Research on Improving Fertility Sandy Soils from Dabuleni Field by Administration of Loess

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In order to solve and clarifying certain aspects of the clay content (particles <0.002 mm) sands and sandy soils, humus, respectively, the process of bioaccumulation and mineralization the organic matter of the land, in the Research and Development Centre for Plant Growing on Sand Dabuleni, have initiated research aimed at finding methods and means for accumulating and thus the increase in the content of clay in the soil, respectively humus.Therefore, to improve radical of sandy soils, we found it necessary to resort to what is called loess process. It consists in enriching the horizon the surface soil (20-25 cm) the fraction with 8-10% clay, to 1.5-5%, as currently it contains. It is primarily intended to influence various amounts loess material on physical, hydro- physical and chemical properties of soils, then the plant response to changes products in the soil, increasing the guaranteed potential fertility of these soils, which will result in production high and constant.Obtaining appropriate agricultural production on sandy soils (eutric psamosol) it is limited not only by the soil, but also other factors such as relief, drainage and even climate. Because coarse texture, water-holding capacity in the case of sandy soils it is very low in all soils, the clay content below 5% production capacity of soils it is particularly low in the absence of agropedoameliorative measures and especially irrigation. Wind erosion occurs in all perimeters sandy soils, with higher intensity is observed in Oltenia Plain (Dabuleni Field).

*Keywords**:** sandy soils, fertility, clay, agropedoameliorative measures, alfalfa*

This paper develops an idea that has not been addressed in the literature global specialty, a priority of Romanian soils research.

Recovery sands and sandy soils is a very topical issue, both nationally and internationally.

The need to increase agricultural production in recent decades has led to the cultivation of agricultural plant surfaces becoming higher these soils.

Sandy soils formed on eolian deposits, although not spread too much, seen as a resource land have a particular importance for the country's agriculture, because it has certain characteristics that make them valuable in relation to plant growth. Among them: warming faster than other soils, thus providing the possibility to obtain early crops; easier work the soil and in a longer time interval, with the energy and lower fuel; greater capacity mineralization of organic matter.

Sandy soils, however, presents a number of shortcomings and limitations of the specific use, but can be relatively easily overcome or offset and other difficult to correct, as is the case granulometry.

The experience increased clay content by loess process on sandy soils (eutric psamosol) under irrigation for culture alfalfa it is stationary and located by the method of the rectangle latin, in randomized blocks in five variants, including the control, with four repetitions, surface experimental plot is 90 m^2 (12m x 7.5 m) (fig. 1).

The experience carried out in field the culture of alfalfa (*Medicago sativa*), observations, measurements and laboratory tests included the following:

- setting means, ways and means of increasing clay content of eutric psamosol in the under irrigation;
- speeding up the process of accumulation of humus;
- clarify certain aspects of the mineralization the organic matter of the sandy soils (eutric psamosol);
- administration loess doses;
- use of chemical fertilizers (NPK).

Variants/ Repetitions	V_1	V_2	V_3	V_4	V_5
R_4	V_4R_4	V_5R_4	V_1R_4	V_2R_4	V_3R_4
R_3	V_3R_3	V_4R_3	V_5R_3	V_1R_3	V_2R_3
R_2	V_2R_2	V_3R_2	V_4R_2	V_5R_2	V_1R_2
R_1	V_1R_1	V_2R_1	V_3R_1	V_4R_1	V_5R_1

Fig. 1. Main experimental plot is 90 m^2 (12m x 7.5 m) (fig. 1)

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Experimental part

Materials and methods

Pedological and agrochemical studies the experimental field within Research and Development Centre for Plant Growing on Sand Dabuleni, been achieved according to the Methodology developed for soil studies, 3 Volumes, ICPA, 1987.

Soil and Agrochemical mapping was performed at 1: 10.000, using contour maps and soil map, Turnu Magurele sheet, scale 1: 200.000. Soil classification level type, subtype were made in according with *Romanian System of Soil Taxonomy* (SRTS, 2003, 2012) ICPA, Bucharest.

For field crops located on flat land or sloping average size of the sampling agrochemical is from 2 to 5 ha.

The sample average is the agrochemical is a number of partial samples, namely: 25 for uniformly fertilized land.

Partial samples are collected from points arranged in zigzag or parallel directions inside of the harvesting parcel. The depth of the collection is 0-20 cm arable land. Each sample was partially collected, placed in a box, representing, thus, the average sample agrochemical. Before placing experience in field they were given loess rates and chemical fertilizers - ammonium nitrate (33.5% N) and complex NPK - 16-16-16 on the surface, namely:

Loess rates:

V_1 - no added loess

V_2 - 40 t/ha

V_3 - 80 t/ha

V_4 -120 t/ha

V_5 - 160 t/ha

Complex fertilizer NPK rates of the type: 16-16-16:

R_1 - no fertilizer

R_2 - N50 P40 K40

R_3 – N100 P80 K 80

R_4 – N150 P 120 K 120

The establishment culture of alfalfa was performed according to the method specified in sandy soils, the ground work is carried out as follows: plowing, discing, rolling before sowing and after sowing, sowing at a depth of 1.5-2 cm and application of irrigation water to 250 m^3/ha.

The following methods have been used for the physical and hydro-physical features:

Particle size distribution (granulometry):

-pipette method for fractions <0.002 mm, including;

-wet sieving method for fractions from 0.002 to 0.2 mm and dried sieving method for fractions > 0.2 mm

For the *textural classes and subclasses,* we used the Romanian system, according to the Methodology developed for soil studies, ICPA, 1987.

Bulk density (DA) method: metal cylinder of known volume (200 cm^3) for the momentary soil moisture.

Total porosity (TP): by computing PT = (1-AD/D)*100

Water permeability (K): in the laboratory on samples with unchanged alignment taken, the method ICPA

Withering coefficient (CO) was estimated based on the content of clay (< 0.002 mm), using the relationship:

CO (%)=0.05+0.35 A, where:

A = clay content < 0.002 mm.

Field capacity (CC): by calculation based on texture and bulk density, % by weight

Useful water capacity (CU): by calculation from the formula CU=CC-CO, % by weight

Total water capacity (CT): by calculation from the formula CT=PT/DA, % by weight

The chemical characteristics were determined using the following methods:

*p*H: potentiometrically, with glass and calomel combined electrode, in aqueous suspension, at the ratio of ½, 5.

Humus: wet oxidation (Walkley-Black method, modified) and results expressed in percentage.

Total nitrogen (Nt): Kjeldahl method, decomposition of H_2SO_4 at 350°C, catalysts: potassium sulphate and copper sulphate.

Available phosphorus (mobile): Egner-Riehm-Domingod method and colorimetric dosed with blue molybdenum, according to Murphy-Riley method (ascorbic acid reduction).

Available potassium (mobile): extraction according to Egner-Riehm- Domingo method and dosing by flame photometry.

Degree of base saturation (V%): was determined with the following formula V=SB/T*100, % by weight

Total cation exchange capacity (T me/100 g soil): was determined with the following formula T (me/100 g soil) T=SB+Ah

Hydrolytic acidity (Ah me/100 g soil) was determined by extraction with 1 N sodium acetate solution buffered to *p*H=8.3.

Interpretation of the results has been submitted in accordance with *Methodology developing soil studies*, ICPA Bucharest, 1987, provided for in current legislation on the subject.

Results and discussions

Experience the culture of alfalfa (*Medicago sativa*) it was placed on the terrace III of the Danube, on a sand and sandy soils (eutric psamosol) under irrigation and fight against the wind deflation to Research and Development Centre for Plant Growing on Sand Dabuleni, Dolj. The village is located on DN 55, Craiova-Bechet-Corabia, 75 km south of Craiova and 40 km west of Corabia.

In terms of taxonomic, soil in the building experience it belongs to the class protisols, namely a eutric psamosol under irrigation conditions.

Eutric psamosoil is characterized by a coarse texture, in which content coarse sand can reach up to 76%, and the clay up to a maximum of 1.1%.

If psamosoils from Oltenia prevails quartz and subordinate orthoclase, microcline, biotite, hornblende, garnet and coil (table 1).

The bulk density varies with the degree of soil formation, the clay content and the humus, it is generally small (DA=1.44 g/cm^3). Shows a very high total porosity (TP =

Table 1
PARTICLE SIZE DISTRIBUTION (GRANULOMETRY) OF EUTRIC PSAMOSOILS

Horizon	Depth (cm)	Clay < 0.002 mm	Clay < 0.01 mm	Silt 0.002-0.02 mm	Fine sand 0.02-0.2 mm	Coarse sand 0.2-2.0 mm
Aop	0-20	0.5	1.6	2.7	24.4	72.4
Ao	21-35	0.5	1.9	2.6	24.2	72.7
AC	36-52	0.5	1.9	2.0	21.6	75.9
C_1	53-95	0.7	2.2	3.0	29.3	67.0
C_2	96-132	0.6	0.8	4.3	31.6	63.5
C_3	133-170	1.1	3.0	4.1	33.8	61.0
C_4	171-200	0.9	1.2	4.1	34.0	61.0

49.5%), making the permeability of these soils, expressed by the hydraulic conductivity to be high (K > 45 mm/h). Withering coefficient is very low (CO= 0.5-1.2%), but it is an advantage to plants which can realize low moisture water content (table 2).

The chemical reaction of these soils are grouped within the range between 5.65 to 6.45 horizons Ao and AC, the weak-moderate acid and at the horizon C_4 is neutral (*p*H = 7.0) (table 3). In terms of content of humus, eutric psamosoils are generally low in humus, containing from 0.35 to 1.06%. The total cation exchange capacity it is characterized by extremely low values and very small (T=4.84-6.33 me/100 g sol) and the degree of base saturation is between 68-89%.

Determinations were performed on granulometry and the content of calcium carbonate the loess used in the experimentation before placing experience in the field (table 4, fig. 2).

In the analyzes, coarse sand content ranged between 19.0 and 42.8%, and the fine sand between 64.1% and 42.8%. Clay content have values, and the content of calcium carbonate is medium (5.0 to 9.2%).

Table 2
THE PHYSICAL AND HYDRO-PHYSICAL PROPERTIES OF EUTRIC PSAMOSOILS

Horizon	Depth (cm)	DAwi (g/cm^3)	RP (kgf/cm^2)	PT (%)	wi (% g/g)	IC (-)	K sat (mm/h)	CO (% g/g)	CC (% g/g)	CU (% g/g)	CT (% g/g)	CD (% g/g)
Aop	0-20	1.34	17	49.5	5.3	0.0215	90.79	1.2	12.3	11.1	36.9	24.6
Ao	21-35	1.44	20	45.7	2.1	0.0879	46.28	1.1	11.2	10.1	31.7	20.5
AC	36-52	1.56	34	41.1	4.0	0.0211	45.31	0.7	10.3	9.6	26.3	16.0
C_1	53-95	1.51	33	43.2	2.5	0.0785	56.12	0.5	10.2	9.7	28.6	18.4
C_2	96-132	1.44	37	45.9	3.1	0.0638	46.60	0.5	10.1	9.6	31.9	21.8
C_3	133-170	1.53	27	42.3	4.8	0.0179	53.86	0.6	9.7	9.1	27.6	17.9

Table 3
THE CHEMICAL PROPERTIES OF EUTRIC PSAMOSOILS

Horizon	Depth (cm)	pH (H_2O)	Humus %	SB me/100 g sol	Ah me/100 g sol	T me/100 g sol	V_{Ah} % from T	Total nitrogen %	P_{AL} ppm	K_{AL} ppm
Aop	0-20	5.65	1.06	3.92	1.80	5.71	68.6	0.059	38	83
Ao	21-35	5.88	0.94	4.12	1.55	5.67	72.6	0.043	36	74
AC	36-52	6.45	0.35	4.32	0.96	5.28	81.8	0.025	18	40
C_1	53-95	6.23	-	4.32	1.01	5.33	81.1	-	-	-
C_2	96-132	6.33	-	4.62	0.90	5.52	83.7	-	-	-
C_3	133-170	6.34	-	5.52	0.81	6.33	87.2	-	-	-
C_4	171-200	7.00	-	4.32	0.53	4.84	89.2	-	-	-

Table 4
PARTICLE SIZE DISTRIBUTION (GRANULOMETRY) OF LOESS USED IN THE EXPERIMENT

Sample	Horizon	Depth (cm)	Clay		Silt 0.002-0.02 mm	Sable fin 0.02-0.2 mm	Coarse sand 0.2-2.0 mm	$CaCO_3$ %
			<0.002 mm	< 0.01 mm				
1	Ao	0-30	2.7	10.0	14.2	64.1	19.0	9.2
2	Ao	0-30	6.9	10.6	7.5	42.8	42.8	5.0

Fig. 2. Source of loess used for experiments on the terrace III Danube the Dabuleni

The materials used as the source of loess they were administered to the soil surface and incorporated by a basic work of the soil (plowing) at a depth of 0-28 cm. Plowing was executed with plow P2V in aggregate with the tractor U650 on 08.30.2017 (fig. 3).

Fig. 3. Plowing executed at 25-28 cm deep in the experimental field

Semis alfalfa it was done with SUP-21 at a depth of 1.5-2.5 cm spacing is 12.5 cm, perpendicular to the direction of prevailing winds, on 09.05.2017; ranks were oriented from north to south. Emission seed is 26 kg /ha and used alfalfa variety Pomposa.

The rolling after sowing with smooth rolling 3 TN–1,4, on 05/09/2017 and irrigation water 250 m^3/ha, for the seed to find in sandy soils the necessary humidity and placed in contact with the sand for germination. In dry autumns recommended and a second wetting with water 250-300 m^3/ha at an interval of 10-12 days.

Throughout the growing season is recommended that the irrigation to do so to maintain minimum threshold to 50% of IUA the depth of 80 cm. The necessary water was provided by sprinkler irrigation.

Lack of water from rain and high temperatures high recorded during the vegetation have been necessary to apply irrigation (fig. 4).

Alfalfa (*Medicago sativa*) has risen on 15.09.2017 at least 85%, the distance between rows of 12.5 cm (fig. 5).

Some portions of alfalfa plants have sprung hollow. In phase of 3-5 trifoliate leaves alfalfa plants show different heights from 2 cm (control variant) to 6 cm (fertilized variants) on 10/12/2017 (fig. 6, 7).

In the culture of alfalfa stands the presence of dicotyledonous weed, such as: *Amaranthus retroflexus, Chenopodium album, Cynodon dactylon, Polygonum aviculare* (fig. 8, 9, 10).

On 08/11/2017 alfalfa plants have 7-9 trifoliate leaves and presents different heights at 7 cm (control variant) up to 13 cm (fertilized variants).

Fig. 4. Sprinkler irrigation system in the experimental field.

Fig. 5. Culture of alfalfa (*Medicago sativa*) the distance between rows of 12.5 cm.

Fig. 6. Alfalfa (*Medicago sativa)* in phase of 3-5 trifoliate leaves in fertilized variants.

Fig. 7. Alfalfa (*Medicago sativa)* in phase of 3-5 trifoliate leaves in control variant.

Plant density is 110-120 plants/m^2 variants fertilized with loess and chemical fertilizer, compared to the control variant where the density is 70-80 plants/m^2 (fig. 11- 13).

Fig. 8. *Amaranthus retroflexus* on eutric psamosoils in the Dabuleni Field

Fig.9. *Polygonum aviculare* on eutric psamosoils in the Dabuleni Field

Fig.10. *Cynodon dactylon* on eutric psmosoils in the Dabuleni Field

Fig. 11. Alfalfa (*Medicago sativa*) in phase of 7-9 trifoliate leaves in fertilized variants

Conclusions

Seeding alfalfa around date 5 September prompted the formation of a strong root system and growth of leaf surface which contributes to achieving high-quality productions. Until the advent of winter frosts, culture of alfalfa (*Medicago sativa*) 900-1100 ^{0}C has active temperature, which helps

Fig. 12. Alfalfa (*Medicago sativa*) in phase of 7-9 trifoliate leaves in control variant

Fig.13. Alfalfa (*Medicago sativa*) the distance between rows of 12.5 cm in phase of 7-9 trifoliate leaves

alfalfa plants to take root strong and forming a green carpet, which protects sands against wind deflation.

We will continue phenological observations the culture of alfalfa (*Medicago sativa*) and also administering chemical fertilizers - ammonium nitrate (33.5% N) and complex NPK -16-16-16 throughout period vegetation.

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