The maize crop technology characterized by its main indicators at the country level and in Călăraşi county

Crudu, Giorgiana and Dhary Yusif El-Jubouri, Mohamed and Necula, Raluca

University of Agricultural Sciences and Veterinary Medicine Bucharest, University of Agricultural Sciences and Veterinary Medicine Bucharest, University of Agricultural Sciences and Veterinary Medicine Bucharest

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THE MAIZE CROP TECHNOLOGY CHARACTERIZED BY ITS MAIN INDICATORS AT THE COUNTRY LEVEL AND IN CĂLĂRAŞI COUNTY

CRUDU GEORGIANA[1], MOHAMED DHARY YOUSIF EL-JUBOURI[2], NECULA RALUCA[3]

Abstract: *The aim of this paper was to analyze the maize crop at the country and the Călăraşi county level and in the two companies submitted to the case study. This analysis highlighted the importance of themaize crop, crop that is being cultivated on large areas of the country and county, and that also occupies a larger area of the total area of the two companies. The maize crop is very popular in our country because it finds good environmental factors conducive to a proper development, yields per hectare are very good if the technology requirements are complied The indicators used have emphasized the evolution of this culture during the analyzed periods and its capitalization in the companies studied.*

Key words: *average production, gross margin, maize, revenues, selling price.*

INTRODUCTION

The crop that was subject of analysis is one of the main crops in our country and in the world, occupying a very important place in the national and international economy.

Maize (Zea mays L.) is one of the most important crop plants with multiple uses in human nutrition, industry, animal feed. (According to FAO statistics, the distribution of consumption is 21% of human food, animal feed 72%, 7% industry).The maize is a very important cereal grain for the Călăraşi County agriculture too[3].

The maize grains are used in starch industry, alcohol, glucose and dextrin; seeds are used for oil extraction used in dietetics nutrition.

The Călăraşi County has a natural agricultural land, which occupies over 84% of the County area. Soils, most of them are different types of chernozem and alluvial soils, they have a high fertility, which allows a large scale agriculture, predominantly being the cereal character of vegetal production. This is why, the maize surface and production are higher in this county, in comparation with other counties from this area.

Maize is used as concentrate forage feed (grain), green mass maize (silage), stems (cobs) in combination with urea and molasses, silage (juicy forage).

Phytotechnical particularities: good resistance to drought and heat, relatively small number of diseases and pests, adaptability to different climatic conditions, being a hoeing crop, leaves the field clean of weeds, is a good precursory for many plants, a good capitalization of organic and mineral fertilizers, it reacts strongly to irrigation, a great multiplication coefficient, a very important mellifera and medicinal plant.

The maize is a very important cereal grain for the Călăraşi County agriculture too.

The Călăraşi County has a natural agricultural land, which occupies over 84% of the County area. Soils, most of them are different types of chernozem and alluvial soils, they have a high fertility, which allows a large scale agriculture, predominantly being the cereal character of vegetal production. This is why, the maize surface and production are higher in this county, in comparation with other counties from this area.

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[1] Ph.D, University of Agricultural Sciences and Veterinary Medicine Bucharest, 59 Marasti, District 1, 11464, Bucharest, Romania, Phone/Fax: 00 40 744 6474 10, Email: georgianacrudu@yahoo.com
[2] Ph. D Student, University of Agricultural Sciences and Veterinary Medicine Bucharest, 59 Marasti, District 1, 11464, Bucharest, Romania, Phone/Fax: 00 40 744 6474 10,
[3] Ph. D, University of Agricultural Sciences and Veterinary Medicine Bucharest, 59 Mărasti, District 1, 11464, Bucharest, Romania, Phone/Fax: 00 40 744 6474 10, Email:raluca_nec@yahoo.com

MATERIAL AND METHODS

In the paper we used the following indicators: arithmetic mean, standard deviation, mean square deviation, coefficient of variation, confidence limits for a given risk, average annual growth rate, the limits amplitude for a given risk towards the average and statistical significance of these indicators.

The formulas used to calculate these indicators are presented [1], [4], [10]:

For the arithmetic mean = $\overline{x} = \frac{\sum xi}{n}$; where:

$\overline{X}$ = the arithmetical mean; Xi = The average production values for a number of years (i);

n = number of years taken into account

The average annual rate of growth [1] = $r2008-2013 = \sqrt[8]{\prod (p1/p0)} - 1$; where:

r2008-2013 = average annual growth rate; $\prod p1/po$ = entangled growth indicators

For the standard deviation = $\partial = \sqrt{\frac{\sum(\overline{x}-xi)^2}{n-1}}$; where:

∂ = standard deviation; xi = the average values for a number of years

n = number of years taken into account

For mean square deviation = $\partial x = \sqrt{\frac{\sum(\overline{x}-xi)^2}{n(n-1)}}$; where:

∂x = mean square deviation;

The confidence limits corresponding to a given risk X = +/-ðx * tp, in which:

X = the arithmetic average; average square deviation;

tp = tabular value for the probability of transgression (risk)

Amplitude of oscillation of the limits of confidence[4] =

= ((X + ðx * tp)-(X-ðx * tp)/(X)) * 100

Coefficient of variation = $C = \frac{\delta}{\overline{X}} x100$, where:

C-coefficient of variation (expressed as a percentage)

Coefficient of variation can be: between 0-10% variation; between 10-20%-sized variation; more than 20%-large variation

The linear trend equation: Y(kg/ha)=At+b, where a and bare the equations coefficients ; t=time

The equation significance is done by: R^2 (the determination coefficient) and r(correlation report)[2]

The data used was source: internal database of SC Toma SRL, SC ILDU SRL, the data from the literature.

RESULTS AND DISCUSSIONS

At the country level, as shown in Table 1 maize is a highly valued crop being cultivated on large areas of our country. In the year 2007, the maize surface was about 2524700 ha, years 2008, 2009, 2010 bring a lower level, followed by an increase in 2011 and 2012 with 2,6% towards 2007 and respectively 7,8%.

Although it is a crop that carries out important production per hectare, at the country level, the average yields are situated around 3195 kg / ha, with a high degree of dispersion, of 30.9%.

Table . The surface, average production and total production evolution of the maize grain crop at the country level for the period 2007-2012

Specification	UM	2007	2008	2009	2010	2011	2012	Average (kg/ha)	δ (kg/ha)	c (%)
Surface	mii ha	2524.7	2441.5	2338.8	2098.4	2589.7	2721.2	2452.4	164.7	6.7
	%	100.0	96.7	92.6	83.1	102.6	107.8	X	X	X
Average Production	Kg/ha	1526	3215	3409	4309	4525	2188	3195.3	986.6	30.9
	%	100.0	210.7	223.4	282.4	296.5	143.4	X	X	X
Total Production	mii to	3853.9	7849.1	7973.3	9042.0	11717.6	5953.4	7731.6	2335.0	30.2
	%	100.0	203.7	206.9	234.6	304.0	154.5	X	X	X

Source ***MADR,2013, Cereals, http://www.madr.ro/ro/culturi-de-camp/plante-tehnice.html

In Călăraşi County the maize crop average productions has values higher than the country (Table 2). In 2011 were obtained about 5291 kg / ha, and the years average is about 4124 kg / ha, with about 1000 kg / ha higher than the national level.

Table 2. The maize grain average production evolution in Călăraşi County, during 2000-2011

Specification	UM	2000	2005	2010	2011	Average(kg/ha)	δ (kg/ha)	c (%)
Maize grain	kg/ha	1306.8	4941.4	4956.6	5291.6	4124.1	1524.7	37.0
	%	100.0	378.1	379.3	404.9	X	X	X

Source:***I.N.S.,2013, territorial Statistics, Statistică teritorială_2013.pdf Adobe Reader[9]

In the figures 1 and 2 are illustrated the maize average production evolutions, both at the country level and in the county of Calarasi. Calculated by linear regression estimates a favorable trend for the coming years.

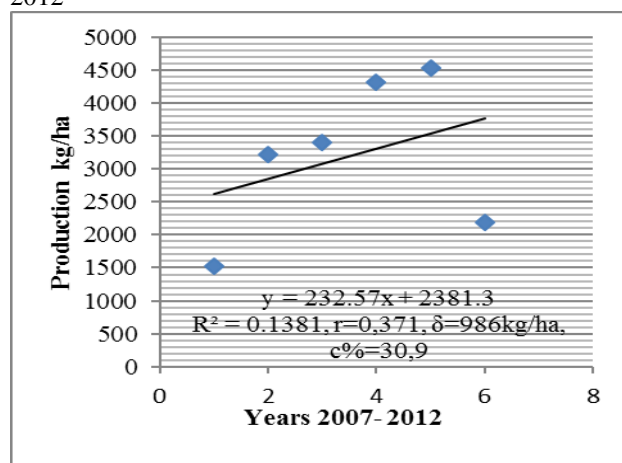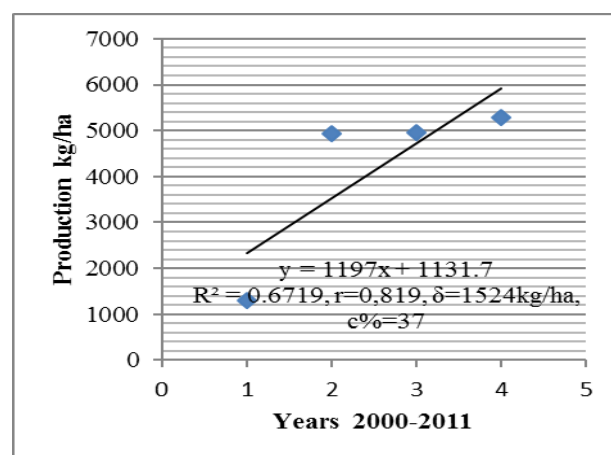Figure.1. The maize grain average production evolution at the country level for the period 2007-2012

Figure. 2 The maize grain average production evolution in Călăraşi County, during 2000-2011

$y = 232.57x + 2381.3$
$R^2 = 0.1381, r=0,371, δ=986kg/ha, c\%=30,9$

$y = 1197x + 1131.7$
$R^2 = 0.6719, r=0,819, δ=1524kg/ha, c\%=37$

A. SC TOMA SRL ANALYSIS

Table 3. The main indicators evolution characterizing the maize crop technology in SC Toma SRL, Modelu village, Călăraşi County, during 2008-2013

Specification	Maize crop UM	Years						Average	Stand. Dev.	c (%)	Mean square dev. (kg/ha)	Probability 90%(t=2,13)			
		2008	2009	2010	2011	2012	2013					min	max	Abs (+/-)towards average	%
Average production	kg/ha	5100	5400	7800	8000	5200	9000	6750	1713	25,4	699	5260	8240	2979	44,1
The selling price	lei/to	354	408	652	717	1047	580	626	249	39,7	102	410	843	433	69,1
Incomes	lei/ha	1805	2203	5086	5736	5444	5220	4249	1757	41,4	717	2721	5777	3056	71,9
The gross margin	lei/ha	221,4	365,2	2740,6	3327	2433,4	2051	1856	1282	69,0	523	742	2971	2229	120,1

Source: Own processing after the record data from SC Toma SRL[11]

Regarding SC Toma SRL, the technological indicators maize crop were as follows:
- Production / ha has an average per year of 6750 kg / ha, the highest production being obtained in the last year, 2013, 9000 kg / ha. (Figure.3)
- The selling price has variable values along the analyzed period, the year 2012 representing the year with the best capitalization price , of 1047 RON / to of maize. (Figure 4).

Figure 3. The maize crop production evolution in SC Toma SRL, Modelu village, Călăraşi County, during 2008-2013
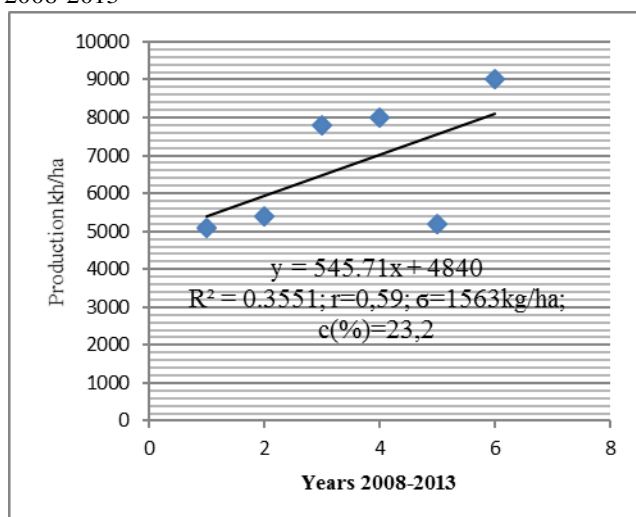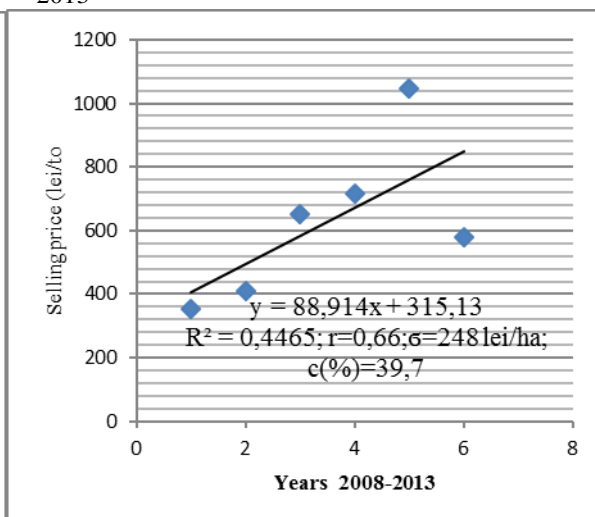
Figure 4. The maize crop price evolution in SC Toma SRL, Modelu village, Călăraşi County during 2008-2013

$y = 545.71x + 4840$
$R^2 = 0.3551; r=0,59; \sigma=1563 kg/ha; c(\%)=23,2$

$y = 88,914x + 315,13$
$R^2 = 0,4465; r=0,66; \sigma=248 lei/ha; c(\%)=39,7$

- Although the highest production was carried out in 2013, taking into account the selling price and the production achieved , the highest revenues were achieved in 2011, 5736 lei / ha, with 516 lei more than in 2013 . (Fig.5)
- The gross margin shows a wide variation, with a c% of 69%, a standard deviation of 1282 lei / ha and an years average of 1856 lei / ha. (Fig.6)

Figure 5. The maize crop revenues evolution in SC
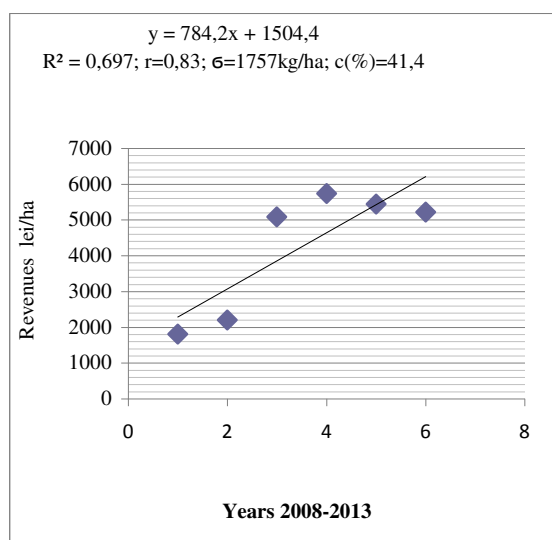Toma SRL, Modelu village, Călăraşi County, during
2008-2013

Figure 6. The maize crop gross margin evolution in
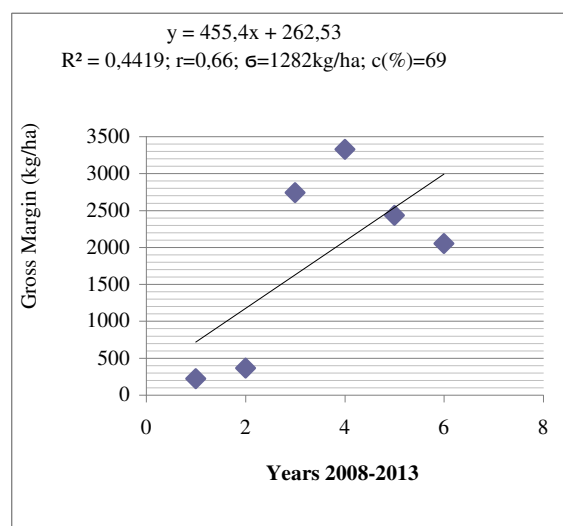SC Toma SRL, Modelu village, Călăraşi County,
during 2008-2013

y = 784,2x + 1504,4
R² = 0,697; r=0,83; ϭ=1757kg/ha; c(%)=41,4

y = 455,4x + 262,53
R² = 0,4419; r=0,66; ϭ=1282kg/ha; c(%)=69

Table 4.   The maize hybrids cultivated in SC TOMA SRL for 2007-2013

Crop/year	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013
Maize	OLT	HELGA	FLORENCIA	Flato	PR35F38	PR37F73

Source: Own processing after the record data from SC Toma SRL[11]

Following the maize hybrids used (Table 4) our attention is drawn by those who gaved the highest yield per hectare:

Flato [6] which has as strengths: starting in very vigorous vegetation, a fast-drying capacity of grains on the cob at the end of the growing season (over 0.8% / day), the "stay green" capacity until the harvest, an excellent tolerance to Fusarium, Helminthosporium, Ustilago.

The plants are short, low insertion of the corn cob and the vigorous strain which adds security and the early flowering causes tolerance to drought.

The potential yield is of 14200 kg / ha, the seed at a density of 70000 plants / ha.

PR37F73 [6] is a simple semi-early hybrid with exceptional adaptability and stability, ensuring stable and reliable production.

Advantages: Drought tolerant; the character "stay green", good resistance to breaking and falling.

B. SC ILDU SRL ANALYSIS

The main indicators evolution of the maize crop technology in the second company subject of our study case, SC ILDU SRL is shown in Table 5 and Figures 7, 8 and 9.

The average production / ha recorded higher values compared to the production obtained in SC Toma SRL, in the years 2010, 2012 and 2013 productions yielding 9000 and 9200 kg / ha.

The average production per year / ha is of 7367 kg/ha, with 617 kg / ha higher than the years average of the other company (Fig 7).

Table 5. The main indicators evolution characterizing the maize crop technology in SC ILDU SRL, Vâlcelele village, Călăraşi County, during 2008-2013

Specification	Maize crop UM	Years						Average	Stand deviation	c (%)	Mean square dev.	Probability 90%(t=2,13)			
		2008	2009	2010	2011	2012	2013					min	max	Abs (+/-) f	%
Average production	kg/ha	8000	5000	9000	4000	9000	9200	7367	2282	31,0	932	5382	9351	3968	53,9
Selling price	lei/to	354	408	652	717	1047	580	626	249	39,7	102	410	843	433	69,1
Revenues	lei/ha	2832	2040	5868	2868	9423	5336	4728	2757	58,3	1125	2331	7125	4794	101,4
Gross margin	lei/ha	1582	590	4018	968	6923	2424	2751	2380	86,5	972	681	4821	4140	150,5

Source: Own processing after the record data from SC ILDU SRL[8]

The selling price of production knows significant fluctuations from 354 lei/ tonne in 2008 to 1047 lei / tonne in 2012, with an average of 626 lei / tonne and a deviation of 249 lei / tonne.

Figure 7. The maize crop production evolution in SC ILDU SRL, Vâlcelele village, Călăraşi County, during 2018-2013
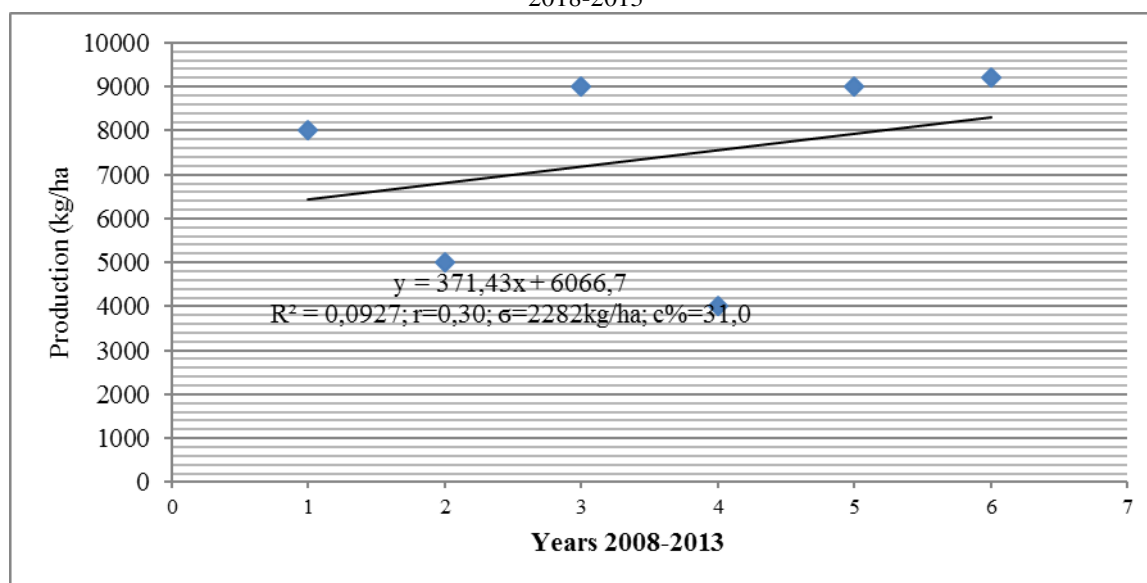
Given the high value of production obtained and the selling price, the year 2012 recorded the highest revenues of 9423 lei / ha (Figure 8), and the gross margin is also the highest, of 6923 lei / ha (Fig. 9).

The two indicators variations, calculated using the coefficient of variation, are very high, with values of 58.3% and 86.5%.

Figure 8. The maize crop revenues evolution in SC ILDU SRL, village Vâlcelele, Călăraşi County, during 2008-2013
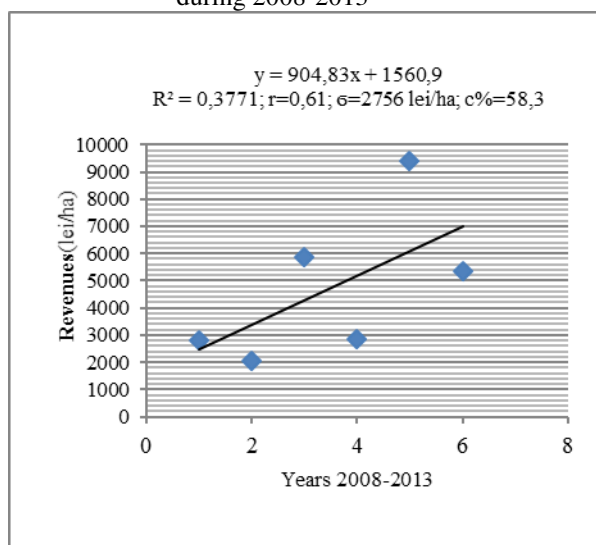
Figure.9. The maize crop gross margin evolution in SC ILDU SRL, Vâlcelele village, Călăraşi County, during 2008-2013
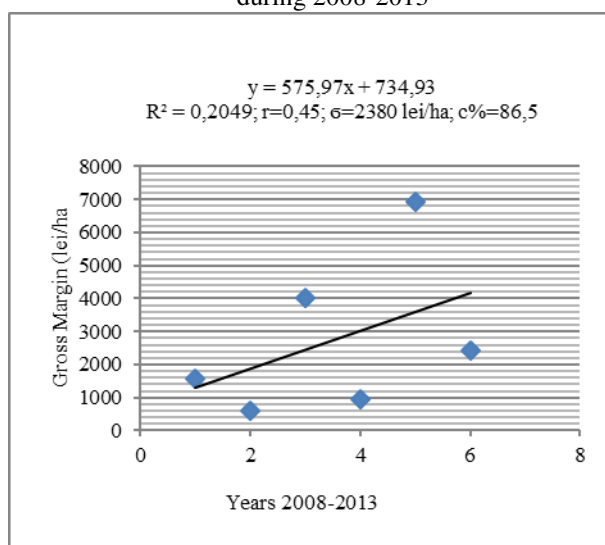

Table 9. The maize crop hybrids cultivated in SC ILDU SRL, 2007-2012

Crop/ year	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012
Maize	ZAMORA	PR_5A_{24}, D_{25}	ZAMORA	DKC 4608	$P_{94}94$, D_{81}

Source: Own processing after the record data from SC ILDU SRL[8]

The company uses maize hybrids categorized as cutting-edge products in the Romanian agriculture, receiving generous productions (Table 9):

DKC 4608 is a new generation of hybrids, achieved by selecting the best possible combinations and proven by higher production worldwide.

The P9494D81 [7] hybrid is a part of FAO 350-400. It has excellent performance with low humidity, resulting in yields of 10 to 11 t / ha. The achievements in crop technology, as an average over the period 2008-2012 showed good expenditure management so that the total technology that has spent less , 2912 lei / ha, compared to SC Toma SRL where they amounted 3170 lei / ha .

CONCLUSIONS

1. Following the maize crop results at the country level, we notice the fact that although Romania has a large maize cultivated area, the productions per hectare are lower compared to the predominantly cereal countries, both in EU and globally.

2. In the Calarasi county, were recorded higher production then the national levels, particularly in the recent years, surpassing by almost 1000 kg / ha the country's average (2011);

3 . Extrapolating by the trend equations, it demonstrates an increasing trend, both at national and at the county level.

4. The study of the two agricultural companies, by characterizing the maize crop main indicators have revealed the following:

- The use of the high quality hybrids, adapted to the environmental conditions specific to the culture, lead to extra quality and quantity of production;

- Both companies (SC Ildu SRL, SC Toma SRL) are specialized in large crops field with good maize crop development;

- SC Ildu SRL, compared with SC Toma SRL showed greater stability of production, managing increase production, with higher incomes.

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