

# Sustainable Exploitation of Ecosystems on the Big Island of Braila

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*Sustainable agriculture is the only solution to both meet human needs and conserve natural resources to maintain and improve the environment. To achieve all this, however, requires greater research into cereal production the economic efficiency of this sector. The research over the period 2007-2009 was designed to establish the adaptability on various systems of soil mechanic works and different doses of fertilizer of maize hybrids by applying classical and conservative technologies, agricultural technologies less pollutant in the Big Island of Braila, agricultural technologies what can ameliorate physical, chemical and biological parameters of soil. The poly-factorial type 2x2x3 experiment used two hybrids of maize (PR36R10 and PR36R11), two tillage systems (traditional and conservative) and 3 doses of fertilizer (unfertilized,  $N_{50}P_0$ ,  $N_{100}P_0$ ); the experiment was done on a eutric gleisol, soil characteristic of the analyzed ecosystem. By introducing averages obtained during the three study years in the analysis of production variance, statistical interpretation was concluded that the production fluctuations from year to year were high, and the combination of factors is significant. Following statistical interpretation of results, the evolution of the average productions, average quantity of grain maize obtained were shown to have a significant decreased in 2007, due to drought and high temperatures during pollination. This had led to the disruption of the grain formation process. From the analysis of the influence of the tillage system on production, significant increases between the PR36R10 hybrid and the control variant (0.48 - 0.68 t/ha,). Comparison of the classic system and the conservative system showed one influenced less the grain production, both for PR36R10 hybrid and the PR36R11 hybrid. Following the productions in terms of N dose application, in comparison to the dose of fertilization which took effect obviously on production, the system of mechanical work of the soil influenced insignificant production of grain maize obtained it was found that production increased by up to 1320 kg/ha in comparison with the control variant, without fertilization, liming on the basis of nitrogen have led to advancements in production. Variants treated with fertilizer 100 kg N active substance have had increase in higher production with 583 kg/ha, compared with variants treated with fertilizer - 50 kg active substance N.*

*Keywords: cereals hybrid adaptability, conservative procedure, conventional, fertilization*

Sustainable agriculture must be economically viable, ecologically "healthy" and socially equitable [1]. On a national level in Romania, concerns for sustainable agricultural development using long-term research on crop productivity factors, biodiversity, environmental protection, use of bio-resources have been important goals over the last few decades, work synchronized with that at a European and indeed, global level [2, 3]. The meeting of CGIAR-Consultative Group on International Agricultural Research members in 1971 identified the need for the sustainable development of agriculture, because of the challenges the industry faces regardless of where in the world occurs [4].

The replacement of human and animal labour power with fossil energy using fertilizers and plant protection products has allowed increases in the productive capacity of the land and boosted crop efficiency, so that agriculture can now generate short-term profits, but threatens to destroy the necessary relationship between a profitable agriculture and the quality of the natural environment. Given all the possible constraints, it seems reasonable

to argue that the volume of food supply ultimately will determine the carrying capacity of the Earth's population. Three key environmental factors contribute to the growth of the world food production: the sustainable production of oceanic fish, the amount of fresh water produced by the hydrological cycle and the quantity of fertilizers which can effectively be used by the existing plant varieties (including plant hybrids). Environment degradation is a consequence of growth of the world population and a phenomenon highlighted by population pressure. It is a phenomenon further impacted by both the processing by people the uninhabited areas in urban areas, anisotropic and extreme weather conditions including rising temperatures and a lack of rain which may be further compounded by climate change [5-17].

The aim of the experiments discussed in this paper was to emphasize the interdependent relationships which exist under the specific ecosystem found on the Big Island of Braila, viewing the efficient use of natural resources and also the time changes of some agrochemical indices of the soil under the influence of

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the analyzed factors, agrochemical indicators of soil which have undergone some changes have been monitored. There are few data available on the adaptation of the maize hybrids, the influence of soil conditions and fertilization on the Big Island of Braila and even fewer regarding their approach with other technological links and especially in terms of preventing the environmental factors pollution, in order to lead the agricultural production to a sustainable development. Correct approach technological measures can prevent ground pollution and develop a sustainable agriculture. This paper attempts to fill that gap.

### The area under study

The name "Insula Mare a Brăilei" (translation: The Great Island of Brăila) was given by reporters to that region between the channels of the Danube, also known as "Balta Brăilei" (translation: Brăila's Lake). It is located between Giurgieni – Vadu Oii, to the south and Brăila to the north, it is 60 km long and as much as 20 km wide. Insula Mare a Brăilei has a surface of 721 km<sup>2</sup>, between the Vâlcu channel to the west and the Măcin channel to the east. Between the navigable part of the Danube and the Vâlcu channel there lies Balta Mică a Brăilei (translation: The Small Brăila's Lake), which was declared a National reservation. Its coordinates are 44°44' and 45°30' N lat.; 27°04' and 28°10' E long. (fig. 1).



Fig. 1. Geographic position of the Great Island of Braila on the territory of Romania

Between 1949 and 1951 they excavated 100 km of channels, in order to supply the lakes between them. Their targets were the lakes used for fishing. During the last years of the 20<sup>th</sup> century, they built 1m high dams, to protect the main localities. The most important anthropic interventions in that region started in 1964, when the entire area got surrounded by a single dam, 150km long and 4 m high. The dam along the Măcin channel was 86.4 km long and the one along the Vâlcu channel 64.1. The agricultural land which was protected by those dams measured 681 km<sup>2</sup>. Irrigation was aided by the rich groundwater supply that existed close to that topographic surface. The initiators and supporters of the draining solution for all the river sides in Romania, including the lakes of the Danube and of the Danube Delta, were Antipa Grigore [18-20] and Vidrascu I. [21]. Apart from the Brăila Lake, they also drained vast surfaces of land in the Danube Delta, especially in the Pardina and Sireasa areas [22].

### Experimental part

#### Materials and methods

#### Climate conditions and location of experimental field

The experimental site is on the Big Island of Braila. The climate and this biome soils being atypical for the Braila Plain. The Big Island of Braila is situated in an area of dry steppe, characterized by a temperate continental climate having conservative values, an annual average precipitation of 447 mm, an annual temperature of around 11°C, and a potential evapo-transpiration rate of 650-750 mm. This results in an annual rainfall deficit of 250-350 mm.

During the period of the experiment, the maximum precipitation was recorded during the period October - December, so that, from the point of the analyzed ecosystem, did not influenced directly the plants development, but the values obtained were not directly affected by the plants of maize development (table 1). Thus, the Big Island of Braila has an enclosure dike and the experience has been placed inside the case, here two important rainfall periods could be distinguished:

- an excess period -over the colder months between October and March, at the end of which the accumulation of water on the surface in particular in low areas;

Table 1

CLIMATIC CONDITIONS 2007-2009 AT AGRICULTURAL RESEARCH AND DEVELOPMENT STATION BRAILA

Elements of climate and water consumption		VALUES												TOTAL
		X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX	
Normal year	T (°C)	11.7	5.6	0.4	-2.5	-0.3	4.6	10.9	16.9	20.7	22.8	22.8	17.5	10.9
	P (mm)	31	36	33	27	27	29	36	52	63	47	42	29	447
	I	3.62	1.19	0.02	0	0	0.88	3.26	6.32	8.59	9.95	9.42	6.66	49.25
2006-2007	T (°C)	12.4	6.7	2.3	3.6	2.8	7.7	11.3	19.0	23.6	25.8	23.6	16.6	12.9
	P (mm)	5	10	15	27	16	38	29	18	10	1	96	35	400
	ETP (m <sup>3</sup> /ha)	512	233	59	105	76	278	454	884	1166	1307	1166	743	6983
	KI	0.94	0.79	0.74	0.79	0.81	1.02	1.13	1.29	1.31	1.32	1.04	0.94	-
	ETP <sub>c</sub> (m <sup>3</sup> /ha)	481.28	184.07	43.66	82.95	61.56	283.56	513.02	1140.36	1527.46	1725.24	1422.52	772.72	8238.4
	Kp	-	-	-	-	-	-	0.94	0.61	0.98	1.29	1.28	0.81	-
	ETRO (m <sup>3</sup> /ha)	-	-	-	-	-	-	482.23	695.61	1496.91	2225.56	1820.82	625.90	-
2007-2008	T (°C)	11.8	3.9	0.1	-1.3	2.6	8.3	12.5	16.3	21.6	22.9	24.3	16.3	11.6
	P (mm)	81	53	77	7	2	15	44	86	40	7	9	60	482
	ETP (m <sup>3</sup> /ha)	480	116	1	0	69	306	517	726	1041	1122	1211	726	6315
	KI	0.94	0.79	0.74	0.79	0.81	1.02	1.13	1.29	1.31	1.32	1.04	0.94	-
	ETP <sub>c</sub> (m <sup>3</sup> /ha)	451.2	91.64	0.74	0	55.89	312.12	584.21	936.54	1363.71	14.81.04	1477.42	755.04	7509.55
	Kp	-	-	-	-	-	-	0.94	0.61	0.98	1.29	1.28	0.81	-
	ETRO (m <sup>3</sup> /ha)	-	-	-	-	-	-	549.15	571.29	1336.43	1910.54	1891.09	611.58	-
2008-2009	T (°C)	12.1	6.6	3.3	0.3	2.5	5.6	11.5	17.5	21.4	24.5	22.6	17.6	12.1
	P (mm)	21	18	24	64	27	29	11	32	25	43	16	53	363
	ETP (m <sup>3</sup> /ha)	496	228	94	4	66	185	465	795	1029	1223	1103	801	6489
	KI	0.94	0.79	0.74	0.79	0.81	1.02	1.13	1.29	1.31	1.32	1.04	0.94	-
	ETP <sub>c</sub> (m <sup>3</sup> /ha)	466	180	70	3	53	189	525	1026	1348	1614	1147	753	7374
	Kp	-	-	-	-	-	-	0.94	0.61	0.98	1.29	1.28	0.81	-
	ETRO (m <sup>3</sup> /ha)	-	-	-	-	-	-	493.5	625.86	1321.04	2082.06	1468.16	609.93	-

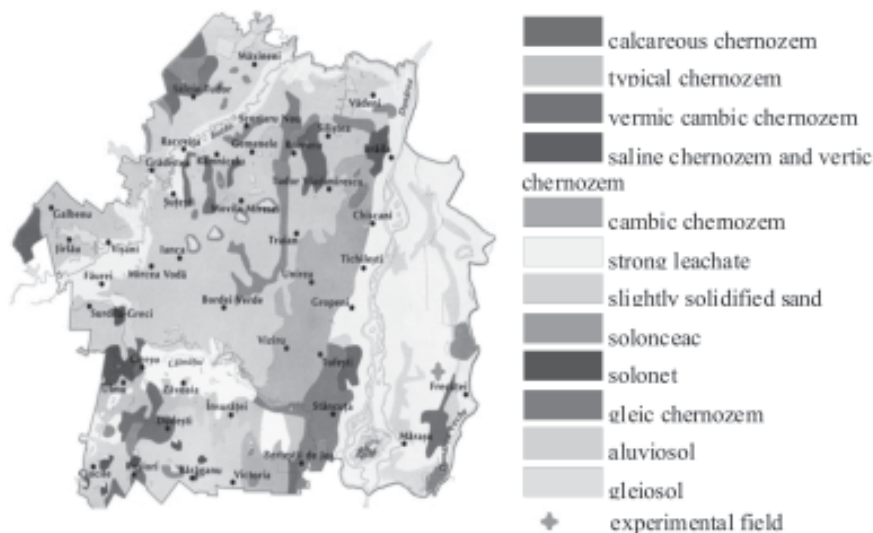


Fig. 2. A pedological map of Braila county with location of experimental area

- a warm period - between April and September, a period of low precipitation, with a maximum of about 350 mm.

Two-thousand and seven was characterized, as an exceptionally dry year. The monthly average rainfall was lower overall with an average of only 20-50 mm. August was the exception with a rainfall of 96 mm, well above the average for the month of 54 mm. However, this had no significant impact on cropping except by favoring a weeding explosion, which resulted in compounding the problems in created harvesting un-irrigated crops that had been particularly had hit by the drought.

The total annual rainfall for the whole agricultural year 2006-2007 was 400 mm, 47 mm below normal. In 2008, the total rainfall of 481 mm, exceeded the average annual value (447 mm) by 34 mm, being considered a year with over average values, but very contrasting, higher values of the normal average. The summer was particularly dry, and this had a major impact on crops that had been planted that spring especially in the pheno-phases determined by the agricultural productivity spring crops being affected, during the first phase of plant growth. In 2009, the total rainfall of 363 mm was below the annual average (447 mm) by 84 mm, certifying under average year, but very contrasting. The lowest values were recorded between April and June, these being of between 25 and 38 mm are regarded as a climatically normal year for agriculture characteristic of the low precipitation received for the year as a whole.

Studies made on Braila emphasized the large range and diversity of soils that exist, whose distribution is conditioned by lithological geo-morphological elements, climate and vegetation. These soils include Protisoils, Cernisoils, Hidrisoils and Salsodisoils. Inside the biome that makes up The Big Island of Braila soils belong to the Protisoils and Hidrisoils class, the experimental area itself being located on a gleiosol type, although inside the farm there were also aluvio-soils at 600 m from the place of experience have been encountered aluviosols (fig. 2).

### Methodology

The experimental was carried out in 2007, on the Big Island of Braila. For the following three years the influence of tillage and fertilization on the production of maize hybrids was monitored in the context of the sustainable development of the ecosystem. The approach adopted was the subdivided parcels method and included the following factors:

- i) *a factor*, a crop, with two graduations:
  - $a_0$  - non-genetically modified maize hybrid (PR36R10);
  - $a_1$  - genetically modified maize hybrid (PR36R11).
- ii) *b factor*, a tillage system, with two graduations:
  - $b_0$  - conventional works;
  - $b_1$  - conservative works.
- iii) *c factor*, fertilization, with three graduations:
  - $c_0$  - unfertilized;
  - $c_1$  - agro-fund  $N_{60}P_{60}$ ;
  - $c_2$  - agro-fund  $N_{100}P_{60}$ .

The soil, where the experimental area was located was composed of the aluvio-soil that is characteristic for the entire island. In agricultural production, both natural factors (light, heat, water, nutrients) and human factors (works, fertilizers and the like) do not act independently but in correlation [11]. The experiment (table 2) included four separate blocks (repetitions) resulting in 48 basic plots. The surface of each plot was 1456 m<sup>2</sup>.

The classical, conventional system included the following elements:

- experimental scarification done in the first year;
- tillage using the plow to a depth of 30 cm in 2008 and 2009;
- disc harrowing;
- preparation of seedbed, harrow disc work, till fields and sowing have been performed separately.

The conservative papers (“minimum tillage”) of the soil consisted of:

- the works to disk sharing and tillage were carried out concurrently;

Rehearsal Variant	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12
R1	$a_0b_0c_0$	$a_0b_0c_1$	$a_0b_0c_2$	$a_0b_1c_0$	$a_0b_1c_1$	$a_0b_1c_2$	$a_1b_0c_0$	$a_1b_0c_1$	$a_1b_0c_2$	$a_1b_1c_0$	$a_1b_1c_1$	$a_1b_1c_2$
R2	$a_0b_1c_0$	$a_0b_1c_1$	$a_0b_1c_2$	$a_1b_0c_0$	$a_1b_0c_1$	$a_1b_0c_2$	$a_1b_1c_0$	$a_1b_1c_1$	$a_1b_1c_2$	$a_0b_0c_0$	$a_0b_0c_1$	$a_0b_0c_2$
R3	$a_1b_0c_0$	$a_1b_0c_1$	$a_1b_0c_2$	$a_1b_1c_0$	$a_1b_1c_1$	$a_1b_1c_2$	$a_0b_0c_0$	$a_0b_0c_1$	$a_0b_0c_2$	$a_0b_1c_0$	$a_0b_1c_1$	$a_0b_1c_2$
R4	$a_1b_1c_0$	$a_1b_1c_1$	$a_1b_1c_2$	$a_0b_0c_0$	$a_0b_0c_1$	$a_0b_0c_2$	$a_0b_1c_0$	$a_0b_1c_1$	$a_0b_1c_2$	$a_1b_0c_0$	$a_1b_0c_1$	$a_1b_0c_2$

Table 2  
THE VARIATIONS LOCATION  
IN THE EXPERIMENTAL  
FIELD

Experimental year	Experimental variant	Depth of sampling, April, 05 (cm)			Depth of sampling, October, 21 (cm)		
		0-20	20-40	40-60	0-20	20-40	40-60
2007	a <sub>0</sub> b <sub>0</sub> c <sub>0</sub>	1.19	1.25	1.24	1.23	1.26	1.25
2009		1.22	1.27	1.25	1.24	1.25	1.23
2007	a <sub>0</sub> b <sub>0</sub> c <sub>1</sub>	1.18	1.22	1.21	1.19	1.25	1.24
2009		1.20	1.23	1.21	1.24	1.25	1.23
2007	a <sub>0</sub> b <sub>0</sub> c <sub>2</sub>	1.21	1.24	1.22	1.24	1.23	1.22
2009		1.19	1.21	1.20	1.20	1.22	1.21
2007	a <sub>0</sub> b <sub>1</sub> c <sub>0</sub>	1.17	1.22	1.19	1.19	1.21	1.20
2009		1.20	1.25	1.23	1.22	1.27	1.24
2007	a <sub>0</sub> b <sub>1</sub> c <sub>1</sub>	1.19	1.24	1.23	1.20	1.23	1.22
2009		1.18	1.23	1.22	1.19	1.25	1.24
2007	a <sub>0</sub> b <sub>1</sub> c <sub>2</sub>	1.18	1.21	1.23	1.22	1.21	1.20
2009		1.21	1.22	1.21	1.22	1.25	1.23
2007	a <sub>1</sub> b <sub>0</sub> c <sub>0</sub>	1.21	1.23	1.22	1.23	1.26	1.25
2009		1.24	1.28	1.27	1.25	1.27	1.26
2007	a <sub>1</sub> b <sub>0</sub> c <sub>1</sub>	1.20	1.22	1.19	1.21	1.25	1.24
2009		1.23	1.24	1.22	1.26	1.23	1.28
2007	a <sub>1</sub> b <sub>0</sub> c <sub>2</sub>	1.22	1.22	1.21	1.21	1.25	1.22
2009		1.22	1.26	1.25	1.23	1.27	1.25
2007	a <sub>1</sub> b <sub>1</sub> c <sub>0</sub>	1.19	1.24	1.23	1.21	1.25	1.26
2009		1.24	1.26	1.26	1.23	1.27	1.26
2007	a <sub>1</sub> b <sub>1</sub> c <sub>1</sub>	1.26	1.27	1.23	1.25	1.25	1.24
2009		1.29	1.28	1.25	1.27	1.30	1.29
2007	a <sub>1</sub> b <sub>1</sub> c <sub>2</sub>	1.23	1.22	1.24	1.23	1.24	1.22
2009		1.28	1.31	1.26	1.30	1.32	1.30

**Table 3**  
APPARENT DENSITY (g/cm<sup>3</sup>) OF  
EXPERIMENTAL VARIANTS

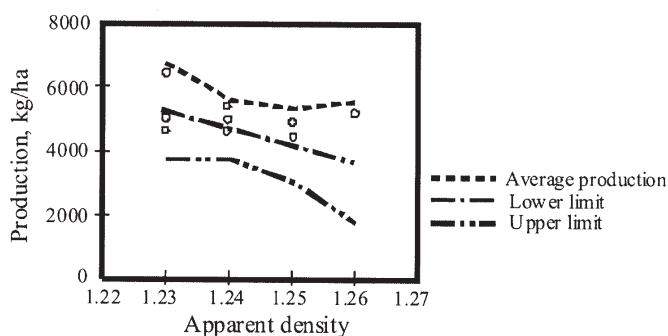


Fig. 3. Correlation between experimental apparent density and field production

Tillage system	Average production / ha PR36R10		
	Average production [t/ha]	Limits of variation of production [kg/ha]	Difference [t/ha]
2007			
Conventional	5.05	4321 - 5863	0.48 **
Conservative	4.58	4323 - 4771	mt
<i>DL<sub>5%</sub> = 0.30 t/ha    DL<sub>1%</sub> = 0.41 t/ha    DL<sub>0.1%</sub> = 0.53 t/ha</i>			
2008			
Conventional	4.12	3153 - 5158	0.48**
Conservative	3.64	3201 - 4013	mt
<i>DL<sub>5%</sub> = 0.32 t/ha    DL<sub>1%</sub> = 0.43 t/ha    DL<sub>0.1%</sub> = 0.57 t/ha</i>			
2009			
Conventional	5.60	4837 - 6831	0.68***
Conservative	4.92	4137 - 5412	mt
<i>DL<sub>5%</sub> = 0.26 t/ha    DL<sub>1%</sub> = 0.35 t/ha    DL<sub>0.1%</sub> = 0.47 t/ha</i>			

**Table 4**  
INFLUENCE OF DIFFERENT TILLAGE  
SYSTEMS ON PRODUCTION OUTPUT

- seedbed preparation was performed simultaneously with sowing and fertilization.

### Results and discussions

The analysis performed in the laboratory confirmed the overall texture of the ecosystem gleisoloil on the Big Island of Braila as fine a clay-clay medium. The density of the soil plays a decisive role with respect to most physical properties of the soil, but especially with respect to its porosity. Based on the analysis performed and as shown in table 3, it was found that the use of a conservation tillage system changed the bulk density values, which were higher than those found into conventional system of mechanical works of the soil.

The bulk density values recorded at the variants where factor b<sub>0</sub> acted with conventional system of mechanical works of the soil were between 1.18 g/cm<sup>3</sup> and 1.32 g/cm<sup>3</sup>. At sampling depth of 20-40 cm, values were higher than 40-60cm for the depth profile, regardless of the tillage system and the fertilization dose applied. The highest value of bulk density (1.32 g/cm<sup>3</sup>) was recorded at the a<sub>1</sub>b<sub>1</sub>c<sub>2</sub> experimental variant where tillage system

was conservative, value that was recorded at the end of the experiment (2009).

Following the evolution of the soil bulk density from the experimental field, it was found to have an increase of at least 0.05g/cm<sup>3</sup> in all its versions, compared to the initial value recorded that had been recorded in the first year of experimentation thus clearly detaching all the values recorded in the variant with conservative system of soil working, the best values were in the standardized system variants of soil works. The results obtained established a strong correlation between bulk density and production, the coefficient of correlation values was 0.83 (fig. 3).

The total amount of grain produced was plainly influenced by the lack of rainfall. This was reflected in the yields from each hybrid analysis, which showed much lower values than indicated by their genetic potential. Maize yields from experimental plots during 2007 - 2009 were influenced both by eco-technologic factors and climate conditions. The average output recorded with each repetition of the variants varied from 3643 to 6831 kg/ha (table 4).

Tillage system version	Average productions / ha PR36R11					
	2007	Difference	2008	Difference	2009	Difference
Conventional works	4.28	0.21 <sup>ns</sup>	3.64	-0.09	4.74	0.13
Conservative works	4.07	-	3.74	-	4.61	-

DL<sub>5%</sub> = 0.35 t/ha    DL<sub>5%</sub> = 0.32 t/ha    DL<sub>5%</sub> = 0.26 t/ha  
DL<sub>1%</sub> = 0.42 t/ha    DL<sub>1%</sub> = 0.44 t/ha    DL<sub>1%</sub> = 0.35 t/ha  
DL<sub>0.1%</sub> = 0.61 t/ha    DL<sub>0.1%</sub> = 0.57 t/ha    DL<sub>0.1%</sub> = 0.47 t/ha

**Table 5**  
INFLUENCE OF TILLAGE SYSTEMS ON PRODUCTION

Variant (Agrofond)	Average productions [t/ha]					
	2007	Difference	2008	Difference	2009	Difference
N <sub>0</sub> P <sub>0</sub>	4.33	-	3.48	-	4.74	-
N <sub>50</sub> P <sub>0</sub>	4.79	0.46**	3.75	0.27	5.18	0.44**
N <sub>100</sub> P <sub>0</sub>	5.31	0.98***	4.42	0.94***	5.86	1.12***

DL<sub>5%</sub> = 0.36 t/ha    DL<sub>5%</sub> = 0.39 t/ha    DL<sub>5%</sub> = 0.25 t/ha  
DL<sub>1%</sub> = 0.49 t/ha    DL<sub>1%</sub> = 0.49 t/ha    DL<sub>1%</sub> = 0.39 t/ha  
DL<sub>0.1%</sub> = 0.61 t/ha    DL<sub>0.1%</sub> = 0.58 t/ha    DL<sub>0.1%</sub> = 0.53 t/ha

**Table 6**  
INFLUENCE OF FERTILIZATION ON PRODUCTION SYSTEM

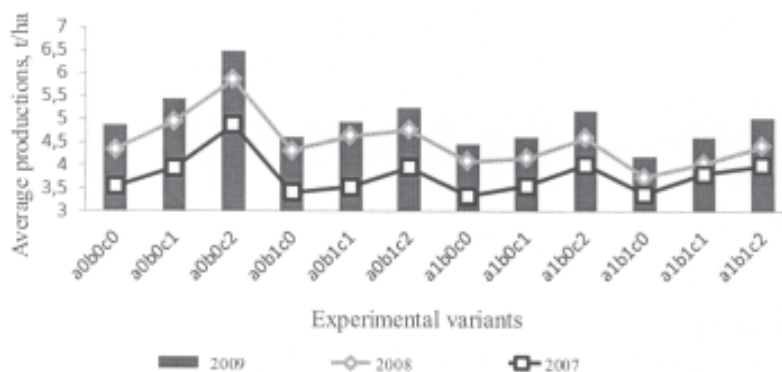


Fig. 4. Average production in the experimental field

Variant (Agrofond)	Average productions [t/ha]					
	2007	Difference	2008	Difference	2009	Difference
N <sub>0</sub> P <sub>0</sub>	3.92	-	3.36	-	4.32	-
N <sub>50</sub> P <sub>0</sub>	4.10	0.19	3.69	0.33**	4.61	0.29*
N <sub>100</sub> P <sub>0</sub>	4.50	0.50**	4.01	0.65***	5.14	0.82***

DL<sub>5%</sub> = 0.34 t/ha    DL<sub>5%</sub> = 0.31 t/ha    DL<sub>5%</sub> = 0.27 t/ha  
DL<sub>1%</sub> = 0.42 t/ha    DL<sub>1%</sub> = 0.43 t/ha    DL<sub>1%</sub> = 0.36 t/ha  
DL<sub>0.1%</sub> = 0.64 t/ha    DL<sub>0.1%</sub> = 0.56 t/ha    DL<sub>0.1%</sub> = 0.45 t/ha

**Table 7**  
INFLUENCE OF FERTILIZATION ON PRODUCTION SYSTEM

Higher production was obtained in conventional tillage system in all years studied when basic work consisted in plowing the soil. The influence of b<sub>0</sub> factor led to significant increases in grain production among all experimental variants. Even though the average agricultural output in 2008 was significantly lower compared to that in the first and the last years of the experiment, the differences obtained compared to the control group showed a distinct significant increase of up to 0.48 t/ha. In the last year of the experiment production was statistically insured, having the greatest difference of production from the control (0.68 t/ha).

Analyzing the average yields recorded in the experimental plots and reported per hectare, it was found that an important role in enhancing production lay in the conventional tillage system. Compared to the PR36R10 hybrid, that in all experimental years recorded, production had statistical insurance, the genetically modified maize yields exhibit little difference between the two tillage systems (table 5). It was found that the GM hybrid system suitability conservation tillage and climatic conditions of the Big Island of Braila, compared to non-genetically modified hybrid, is much better. In the climatic grounds of the Big Island of Braila the hybrid PR36R10 had higher values in conservative system variants of the work of the soil.

The years 2007-2008, years of marked climate contrasts, it was characterized as being one dry year on

vegetation period of the culture of corn. This feature did not negatively affected growth and development of the genetically modified maize, the Hybrid PR36R10 had production less than in the conventional system variants with the work of the soil. The results obtained are presented in table 6 and demonstrate that the average production of the fertilized variants of the generically unmodified hybrid resulted in significant increases. In the crop year 2008, the increase in production obtained from the fertilized variants with N<sub>50</sub>P<sub>0</sub> was not statistically significant at 0.27 t/ha.

The application of different doses of nitrogen resulted in increases in production directly proportional to the quantity applied, producing a constant growth in output in each experimental year. Even in poor conditions experienced over the last year of the experiment production growth occurred with a maximum of 5863 kg/ha more than 1,120 kg/ha from control variant. In conclusion, the level of fertilization applied positively influenced the maize productions in all the studied years; weather conditions directly influenced output (decrease) during the experiment if we related to the genetic capacity of the used material, regardless of the genetic capacity of hybrids.

The genetically modified hybrid recorded statistically significant production increases in every experimental year, regardless the amount of fertilizer applied. The variant N<sub>50</sub>P<sub>0</sub> from 2006- 2007 has had no insurance for

Graduation factors		Relative values (%)
		Production and statistical significance
The crop	a <sub>0</sub>	110.25***
	a <sub>1</sub>	100
The tillage	b <sub>0</sub>	106.34***
	b <sub>1</sub>	100
Dose of fertilizer	c <sub>0</sub>	100
	c <sub>1</sub>	106.58 ***
	c <sub>2</sub>	120.89 ***

**Table 8**  
SUMMARY PARTIAL EFFECTS OF THE  
FACTORS STUDY ON PRODUCTION  
(AVERAGE 2007-2009)

Variant	Production (t/ha)	Difference from the control sample	The statistical significance
a <sub>0</sub> b <sub>0</sub> c <sub>0</sub>	4.26	0.3	**
a <sub>0</sub> b <sub>0</sub> c <sub>1</sub>	4.78	1.0	***
a <sub>0</sub> b <sub>0</sub> c <sub>2</sub>	5.74	1.96	***
a <sub>1</sub> b <sub>0</sub> c <sub>0</sub>	3.96	0.18	-
a <sub>1</sub> b <sub>0</sub> c <sub>1</sub>	4.11	0.33	**
a <sub>1</sub> b <sub>0</sub> c <sub>2</sub>	4.60	0.82	***
a <sub>0</sub> b <sub>1</sub> c <sub>0</sub>	4.12	0.34	***
a <sub>0</sub> b <sub>1</sub> c <sub>1</sub>	4.37	0.59	***
a <sub>0</sub> b <sub>1</sub> c <sub>2</sub>	4.65	0.87	***
a <sub>1</sub> b <sub>1</sub> c <sub>0</sub>	3.78	100	-
a <sub>1</sub> b <sub>1</sub> c <sub>1</sub>	4.16	0.38	***
a <sub>1</sub> b <sub>1</sub> c <sub>2</sub>	4.48	0.7	***

DL 5% = 0.218 t/ha      DL 1% = 0.289 t/ha      DL 0.1% = 0.376 t/ha

**Table 9**  
COMBINATION OF  
EXPERIMENTAL FACTORS ON  
PRODUCTION OUTPUT

production (table 7). The average production obtained statistically and recorded during the experimental years, was visibly lower in comparison to the genetically unmodified hybrids, this led to the conclusion that under specific weather conditions from The Braila Great Island, the modified hybrids capitalized at a high extend the different application of the fertilizers doses. The two hybrids in the experience, located in the Big Island of Braila, have leveraged differently the doses of fertilizer applied.

Highly significant production increases were achieved for the N<sub>100</sub>P<sub>0</sub> variants, both in 2008 and 2009. In all variants during the studied years, the application of the fertilizers positively influenced the output obtained. Thus, the greater the nitrogen dose the more the grain output increased. This demonstrates that the genetically modified maize averaged the applied fertilization but less than with the unmodified hybrids.

Based on the changes in average production, it was observed that there was a very significant reduction over time. In 2007, due to drought and high temperatures during pollination there was a disruption in the process grain formation, which resulted in lower output.

The obtained results (fig. 4) demonstrate the striking influence of climate conditions, combined with the action of the studied factors every year, the system of work of the soil and dose of fertilization on production. Thus, with the application of nitrogen fertilizers in a dose of 100 kg active substance the highest production of 6.49 t/ha could be obtained, under the weather conditions experienced in 2009, for the hybrid PR36R10 with classic system of work of the soil. By analyzing the variance (table 8), to identify the partial or combined influence of the experimental factors, the following results were obtained.

All factors studied influenced the experimental field maize grain yields significantly distinct, in the statistical interpretation the variant is statistical insured. The combined action of the factors examined led to statistically robust increases in all experimental variants. The only experimental variant which recorded a statistically non-robust result was the V<sub>7</sub> variant (a<sub>1</sub>b<sub>0</sub>c<sub>0</sub>) with an increase of 0.18 t/ha (table 9).

## Conclusions

Achieving an integrated management strategy for the sustainable management of agricultural ecosystems by developing and at the same time, by exploiting sustainable technologies, is one that can be applied as widely as possible to ensure alternative clean and sustainable agriculture practice. The pace and intensity of soil quality has degraded over the past decade, encouraged by human intervention. This supports the need for effective work to restore soil health.

Studies to support the sustainable development of the biomass of Big Island of Braila are required at the level of each farm. At the same time, in this, the complex of natural factors including climate, soil and relief must be taken into account to establish a conservative and productive technology. The maize ecosystem was chosen due to the introduction of genetically maize hybrids at a national level in order to follow their adaptability and that of the non-genetically modified plants under the specific weather, soil and technology conditions found on the Big Island of Braila, against a background of global climate change.

Annual climate changes directly influence grain production, both that of genetically modified maize hybrids and non-modified ones, fact that demonstrates their importance for agriculture, precipitation and temperatures during the period of growth and development of the plants have played a role on the production. Within the total range of climate elements, a special impact on the ecosystem was determined by the low level of rainfall and high temperatures which characterized the experimental period. The average yield of variants treated with fertilizers with 50 and 100 kg N active substance have obtained advancements in production distinct significantly and very significantly. The fertilization of PR36R10 hybrid with N<sub>50</sub>P<sub>0</sub> and N<sub>100</sub>P<sub>0</sub> showed an increase of production with 0.96 to 1.48 t/ha for the conventional soil system works and an increase of 0.28 to 0.53 t/ha for the conservative works. The PR36R11 hybrid, under the action of C (the dose of fertilizer) recorded an increased of the production with 0.49 to 0.64 t/ha during the system of work of conventional soil (maximum number of works in the

ground) and 0.3 to 0.7 t/ha during the conservative work of the soil (minimum number of works in the ground). The high productivity of the non-genetically modified hybrid for which high values were obtained for all experimental factors is noteworthy. In terms of sustainable exploitation, the conservative tillage system has an important role in maintaining and improving the physical and chemical indicators of the gleisoiil of the experimental field.

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