PEDOCLIMATIC FACTORS THAT INFLUENCING THE PRODUCTIVITY OF LANDS FROM BOIANU PLAIN

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***Abstract** The research has as purpose the support of agricultural systems, responding to local requirements, to establishing the scientific data base necessary for the support of new technologies and the development of integrated management measures for agro-eco-systems. Among the main cultivated species and soil properties it can be established diverse and complex relations. To determine the complex relationships between the different soil properties, it were undertaken numerous studies, both in our country and in the world. These studies have elucidated a lot of mutual causality, thereby helping to define soil taxonomy, both in terms of genetic and the fundamental characteristics, in relation to their differential contribution to the productivity of land and their suitability for plants.The research of this project lies in the accumulation of scientific data on the evolution of components productivity of agricultural land on the atmospheric, cosmic-telurico-edaphic offer, necessary to support new technologies, through an complexes approach of physical, geographical, edaphic and climatic conditions from Boianu Plain.The problem concerns an area of 99.880 ha of agricultural land, located in Boianu plain, characterizing small land areas of about 2 hectares, with excess of surface moisture (UAT Vilcele and Brebeni), soil identified as Pelosol stagnated and the land with big surfaces of eluvial-stretched processes of clay of approximately 50 hectares (UAT Crampoia), where was identified vertic preluvosoil soil.*

***Key words:** plain, land, quality, factors, productivity*

INTRODUCTION

Sustainable management of natural resources (atmosphere, soils, water courses, vegetation and fauna etc.) represent a modern form of land management, the existence and economic development of any society, regardless of its nature, being unimaginable beyond them having a decisive weight according to the progress of society.

Increase, improve and stability of agricultural production and food security in all agricultural areas (tropical, subtropical, temperate, etc..) is achieved by cultivating certain plants, creating for them the defined technology elements, optimal growing conditions, starting to the fundamental idea that man must cooperate with the environment, to become conscious his protector. It is, therefore, necessary to achieve growth in full compliance with the requirements of conservation and protection of the environment.

Among the main cultivated species and soil properties it can be established diverse and complex relations. The developing of root system, mineral nutrition, providing aerohidric and thermal regime of soils are influenced by the soil properties. So, the plants acts, both directly and indirectly, on the soil fertility status.

In our country and in the world were undertaken numerous studies to determine the relationships that are established between all the soil properties. That studies have elucidated the causality, helping to define soil taxa, in terms of genetic and main characteristics, in relation to the contribution to the suitability of land for plants and soil productivity.

The research of this project lies in the accumulation of scientific data on the evolution of components productivity of agricultural land on the atmospheric, cosmic-telurico-edaphic offer, necessary to support new technologies, through an complexes approach of physical, geographical, edaphic and climatic conditions from Boianu Plain.

In F.A.O. terminology, „land quality" is defined as a complex of factors that influence land sustainability for the differed purposes. The term „land" is referring to soils, landscapes, climate, hydrology, vegetation and fauna, including land improvements and other forms of management etc. (Dumitru and col, 2000).

In the terms of Romanian school of pedology, *the quality of the land (soil)*, represents the totality of basic features and characteristics, through which a part of soil differs from the others, being better or worse (D. Teaci, 1980).

Based on the data extracted from scientific research topics, the authors present in this paper some aspects that define fertility and soil quality. These aspects are necessary to ensure the support for development programand the management of soil and water resources.

MATHERIALS AND METHODS

The issue addressed concerns as an area of 99880 ha (Table 1) agricultural lands (22.97 % of total agricultural surface of Olt county), located in the south of Romania.

Table 1

Agricultural area by use of Boianu Plain

No .crt	Locality	Agricultural land (ha)	Surface, on main land use				
			Arable	**Pasture**	**Hayfield**	**Wineyard**	**Orchard**
1	Brebeni	8705	8059	502	-	71	73
2	Cotean	3300	2730	469	-	101	-
3	Crîmpoia	3522	3299	119	-	74	30
4	Dăneasa	3890	3443	36	-	85	-
5	Drăgănești-Olt	5 4	5363	245	-	356	-
6	Icoana	4877	4585	204	-	52	36
7	Izvoarele	4425	4078	248	-	99	-
8	Mărunței	4808	4360	318	-	130	-
9	Mihăești	5095	4957	41	-	5	92
10	Movileni	4472	4116	269	-	82	5
11	Nicolae Titulescu	015	1828	155	-	32	
12	Perieți	3151	2903	203		43	2
13	Radomirești	8799	8465	216	-	118	-
14	Schitu	3409	2990	324	-	85	10
15	Seaca	3830	3719	71	-	40	-
16	Șerbănești	3793	3606	109	-	65	13
17	Stoicănești	9281	9035	131	-	115	-
18	Tufeni	6145	5875	206	-	57	7
19	Văleni	57 8	5174	416	1	115	5
20	Vîlcele	4671	4260	324		87	-
Total Câmpia Boianu		**99880**	**92845**	**4932**	**18**	**1812**	**273**

The research of the pedological conditions was done in accordance with the "MESP" (vol. I, II, III) elaborated by I.C.P.A. Bucharest in 1987, supplemented with specific elements of the Romanian Soil Taxonomy Systems (SRTS-2003/2012) and other normative acts updated by MAAP Order 223/2003, respectively Order MADR 278/2011

The analysis and other determinations were carried out in the physical-chemical analysis laboratory ***O.S.P.A Olt.***

RESULTS AND DICUSSIONS

As a result of its location between the Olt and Vedea, the Plain Iminog (subunit of Plain Boianu), appears as an extension to the south of the base Cotmeana is formed by filling the area with sediments to the rivers of the Carpathian and Subcarpathian during Quaternary (Posea Badea, 1984), natural conditions (relief, lithology, hydrology, vegetation) specific to the interfluves.

He bowed slightly to the south, having the appearance of a piedmont plains held between 110-180 meters altitude and is crossed by: Iminogului Călmăţui, Dorofei, Plapcea Valleys which produce some variation in the monotony of the landscape.

They are accompanied by meadows raised to 2.5 to 4 meters above the meandering river beds and low terraces (8-10 m and 12-15 m). On the slopes, dominating the Olt Valley, there is a strong line of springs that feed all the villages in south of the city Drăgăneşti - Olt (P.V., Coteţ şi Veselina Urucu, 1975).

For this interfluve are used two names: Plain Boiangiului (north) and Boian Plain (south) and in contact with the Getic Plateau, in the transition area, meet two names: Field Slatina and field Carbunarilor.

Interfluves weak fragmented, are sprinkled with numerous depressions tap the excess of moisture accumulates from the precipitation.

Geologically, the investigated area overlaps two great establishments located outside the Carpathians: Getic Depression in the north and Platform Moesian in south. Alternations of clay, marl, sand and gravel thickness of approx. 150-200 m representing the characteristic of this complex lithology, this development the main types of soil in the area investigated (Table 2-4) commonly affected by excess humidity from rain water.

The stagnant moisture excess is caused both by the micro relief and especially by the presence of montmorillonite clay rich horizons.

The hydrographic network of the area studied is the Olt and Vedea rivers, with their tributaries.

Pedofreatice water depth is closely related to the main forms of relief and lithology permeability of surface deposits and season. Being fed by rainfall or rivers by relief are differentiated blades meadow and interfluves. The first is found in alluvial floodplain rivers: Olt, Vedea and their tributaries, are encountered at depths of 1-4 m, but in some sand banks, may be 5-6 m. Their level is very oscillating however, depending on the level of ordinary rivers which are fed, but the groundwater horizon meadows pertain to depths of less than 1 m. the highest levels are found in spring and early summer and autumn and winter the lowest.

The climate of investigated space is temperate continental, with Danubian climate, with the average annual temperature is between 11,1-12,0°C (11.2 ° C,) and the average annual rainfall 551-600 mm (561 6 mm) Weather-station Slatina, 1980-2012, respectively, from 2013 to 2017 757.9 mm, (Table 3).

These elements, along with other indicators of potential climatic characterization and annual total amount of days without frost is 193 days from the north of Slatina, indicating the elements needed to establish technological links with particular relevance to agricultural practice.

Table 2

Average of mounthy, annual temperature °C, SLATINA meteorological station

Year	**monthly**												**Annual**
	I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**	
2013	-0,3	2 7	4,6	13,5	1 ,1	20,9	22,8	24,1	16,7	11,4	7,9	-0,7	11,9
2014	0,0	,5	8,9	11,6	15,8	19,3	22,0	22,3	17,2	11,3	5,3	1,2	11,4
2015	0,5	1,4	6,1	11,6	18,2	20,5	25,2	23,	19,3	10,4	8,0	3,5	12,3
2016	-3,0	6,4	7,4	14,4	15,9	22,3	24,1	23,1	19,0	9,8	5,0	-0,6	12,0
2017	-5,3	1,3	9,4	11,0	16,6	23,0	23,6	24,4	18,7	11,6	6,4	2,9	12,0
2018	0,7	0,9	3,6	15,9	19,0								
013-017	-1,7	2,7	7,3	12,4	17,1	21,2	23,5	23,5	18,2	10,9	6,5	1,3	**11,9**
982-012	-0,9	0,5	5,5	11,7	17,1	21,0	23,1	22,4	17,4	11,3	5,0	0,2	***11,2***
Diff.	-0,8	**+2,2**	**+1,8**	**+0,7**	0,0	**+ 0,2**	**+ 0,4**	**+ 1,1**	**+ 0,8**	-0,4	**+1,5**	**+1,1**	**+ 0,7**

Table 3

Average annual rainfall mm, SLATINA meteorological station

Year	monthly												Annual
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
2013	34,5	57,6	65,3	48,2	38,0	12 ,0	47,0	24,2	66,0	104,2	48,4	0,2	662,6
2014	80,7	8,3	79,9	152,8	132,0	66	183,2	38,4	2,4	47,0	24,5	158,8	1024,2
2015	37,1	40,7	71,1	41,1	29,6	123,4	6,2	169,2	145,4	66,4	101,5	3,3	835,0
2016	68,7	24,8	105,4	62,6	75,4	48,6	35,0	36,2	60,2	60,8	51,4	4,4	633,5
2017	39,0	15,6	43,3	48,5	51,1	29,8	102,4	20,2	40,6	119,4	75,6	49,0	634,5
2018	42,8	73,9	84,5	21,6	52,2								
013-017	52,0	29,4	73,0	70,6	65,2	79,4	74,8	57,6	72,9	79,6	60,3	43,1	**757,9**
982-012	*33,4*	*32,8*	*34,6*	*44,9*	*60,3*	*64,5*	*69,4*	*61,5*	*41,8*	*41,8*	*38,8*	*37,8*	***561,6***
Diff.	**+18,6**	- 3,4	**+38,4**	**+25,7**	**+4,9**	**+14,9**	**+5,4**	-3,9	**+31,1**	**+37,8**	**+21,5**	**+ 5,3**	**+ 196,3**

From the presented data, the temperature was recorded on a rise of 0.7 ° C (table 2), and rainfall in the range 2013-2017 can be seen that compared to the annual average (1982-2012) of there was an increase of 196.3 mm. To assess the impact of weather conditions on land productivity it was compared the records of rainfall.

Table 4

Semnification of rainfall (mm)

Month	Semnification of rainfall				
	Very dry	Dry	Medium	Optimum	Excedentary
September-October	Sub 40	41-60	61-80	81-150	Above 150
November-March	Sub 100	101-150	151-200	201-300	Above 300
April	Sub 20	21-30	31-40	41-70	Above 70
May-july	Sub 100	101-150	151-200	201-300	Above 300
Annual	Sub 350	351-450	451-600	601-700	Above 700

From the analysis of rainfall data in the range of 2013-2017, in these agricultural years have been surplus quantities of water from rainfall records above-average values (Table 5) with the exception of agricultural year 2016-2017 which was satisfactory and the period from September to May of the agricultural year 2017-2018, when was recorded the amount of 552.1 mm, slightly (9.5 mm) below the annual average of 561.6 mm.

Table 5

Semnification of rainfall (mm) in 2013-2017

Characteristic periods										
Year	IX-X	Semnif.	XI-III	Semnif.	IV	Semnif.	V-VII	Semnif	Anual	Semnif
13-14	170,2	exced.	217,5	optim	152,8	xced.	381,4	exced.	960,3	exced.
14-15	89,4	optim	331,6	exced.	41,1	optim	159,2	satisf.	790,5	exced.
15-16	211,9	exced.	303,7	exced.	62,6	optim	159,2	satisf.	773,6	exced.
16-17	121	optim	153,7	satisf.	48,5	optim	183,3	satisf.	526,7	satisf.
17-18	152,5	exced.	325,8	exced.	21,6	secetos	-	-	-	-

Referring to the edaphic cover of investigated space, were done soil profiles, morphogenetic studys of the soil profiles and analytical determinations (Tab. 6, 7 and 8) that indicates a stage of characteristic development of the land formed on clays, having the profile Ap-AB- Byz-Bcyz type.

Under the influence of relief and soil factors, the soils were modified differently in time and space. The human intervention is found in the productive capacity of each soil units. In the investigated space were identified 23 soil types, representing a series of subtypes and varieties of (TEO) and were characterized according to the current Methodology of Development of pedological studies, using a series of indicators: ind. 3C - annual average temperature, ind. 4C - annual average precipitation; Ind. 14 - gleization, ind. 15 - pseudogleization (stagnoglization); Ind. 16 or 17 - Alcalation (Sodizing); Ind. 23A - A-texture or the first 20 cm; Ind.29 - pollution; Ind. 33 - slope; Ind. 38 - slides; Ind. 39 - depth of groundwater; Ind. 40 - flood; Ind. 44 - total porosity in the restrictive horizon; Ind. 61 - total $CaCO_3$ content of 0-50 cm; Ind. 69 - degree of saturation in Bases or 0-20 cm; Ind.133 - the useful edaphic volume; Ind. 144 - humus reserve in the 0-50 cm layer; Ind. 181 - excess of stagnant (surface) humidity; Ind. 271 - Land Improvement, indicators found in pedological and agrochemical studies.

Each indicator above, with the exception of ind. 69, participates directly in determining the rating of soil, by a coefficient representing values between 1 (one) and 0 (zero). Depending on the intensity of the limiting factor (1 = very favorable, 0 = unfavorable), for each indicator there are tables containing the respective coefficients (both for natural and anthropic conditions.

Depending the values of indicators, for each of the main categories of use (AR-Arable, PS-pasture, FN-hayfields, VN- wineyards, LV- orchards) were ranked in **quality classes**, from I to V (Order MADR 278/2011), grouping the grades from 20 to 20 points as follows:

- Class I - 81-100 points
- class II - 61-80 points
- class III - 41-60 points
- class IV - 21-40 points

The main soils of the investigated area are presented in the folowing tables:

ELvs- K_4-TT/TT-Sst/NI-A, Boianu Plain, plan : ≤ 2,0 %, underground water ≥ 10,1 m

- texture: medium clay loamy (TT) in 0-95 cm;
- Aparent density (DA g/cm^3) in small in 0-45 cm;
- Total phorosity (PT%) is big in 0-45 cm;
- Grade of settlement (GT%) este small in 0-45 cm;
- the soil reaction is week acide in 0-45 cm, neutre in 45-95 cm;
- humus content (%) is small in 0-45 cm;
-nitrogen index (IN) is medium in 0-45 cm;
-Humus reserve (t/ha) in 0-50 cm is big (164 t/ha);
- the content in mineral nutrients shows an medium phosphorous content in 0-27 cm and very small in 27-45 cm (8 ppm), an mediun content od potasium in 0-45 cm, an medium content of nitrogen in 0-45 cm .

The quality (fertility) classe for arable is II with 74 points.

Table 6

Vertic Halpic Luvisoil, medium clay loamy/ medium clay loamy, Crîmpoia, Olt

Horizons		Ap	AB	Bt	Btyz
Depth		0-27	27-45	45-70	70-95
Coarse sand (2.0 – 0.2 mm)		4,1	2,7	1,8	1,9
Fine sand (0.2 – 0.02)	(2,0 - 0,2 mm) %	35,3	27,7	28,6	32,3
Silt (I + II) (0.02-0.002 mm)	(0,2 – 0,02 mm) %	25,2	27,0	26,4	24,8
Coloidal clay (sub 0.002)	(0,02 – 0,002 mm) %	35,4	42,6	43,2	41,0
Phisical clay (praf II +arg col)	(< 0,002 mm) %	46,6	55,2	58,4	50,6
Texture		**TT**	**TT**	**TT**	**TT**
Specific Density (Ds)		2,68	2,69		
Aparent density (Da)		1,20	1,19		
Total phorosity (PT)		55,2	56,1		
Grade of settlement (GT %)		-05	-05		
Content of $CaCO_3$ (%)		-	-	-	-
pH in H_2O		6,31	6,75	6,88	7,00
Humus (%)		2,92	2,56		

Humus reserve (t/ha) 0-50 cm	164,0			
Nitrogen index (IN)	2,46	2,25		
C:N	12,0	11,7		
N total (%)	0,164	0,148		
P mobile (ppm)	20,0	8,0		
K mobile (ppm)	140,0	160,0		
Bases saturation degree (V, %)	84,5	88,0		

Table 7

Stagnic Pelosol clay loamy / clay loamy, Brebeni, Olt

Horizons		Ap(z)	Bz	Bzw3	BCz
Depth		0-20	20-55	55-85	85-110
Coarse sand (2.0 – 0.2 mm)		1,4	1,8	1,7	
Fine sand (0.2 – 0.02)	(2,0 - 0,2 mm) %	24,6	14,6	21,6	
Silt (I + II) (0.02-0.002 mm)	(0,2 – 0,02 mm) %	22,0	33,0	28,3	
Coloidal clay (sub 0.002)	(0,02 – 0,002 mm) %	*52,0*	*50,6*	*48,3*	
Phisical clay (praf II +arg col)	(< 0,002 mm) %	64,0	82,2	71,3	
Texture		**AL**	**AL**	**AL**	
Schelet (%)		-	-	-	
Specific Density (Ds)			2,66		
Aparent density (Da)			1,35		
Total phorosity (PT)			49,0		
Grade of settlement (GT %)			+15		
Higroscopic Coef (CH %)			11,86		
Falding Coef. (CO %)			17,79		
Field capacity (CC %)			32,73		
pH in H_2O		6,20	6,30	6,40	
Humus (%)		2,88	1,60		
Humus reserve (t/ha) 0-50 cm		142,0			
Nitrogen index (IN)		2,42	1,36		
C:N		12,2	11,0		
N total (%)		0,192	0,092		
P mobile (ppm)		38,0	17,0		
K mobile (ppm)		140,0	120,0		
Bases saturation degree (V, %)		84,0	84,9		

PEst-W_2-K_5-AL/AL-Ssa/NI-A, Iminog Plain, plan ≤ 2,0%,underground water ≥ 10,1m

- texture: clay loamy (AL) in 0-85 cm;
- Aparent density (DA g/cm^3) in big in 22-55 cm;
- Total phorosity (PT%) is small in 22-55 cm;
- Grade of settlement (GT%) este medium in 22-55 cm;
- the soil reaction is week acide in 0-85 cm;
- humus content (%) is small in 0-20 cm and very small in 20-85 cm;

-nitrogen index (IN) is medium in 0-20 cm and small in 20-55 cm;

-Humus reserve (t/ha) in 0-50 cm is medium (142 t/ha);

- the content in mineral nutrients shows an big phosphorous content in 0-20 cm and small in 20-55 cm (17 ppm), an mediun content od potasium in 0-20 cm and small in 20-55 cm (120 ppm), an small content of nitrogen in 0-20 cm and very small in 20-55 cm.

The quality (fertility) classe for arable is III with 42 points.

Table 8

Stagnic Pelosol clay loamy / clay loamy, Vîlcele, Olt

Horizons		Ap(z)	ABz	Bz_1w_3	Bz_2w_3
Depth		0-20	20-35	35-70	70-110
Coarse sand (2.0 – 0.2 mm)		1,2	2,9	0,5	0,7
Fine sand (0.2 – 0.02)	(2,0 - 0,2 mm) %	30,2	17,0	5,8	21,8
Silt (I + II) (0.02-0.002 mm)	(0,2 – 0,02 mm) %	22,7	26,1	28,7	23,5
Coloidal clay (sub 0.002)	(0,02 – 0,002 mm) %	*45,9*	*54,0*	*65,0*	*54,0*
Phisical clay (praf II +arg col)	(< 0,002 mm) %	61,0	65,6	80,2	64,7
Texture		**AL**	**AL**	**AM**	**AL**
Schelet (%)		-	-	-	-
Specific Density (Ds)			2,69	2,74	
Aparent density (Da)			1,30	1,46	
Total phorosity (PT)			52,2	46,4	
Grade of settlement (GT %)			+05	+15	
Higroscopic Coef (CH %)			11,65	10,25	
Falding Coef. (CO %)			17,48	14,64	
Field capacity (CC %)			32,15	27,29	
pH in H_2O		5,75	5,85	5,92	6,10
Humus (%)		2,46	2,10	1,60	
Humus reserve (t/ha) 0-50 cm		137,0			
Nitrogen index (IN)		1,97	1,75		
C:N		12,0	13,0		
N total (%)		0,147	0,118	0,083	
P mobile (ppm)		38,0			
K mobile (ppm)		140,0	120,0	100,0	
Excengeble hidrogen (SH, me la 100 g sol)		5,0			
Cationic exchange capacity (T, me la 100 g sol)		25,0			
Bases saturation degree (V, %)		80,0	83,4		

PEst-W_3-K_5-AL/AM-Ssa/NI-A, Iminog Plain, plan ≤ 2,0%,underground water≥ 10,1m

- texture: clay loamy (AL) in 0-35 cm and 70-100 cm, medium clay(AM) in 20-35 cm and 35-70 cm ;
- Aparent density (DA g/cm^3) is medium in 20-35 cm and big in 35-70 cm ;
- Total phorosity (PT%) is is medium in 20-35 cm and small in 35-70 cm ;
- Grade of settlement (GT%) is small in 20-35 cm and medium in 35-70 cm ;
- the soil reaction is week acide in 0-110 cm;
- humus content (%) is small in 0-35 cm and very small in 35-70 cm;
-nitrogen index (IN) is small in 0-35 cm;
-Humus reserve (t/ha) in 0-50 cm is medium (137 t/ha);
- the content in mineral nutrients shows an big phosphorous content in 0-20 cm and small in 20-55 cm, an mediun content od potasium in 0-20 cm and small in 20-55 cm, an small content of nitrogen in 0-20 cm and very small in 20-55 cm.

The quality (fertility) classe for arable is IV with 40 points.

Knowledge and quantification of these characteristics of the soil profile allow evaluating the potential reserves of macro and micronutrients which they can make available to the plant in time and space, and establishing consequences that man can induce through certain fitting or cultural current changing the essential quality of land and their vocation for certain uses.

Also, according to the soil texture, elements may be determined and the energy consumption as well as the execution period for different ways to work the land, and that the same values of climatic factors they behave differently depending on the soil texture.

The amount of rainfall in a given area of land can be stored in the soil in relation to its potential to retain water (ie, its capacity for water which is quite different from clay soils to the sand) and then spend over the growing season for photosynthesis and is not dispersed into the atmosphere by evapotrare.

For this reason, the actual effect of rainfall on crops is influenced by soil properties (texture, porosity, permeability, etc. Useful water capacity) and of relief (slope, certain forms of microrelief, etc.) properties that can ensure the accumulation and differentiated disposal of water from rainfall.

Agricultural technology implementation requires good knowledge of the natural system suitability culture conditions expected given the limitations of factors may cause some agricultural ecosystem, especially edaphic factors.

CONCLUSIONS

Knowledge of natural conditions and in particular the environmental potential land (as defined in MESP-ICPA Bucharest, 1987) for the main crops present an importance in the completion of the qualitative assessment and characterization technological of land, justifying the need and timeliness of work soil mapping and periodic agrochemical studys.

Soil Mapping and agrochemical systematic soil studyes conducted by the Soil Survey and Agrochemical offices provides valuable data on the physical and geographical peculiarities and the advancement of soil quality of a given geographical area, necessary for developing strategic programs for the rational use of land, including raising production potential and prevent the causes of an abnormal condition called ,, deficiency induced " on phosphorus uptake, which occurs frequently lately in soils well supplied.

In this regard, the methodology for the study of soil, ICPA (1987), integrating organically, unitary, the mapping of soil and other environmental conditions multifaceted applied on the management on natural resources and those induced anthropogenic thus, represents a modern form of land management, having the duty to maintain and enhance soil fertility.

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