1

Horizon Ao (0-22 cm), fine loamy sand, dark brown (2.5 Y 3/2 when wet and 2.5 Y 4/3 when dry), medium grain structure, poorly developed, wet, weak effervescence, frequent fine roots, non-adhesive, non-plastic, gradual transition to the lower horizon, hardpan at the base (20-26 cm);
Horizon A/C (22-48 cm), fine loamy sand, dark olive brown (2.5 Y 3/3 when wet and 2.5 Y 4/4 when dry), moderately developed grain structure, moist, frequent fine roots, non-adhesive, non-plastic, gradual transition to the next horizon;
Horizon C1 (48-86 cm), coarse, poorly structured, olive brown loamy sand (2.5 Y 4/3 when wet and 2.5 Y 5/4 when dry), moderately developed grain structure, moist, frequent fine roots;
Horizon C2 (86-115 cm), coarse, yellowish brown loamy sand (2.5 Y 5/3 when wet and 2.5 YR 6/4 when dry), poorly structured, sand grains visible on the surface of the aggregates, non-plastic, non-adhesive, clear transition to the lower horizon;
Horizon C3 (> 115 cm), coarse, yellowish brown sand (7.5 YR 4/6 when wet and 2.5 YR 7/6 when dry), unstructured, very friable, does not effervescent.
The soil samples were analyzed physico-chemically, the results being shown in Table 2.

Table. 2. Physical and chemical analyses for Typical Arenosols - Secondary profile 1

Soil horizon	**Ao**	**AC**	**C_1**	**C_2**
Depth (cm)	0-22	22-48	48-86	86-115
Coarse Sand (2-0.2 mm)	29.8	32.8	38.6	43.4
Fine Sand (0.2-0.02 mm)	31.6	30.1	31.4	30.3
Dust (0.02-0.002 mm)	30.4	29.8	28.7	25.6
Clay (< 0.002 mm)	8.2	7.3	1.3	0.7
Texture	UF	UG	NG	NG
Soil reaction (pH)	5.0	5.7	6.4	6.7
Humus content (%)	1.38	1.04	0.76	0.15
Bulk density (g/cm^3)	1.23	1.28	1.33	1.44
Total porosity (%)	54	52	50	46
Degree of compaction (%)	non-compacted	non-compacted	non-compacted	non-compacted
Nitrogen index (IN)	0.97	0.74	0.59	-
Base saturation V (%)	70	72	78	83
Mobile phosphorus (ppm)	21	17	13	7
Mobil potassium (ppm)	110	86	71	56
Wilting coefficient (%)	5,3	4.5	3,3	3.1
Field capacity (%)	7.95	6.75	4.95	-
Available water capacity (%)	2.65	2.25	1.65	-
Total water capacity (%)	44	41	37.5	-
Humus reserve (t/ha)	78.0	34.6	22.23	-

Secondary profile 2 Typical Arenosols (Figure 4)
Coordinates: *45.823452 - N and 27.500447 – E*
Rock: *eolian deposits (sandy)*
Relief: *undulating field*
Usage: *arable, wheat stubble*
Groundwater: *over 10 m*

Figure 4. Secondary profile 2

Morphological characterization of the secondary profile 2

Horizon Ao (0-24 cm) fine loamy sand, dark brown (10 YR 4/3 when wet and 10 YR 5/4 when dry), medium grain structure, poorly developed, revan, frequent fine roots, non-adhesive, non-plastic, diffuse transition to the lower horizon;

Horizon A/C (24-50 cm) medium loamy sand, light brown (10 YR 4/4 when wet and 10 YR 6/4 when dry), poorly developed grain structure, revan, frequent fine roots, non-adhesive, non-plastic, clear transition to the underlying horizon;

Horizon C1 (50-90 cm) coarse loamy sand, unstructured, yellowish brown (2.5 Y 4/3 when wet and 2.5 Y 5/4 when dry), moist, rare fine roots;

Horizon C2 (90-130 cm) coarse, unstructured, friable, yellowish loamy sand (2.5 Y 5/3 when wet and 2.5 YR 6/4 when dry), clear transition to the lower horizon;

Horizon C3 (> 130 cm) coarse, pale yellow sand (2.5 Y 6/4 when wet and 2.5 YR 7/4 when dry), unstructured, very friable, very weak effervescence at the base;

Soil samples were analyzed physicochemically, the results being shown in Table 3.

Table 3. Physical and chemical analyses for Typical Arenosols-Secondary profile 2

Soil horizon	Ao	AC	C_1	C_2
Depth (cm)	0-24	24-50	50-90	90-130
Coarse Sand (2-0.2 mm)	20.9	28.7	36.6	42.1
Fine Sand (0.2-0.02 mm)	37.5	32.6	26.8	24.9
Dust (0.02-0.002 mm)	30.7	29.4	28.5	25.3
Clay (< 0.002 mm)	10.9	9.3	8,1	7.7
Texture	UF	UM	UG	UG
Soil reaction (pH)	5.8	5.9	6.2	6.9
Humus content (%)	1.67	1.12	0.62	0.18
Bulk density (g/cm^3)	1.3	1.38	1.39	1.42
Total porosity (%)	52	51	50	44
Degree of compaction (%)	non-compacted	non-compacted	non-compacted	slightly compacted
Nitrogen index (IN)	0.97	0.74	0.59	-
Base saturation V (%)	74	75	79	84
Mobile phosphorus (ppm)	16	11	9	5
Mobile potassium (ppm)	134	126	101	86
Wilting coefficient (%)	5.3	5.0	4.3	3.7
Field capacity (%)	9.6	9.0	7.8	-
Available water capacity (%)	4.3	4.0	3.5	-
Total water capacity (%)	40	37	35	-
Humus reserve (t/ha)	52	40	34	-

Secondary profile 3 Typical Arenosols (Figure 5)
Coordinates: *45.82023 - N and 27.487188 – E*
Rock: *eolian deposits (sandy)*
Relief: *undulating field*
Usage: *arable, rape stubble*
Groundwater: *over 10 m*

Figure 5. Secondary profile 3

Morphological characterization of the secondary profile 3

Horizon Ao (0-32 cm), medium loamy sand, dark yellowish brown (10 YR 4/4 when wet and 10 YR 5/4 when dry), medium grain structure, poorly developed, wet, frequent fine roots, non-adhesive, non-plastic, gradual transition to the lower horizon;

Horizon A/C (32-64 cm), fine loamy sand, light yellowish brown (10 YR 5/3 when wet and 10 YR 6/6 when dry), poorly structured in the upper half, moist, frequent fine roots, non-adhesive, non-plastic, clear transition to the underlying horizon;

Horizon C1 (64-96 cm) coarse, unstructured, yellowish loamy sand (2.5 Y 5/4 when wet and 2.5 Y 6/4 when dry), unstructured, mineral grains of micaceous sand in its mass;

Horizon C2 (96-115 cm), coarse, pale yellow loamy sand (2.5 Y 6/3 when wet and 2.5 YR 7/4 when dry), unstructured, non-plastic, non-adhesive, diffuse transition to the lower horizon;

Horizon C3 (115-135 cm), coarse, grayish yellow sand (5 Y 6/2 when wet and 5 Y 7/3 when dry), unstructured, very friable, very weak effervescence at the base.

The soil samples were analyzed physicochemically, the results being shown in Table 4.

Table 4. Physical and chemical analyses for Typical Arenosols-Secondary profile 3

Soil horizon	**Ao**	**AC**	**C_1**	**C_2**
Depth (cm)	0-32	32-64	64-96	96-135
Coarse Sand (2-0.2 mm)	21.7	16.8	41.1	45.8
Fine Sand (0.2-0.02 mm)	35.8	42.7	21.4	20.6
Dust (0.02-0.002 mm)	31.2	30.8	29.2	26.2
Clay (< 0.002 mm)	11.3	9.7	8.3	7.4
Texture	UM	UF	UG	UG
Soil reaction (pH)	5.6	5.9	6.7	6.9
Humus content (%)	1.58	0.97	0.63	0.17
Bulk density (g/cm^3)	1.28	1.31	1.44	1.49
Total porosity (%)	54	52	50	47
Degree of compaction (%)	non-compacted	non-compacted	non-compacted	non-compacted
Nitrogen index (IN)	1.2	0.75	0.5	0.14
Base saturation V (%)	76	78	80	84
Mobile phosphorus (ppm)	17	11	9	7
Mobile potassium (ppm)	137	116	91	76
Wilting coefficient (%)	6.1	5.7	4.2	4.0
Field capacity (%)	11.1	10.3	7.6	7.3
Available water capacity (%)	5.0	4.6	3.4	3.3
Total water capacity (%)	42	39	35	31
Humus reserve (t/ha)	64	40	29	9.8

Into account the current pedoclimatic conditions in the studied areas, based on the criteria presented in the M. O. of 14.02.2022, the main forest species recommended for afforestation were established and presented.

The soil type is represented by typical arenosoil, very poorly supplied with humus and nutrients, non-adhesive, prone to wind erosion, therefore very easily shattered by the wind, which is why special technologies are recommended to stabilize the sands.

In this situation, it is recommended to reduce the wind speed by setting up forests or forest curtains, on the contour of the soils, establishing tree-wine plantations and maintaining them in pastoral regime (grassed), so that later, interventions according to technology to be carried out without difficulty.

The station sheet for this area was drawn up, according to Table 5.

Table 5. Stationary unit sheet, Tecuci-Matca area, Galaţi County

1. Unity and form of relief: plain 2. Configuration of land: horizontal 3. Slope: 2-5 % 4. Exposition X 5. Altitude: 90-100 m 6. Vegetation: segetal herb												
7	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*
Horizon	***Depth (cm)***	***Humus (%)***	***Texture clase***	***Colour***	***Scheletal***	***Structure***	***humidity***	***Compaction***	***pH***	***Efervescence***	***Soluble salt***	***concretions***
Ao	*0-34*	*1.78*	*Fine sandy loam*	*Dark brown*	-	*Graine moderately structured*	*Ue1*	*Non-compacted*	*7.66*	-	-	-
AC	*34-62*	*1.42*	*Medium clay sand*	*Light brown*	-	*Graine light structured*	*Ue1*	*Moderately compacted*	*7.92*	-	-	-
C1	*62-104*	*0.53*	*Fine clay sand*	*yellowish*	-	*unstructured*	*Ue 1*	*Moderately compacted*	*8.41*	-	-	-
C2	*104-126*	*0.12*	*Medium clay sand*	*yellowish*	-	*unstructured*	*Ue 1*	*Light compacted*	*7.24*	-	-	-
20. Material parental: wind deposits				*24. Zonal and local climate: Continental temperate, specific of plain*						*28.Tipe and subtipe of soil: Typical arenosoil*		
21.Morphological depth: 126 cm				*25. Groundwater: >10,0 m*						*29. Humus of type: mull calcic*		
22.Fiziological depth: 34 cm				*26. Hydrological regime and humidity; H 1 unpercolative*						*30. Proposal for works:* *- establishement of forest plantation* *- energic mobilization of soil*		
23. Wind erosion: moderately				*27.Character of floods: unenviable*								
Stational groupe: GS 79			*Composition of afforestation: 75 Sc (Fr.p, Fr.î) + 25 Ml (Gl, Dd)*									
Observation: Several condition of station (dry-arid climate, soil uncarbonated), natural regeneration occurs with difficulty												

CONCLUSIONS

The studied territory belongs to the urban area of Tecuci, Galați County, geographically included in the Tecuci Plain, characterized by a temperate continental climate, specific plain relief, with plateaus and gently sloping slopes, with the groundwater at over 10 m.

The area taken into study within TC Tecuci, Galați County, is 150.75 ha., arable land, from which over 40 soil samples were collected (in natural and modified settlement).

The purpose of the work was to know the properties of the soil in order to use it judiciously and evaluate the suitability of the land for forestry.

The soil cover in the studied area is consistent with the physical-geographical conditions of the area, with a single type of soil with a zonal character being identified (typical arenosols & molic).

The parental material is predominantly made up of aeolian deposits.

The texture of this type of soil is generally sandy (coarse) with a banded appearance, throughout the depth of the soil profile.

The main limiting factor of production potential is the poor rainfall during the growing season, sandy texture, low humus content, poor structuring, etc.

Recommendation:

- stabilization of the land (bioaccumulative horizon) by establishing fast-growing and lush crops, in order to enrich it with organic matter, stimulate the activity of microorganisms and restore the soil structure;
- protecting the land with a layer of mulch on the surface, with an anti-erosion role or avoiding carrying out land mobilization works in the fall.

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