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# World's and Romania's Food Safety Insurance: What Could Romania's Agriculture Do, from the Plain to the Mountain, in order to Feed its Population and the World Population in 2050

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## ABSTRACT

Taking into account the reality that in 2050 world's population, under the current prognosis functions, will reach 9,3 billion and that 1-1,3 billions of people live in chronic starvation in present, but also by the fact that Romania can't feed, with her own agricultural productions, more than 40% of the population, the study aims to seek solutions for world's, Europe's and Romania's population nutrition, reaching to the following conclusions: Western Europe can increase its agricultural production with maximum 8% in this period, real production potential being achieved. Instead, it could contribute, by the simple process of elimination with only 50% of the huge waste of food, to the nutrition of approximately 2 billion people. However, Europe can bring an important contribution to the world nutrition through technological and educational transfers to the 3<sup>rd</sup> world countries that need food. The analysis of Romania's agricultural achievements in the 1<sup>st</sup> decade of the 21<sup>st</sup> century shows that the balance of agricultural and food production is significantly negative compared to its potential, while some production resources, such as mountain grasslands, with an equivalent 5 Kg/ha current production, practically can't be taken into consideration.

## 1. INTRODUCTION

The hunger is a real problem of the world, which globally reached a record figure of 1,025,000 million people in 2009 (FAO 2010 data, communicated by Qaim M. [1] a year later). The hunger of the world has decreased by about 120 millions, but the trend remains upward (fig. 1).

In the period of January 19-21, 2012, a series of 12 conferences took place in Berlin that ended with the International Forum on January 21, 2012, in which it has been discussed intensely and obsessively the same subject - „World' feeding in 2050”.

The problem occurred during the last years and it has been accelerated by the current financial and economic crisis, also completed by a food crisis. Based on calculations and of population' feeding patterns data prognosis concerning the increase of world population was delivered (table 1). Thus two phenomena occur:

- the population will increase by 1.3 billion over the next 18 years and by another 1 billion until 2050; appears an increase of 2.3 billion people = 33%, growth that will take place exclusively in developing countries;
- at the same time, in some developing countries, the economic phenomenon has improved,

population incomes have increased and thus, the requests for nourishment, including those of food origin have also increased; also, the need of agricultural biomass for renewable energy grew and is still growing.

Under these circumstances, the demand for agricultural products IS EXPECTED TO BE DOUBLE by 2050 and the annual increase of agricultural production would have to be of 1.8%.

Table 1. Long-term evolution of world population (billion) [1].

Specification		2012	2030	2050
Dynamic	Global – total	7.0	8.3	9.3
	Industrialized countries	1.2	1.3	1.3
	Developing countries	5.8	7.0	8.0

## 2. THEORY AND METHODOLOGY

Starting from the EU average yields, by optimal and sustainable exploitation of its natural resources Romania could obtain 362 million tonnes of cereals in 2040. By applying two scenarios of grasslands' ecological and biological activation it could get another equivalent of 1.4 million tonnes of meat, thus theoretically covering the entire Romania's need for food, in case of extremely favourable social conditions in rural areas in the plain but especially in the mountain.

Romania's contribution to the nutrition of local population but also of the world can be made after 5 scenarios, namely:

1. Production at EU level, food for 75 million people.
2. Optimistic scenario of world development, Romania feeds 40 million consumers.
3. European scenario (average): Romania feeds 32.5 million consumers.
4. UE 15 scenario - Romania feeds just 25 million inhabitants.
5. „0” scenario - the lack of growth and development in agriculture maintains the country at the undesirable current level being able to feed only 9 million inhabitants.

The necessary researches for this study were based on official data published by FAO, EUROSTAT, MARD, Romania's National Institute of Statistics, as well as other authors quoted in the text.

The calculations performed by us were based on „mathematical statistics applied in agriculture”, by using the Theory of Probability, especially - the dispersion and variant analysis calculation, the bi- and multifunction analysis calculations of the coefficients and of correlation reports.

For the estimation of trends and prognosis, we removed the random values that exceeded the P90% confidence interval.

The results are presented below in tables and graphs, maps and diagrams.

## 3. RESULTS AND DISCUSSION

### 3.1. Current situation

If production is a function that depends on climatic and soil conditions (CS), on inputs (Ip) and technical progress (T), then:

$$Pr = f(CS + Ip + T)$$

This three-dimensional function can be 80% completed in Europe.

Its application within developing countries does not exceed the coefficient of 0.2. We conclude that the ratio between Europe's ability of producing and the same ability of the developing world countries is  $0.8/0.2 = 4$  times. This is demonstrated by the ratio between the average productions for cereals.

In 2012, the world's average yield of cereals is of about 3 tonnes (2.4 tonnes wheat). In order to cover the need of aliments, in Qaim's vision it would be necessary an average production of cereals (the 3 t - wheat, corn and rice) of about 6 t/ha in 2050, as global average, productions that are difficult or nearly impossible to achieve. However, Qaim itself provides, in Figure 1 [1], three scenarios of production growth by 2050.

Starting with a potential reduction in worldwide financial and economic crisis, the production of cereals:

- can be accelerated exponentially by 2050 (6 t/ha) – optimistic scenario;
- may follow a normal growth of 1.3%/year and will reach an average of 5 t/ha – normal scenario;
- the curve can be flattened due to the conflicts and to the resources deficiency combined with major climate changes, in which we expect a significant deficit of food demand – pessimistic scenario, but possible.

The second way of controlling the demand is by adjusting consumption or, more precisely, by reducing consumption and preferences.

### 3.2. Agriculture and food in Romania

As in all countries, the main source of feeding its own population should be the agriculture of the country. There was no Romanian ministry of agriculture that did not say during its mandate that Romania can easily feed 40 million people.

Most recent calculations, delivered by the European Commission states that if Romania produced the EU average, it could be feeding 80 million inhabitants, which is 4 times its current population.

This observation was recently assimilated by MARD (Ministry of Agriculture and Rural Development).

We plan to make an analysis of the difference between potentially and factually, between Romania and EU average. Romania (fig. 2) has an agricultural surface of 14,709,300 ha from the total surface of the country – 23,839,100 ha (238,391 km<sup>2</sup>).

However, in the year 2011 the new documents of the Ministry of Agriculture registered an agricultural surface of only 12,799,000 ha as compared to 14,800,000 ha as it was already known [2].

The difference, which apparently went to other uses, is very high [14,800,000 – 12,799,000 = 2,001,000 = 13.5%].

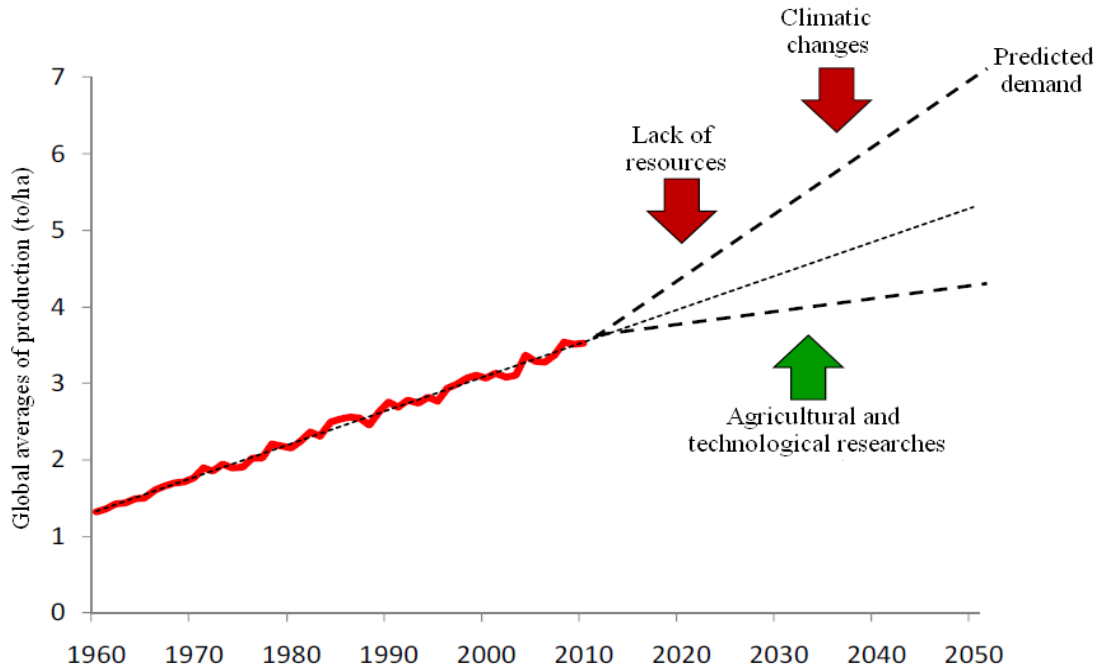


Fig. 1. Three scenarios of increasing production by 2050.

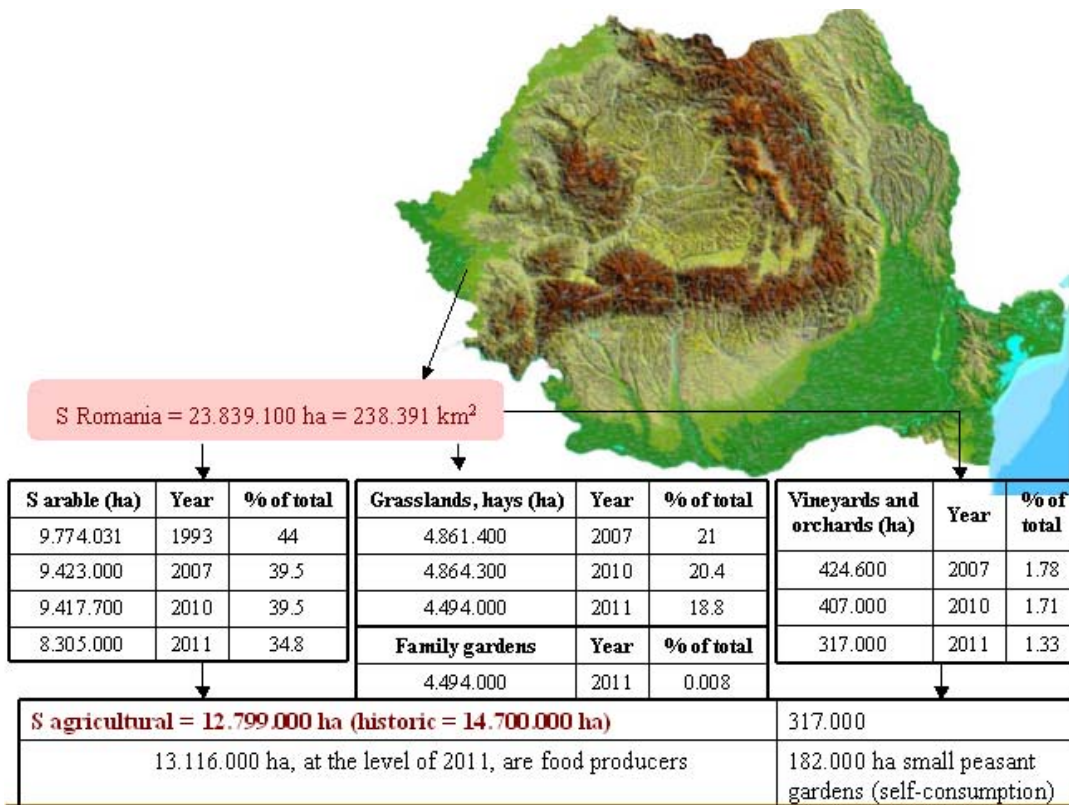


Fig. 2. Romania's surface that allows the production of food and direct aliments [3] [4].

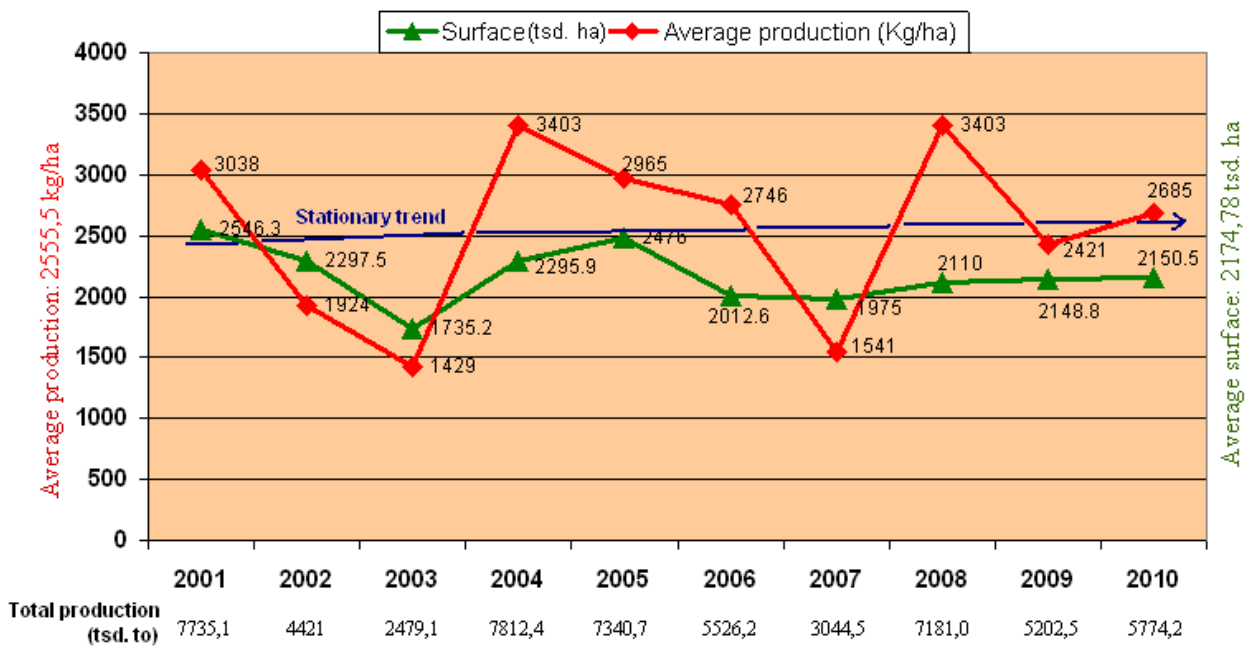
From the statistical data of MARD [4] we also found a continuous decrease in arable land, from 9,774,000 ha in 1993, to 9,417,700 in 2010 and, surprisingly, to 8,305,000 ha in 2011 (?), decreases of 3.7% and 15%, the last decline remaining unexplained by anyone. If so, it would be a serious issue. However, we believe that this is rather determined by the negligence of those who put together the statistics. For these reasons we will remain at  $S_{AGRARIAN} = 9.8$  million ha and starting from it, we will do the remaining calculations: grasslands and hays, regardless of random fluctuations over the years, revolving around 4.8 million ha.

Each inhabitant of Romania is attributed about 0.41 ha of arable land.

### 3.3. Productions obtained in the recent history of the country

The most important crop, which is taken for reference, is *wheat*.

Through simple processing it is used directly in human nutrition. The evolution of total productions / ha, as well as the surfaces are represented in figure 3.



1 <sup>st</sup> decade parameters in wheat crop	→ Total average production:	5,651,670 t
	→ Average production/ha: 2555 kg	Ratio EU/RO = 5425/2555 = <b>2.12</b>
	→ Annually average surface:	2,174,870 ha
Average production EU 25 (Eurostat)	→	5425 kg/ha

Fig. 3. Data on the wheat crop in the 1<sup>st</sup> decade of 21<sup>st</sup> century (Profile Decade I).

The annual variability of average production from 1429 kg/ha in 2003, to over 3400 kg in 2004 and 2008 (ratio 1:2.4) shows the dependence, the extremely significant correlation between production and climatic factors, but also the fact that technologies are applied on deteriorated soils, where water and nutrients conservation remain unresolved problems.

By the average registered for the entire country, Romania's average wheat production has made no progress compared with the previous decade and it is lower than before 1990. If we compare the average production of Romania with the one of EU over the

same period, we find that the ratio  $UE / RO = 2.12$ , a gap difficult to fill in in the next 40 years with the current agricultural policies.

In the 1<sup>st</sup> decade, the total average production is of 5,557 million tonnes.

According to our data [5], only the wheat used for human population (bread and others pastry products) is of 3.75 million tonnes (for 20 million inhabitants).

This implies that the 1<sup>st</sup> decade of the 21<sup>st</sup> century provided Romania an excess of about 1.8 million tonnes of wheat that could have been exported.

Let's not forget, though, that there were years like 2003 and 2007, in which the wheat yields could not be obtained at the level of consumption, so imports have been intensively used.

In our calculations we did not take into account other uses, such as industry (starch, alcohol etc.).

Corn is a very important plant used in human nutrition, in animal feeding and also in industry.

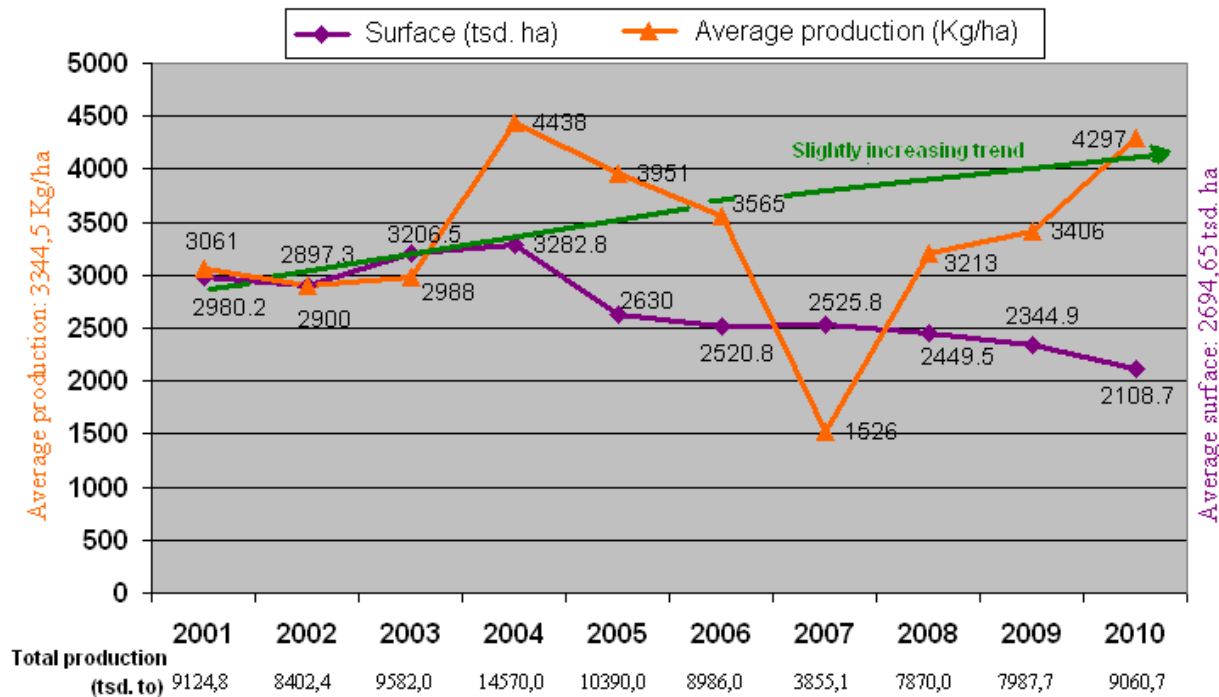
Figures are as follows (after FAO data):

- 21% in human nutrition, worldwide;

- 72% in animal feeding;
- Total: 93% for human food, directly and indirectly;
- 7% for industry.

The dynamic evolution of corn productions throughout the 1<sup>st</sup> decade of the 21<sup>st</sup> century is presented in figure 4.

The variation of corn production is also high: from 1526 kg/ha in the dry year 2007, to 4438 kg/ha in the rainy year 2004.



1 <sup>st</sup> decade parameters in corn crop	→Total average production: 8,982,870 t	Ratio EU/RO = 8120/3344 = <b>2.43</b>
	→Average production/ha: 3344 kg	
	→Annually average surface: 2,694,650 ha	
Average production EU 25 (Eurostat)	→ 8120 kg/ha	

Fig. 4. Data on the production dynamics for corn in the 1<sup>st</sup> decade of the 21<sup>st</sup> century, in Romania.

Ratio M/m = 4438/1526 = 2.90  
Total production stands at 8,982,870 tonnes.

Starting from the Romanians physiologically consumption norms, it results that they should consume, each year:

- 62 kg meat and meat products;
- 220 l, milk equivalent;
- 260 eggs;
- necessary surface = 667 + 711 + 156 = 1534 m<sup>2</sup> x 20 millions = 3,068,000 ha planted with fodder plants (corn grains + barley).

It basically means: 3,068,000 x 3344 = 10,264,521 to equivalent corn.

Corn production of the country = 8,982,870 to, to which is added

$$\frac{\text{barley} = 1,007,540 \text{ to}}{= 9,990,410 \text{ to fodder grains.}}$$

There are missing 1 million tonnes fodder grains for supplying correctly the population with livestock products. Basically, Romanians do not reach the physiological need in case of none of the consumption parameters of livestock products. According to the sources from the same „National Plan of Actions for Nutrition in Romania, 1995” [5] Romanians consume, on average:

- 46 kg meat instead of 62 – deficit 26%;
- 190 eggs instead of 260 – deficit 27%;
- 182 kg milk equivalent instead 220 – deficit 17%.

We can say that overall (on average) Romania's population is undernourished with essential proteins, of high quality.

Taking into account the fact that a large part of the population (around 18%) consume far more than their physiological need and that over 40% of food is lost [6] (see the case of Germany), it results that approximately 45% of the Romanian population has severe problems with nutrition, both quantitative and qualitative.

If we plan to achieve EU consumption, which is significantly higher than ours, the deficient

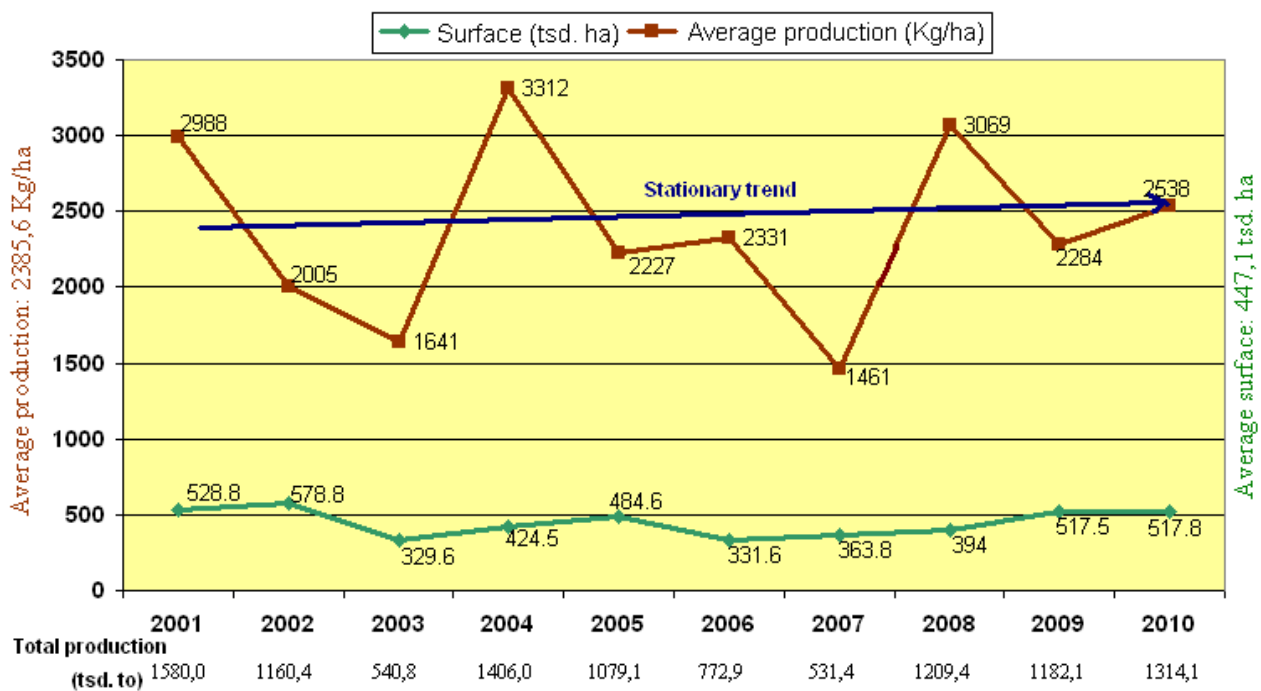
production for Gramineae fodder plants is even higher, adding to the present deficit another over 1 million tonnes, corn equivalent [7].

Nevertheless, mainly due to the lack of livestock exploitations, corn was exported, figures registered between 312,000 tonnes in 2007 and more than 2 million tonnes in 2010.

The strategy of food internal consumption remained in a percentage of around 60-70% based on meat, milk and eggs products, without being able to ensure the physiological need.

*Barley.* In Romania it is cultivated for grains intended to fodder, but also for beer.

The evolution of total production, of average production and of cultivated surface is presented in figure 5.



→Total average production:	1,007,540 t	
1 <sup>st</sup> decade parameters in barley crop	→Average production /ha: 2385 kg	Ratio EU/RO = 6303/2385 = <b>2.64</b>
	→Annually average surface: 447,100 ha	
Average production EU	→ 6303 kg/ha	

Fig. 5. Data regarding the dynamics for the production of barley, of total production and surface, in the 1<sup>st</sup> decade.

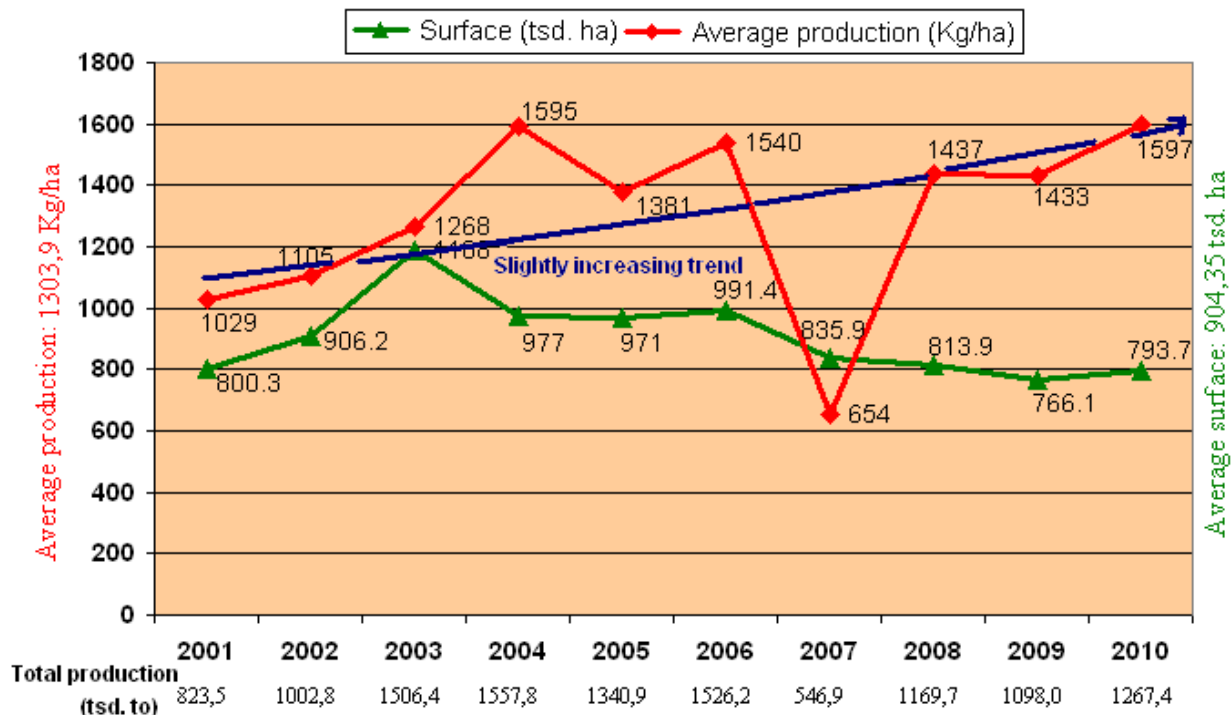
Areas planted with barley ranged from 331,000 ha in 2006, to 578,800 ha in 2002. The ratio is 1:1.74.

The production is presented with one minimal extreme in 2007 (1416 Kg/ha) and a maximum one in 2004, of 3312 kg/ha. The ratio is 3312: 1461 = 2.27.

The total average production of barley is of 1,007,540 tonnes, out of which only half can be laid off

for feeding animals. The rest of it is directed to the production of beer, which is also considered a kind of food. Because of beer production, the availability of barley for producing livestock products needed in population nutrition is reduced.

*Sunflower.* In Romania it is consumed preferably the sunflower oil. It is also used to obtain margarine.



1 <sup>st</sup> decade parameters in sunflower crop	→ Total average production:	1,183,960 t	
	→ Average production /ha:	1303.9 kg	Ratio EU/RO = 3500/1303.9 = <b>2.68</b>
	→ Annually average surface:	904,350 ha	
Average production EU	→	estimated 3500 kg/ha	

Fig. 6. The dynamic evolution of sunflower production and surfaces in 1<sup>st</sup> decade of the 21<sup>st</sup> century.

Areas planted with sunflower have also varied greatly, from 766,000 ha in 2009, to 1,188,000 ha in 2003. The ratio  $M/m = 1,188,000/766,000 = 1.55$ , lower than in the case of cereal crops.

Surfaces were not supported by high yields, what was achieved being significantly below the potential of cultivated hybrids. The minimum production was realized in a very dry year (654 kg/ha), whereas the maximum one in ordinary years 2004 (1595 kg/ha) and 2010 (1597 kg/ha). Ratio  $M/m = 1597/654 = 2.44$ .

Sunflower, although it is a strong culture, does not face water scarcity and water stress caused by climatic conditions and lack of competitive technologies for storage of rainfall water in soil depth.

Total production of sunflower summed up to only 1,183,960 t/year, on average. Sunflower is an oil plant with 48-50% oil, out of which only 40% can become cooking oil, meaning 450,000 tonnes.

According to the „Physiological consumption norms”, each Romanian should consume 13 kg of vegetable fats (oil + margarine), i.e. 260,000 t/year. To obtain these parameters 660,000 ha are needed.

Although productions are low, if a competition between biodiesel and food oils is not carried out, there are still about 190,000 tonnes of oil available for export. Thus we contradict the data published until 2000 [8], which declared Romanians' consumption deficient in oil.

Rape is the second culture with great importance for obtaining oil. It is however a new culture and in Romania it is grown on small areas since the middle of the last decade of the century.

An increase in cultivated surfaces is registered after 2005 (fig. 7), in 2010 reaching to 537,300 ha, which is a 31 times increase of surface as compared to 2004. The surface's growth was made possible by a high demand for oil on the European market for biodiesel production.

Rape does not find the best conditions in Romania, two major biotic risks being able to reduce the production at any time.

These are:

- the risk of freezing through winter (see 2010-2011);
- the risk of drought in spring (see 2007, 2003, 2002).

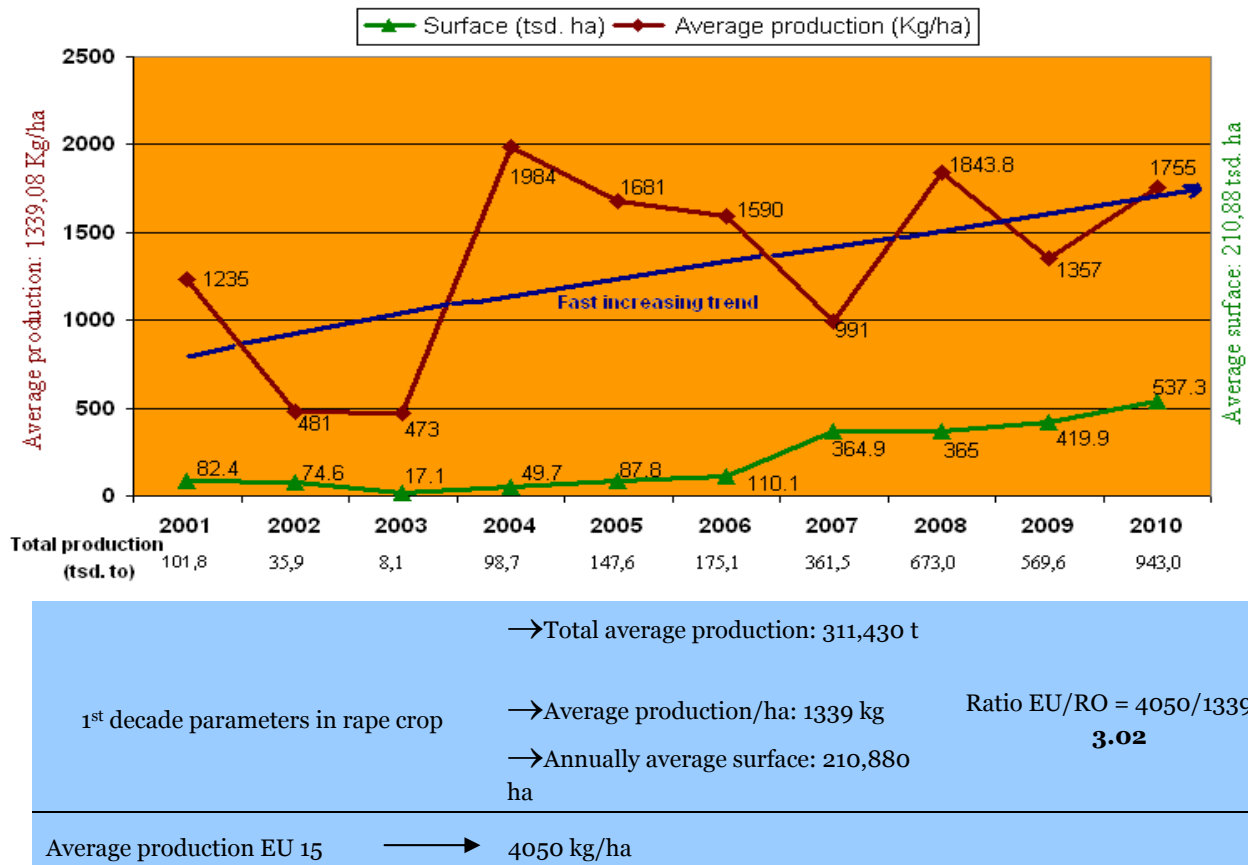


Fig. 7. The dynamic evolution of rape crop in the 1<sup>st</sup> decade of 21<sup>st</sup> century.

Romanian rape production is on average at least 3 times smaller than that of Central Europe. Only the recent price increase has created the possibility of extending the surfaces to over half a million hectares.

Soy is the most important crop, which became a strategic one for population supplying with proteins and fats.

It is also the reason why soy was forbidden for culture in the genetically modified form, but not for consumption.

In Figure 8 it is presented the evolution of surfaces dynamics, of total productions and average productions.

If before the change of political system in Romania soy was cultivated on about 400-500,000 ha, especially under irrigation, the new capitalism has led to instantaneous destruction of irrigation system and to simultaneous reduction of soy in culture, reduction of livestock and to the beginning of meat imports.

The 1<sup>st</sup> decade of the 21<sup>st</sup> century finds soy in culture with only 10% of surfaces – 44,800 ha.

With the introduction of genetically modified varieties the surface increases continuously until 2006, when it reaches about 200,000 ha and when the greatest amount of soy is obtained (345,000 t).

After 2007 the surfaces decrease and only the high prices from the last 3-4 years have led to a slight surface increase in 2010.

The average yield/ha ranged between 1021 Kg/ha, in the really dry year 2007, and 2345 Kg/ha in the normal year 2010.

Through its beans soy offers up to 40% protein and 20% fats. It is the only culture equally offering protein and oil.

The total average production of 186,000 tonnes can ensure a quantity of digestible and usable proteins of  $186,000 \times 0.30 = 55,800$  tonnes.

Human nutrition requires an amount of 62 g protein/day  $\times$  365 days = 22 Kg/year.

$$22 \text{ kg} \times 20,000,000 \text{ people} = 440,000 \text{ tonnes}$$

So, we produce nearly 8 times less protein that we need. As soy is used especially for animal feeding, the conversion coefficient of vegetal protein in animal protein is at most 0.8.

About 44.640 tonnes remain, not taking into account other losses, which in Romania can reach to 40% - losses smaller than in Germany, but inherent. Import becomes necessary even mandatory for Romanians' food safety. There are imported up to 70% from the proteins.

The need of fats as energetic material in Romanians' nutrition is of 286,000 tonnes. From soy we can achieve  $186,000 \times 0.16 = 29,760$  tonnes.

The deficit remains significant, although a large part is covered by sunflower.



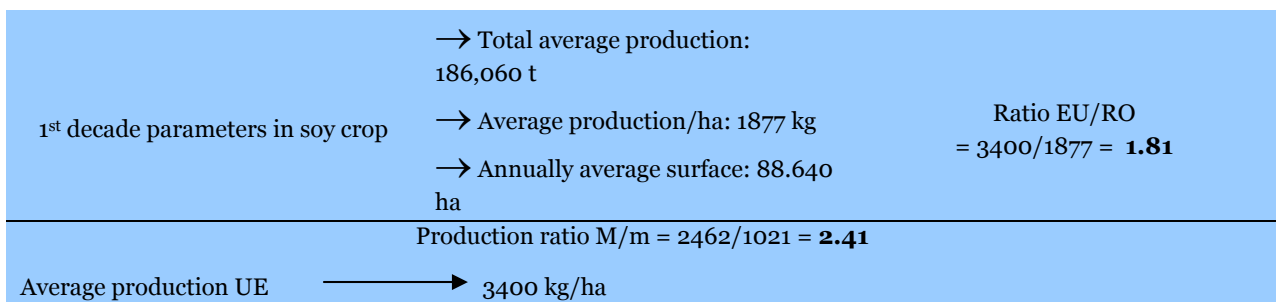
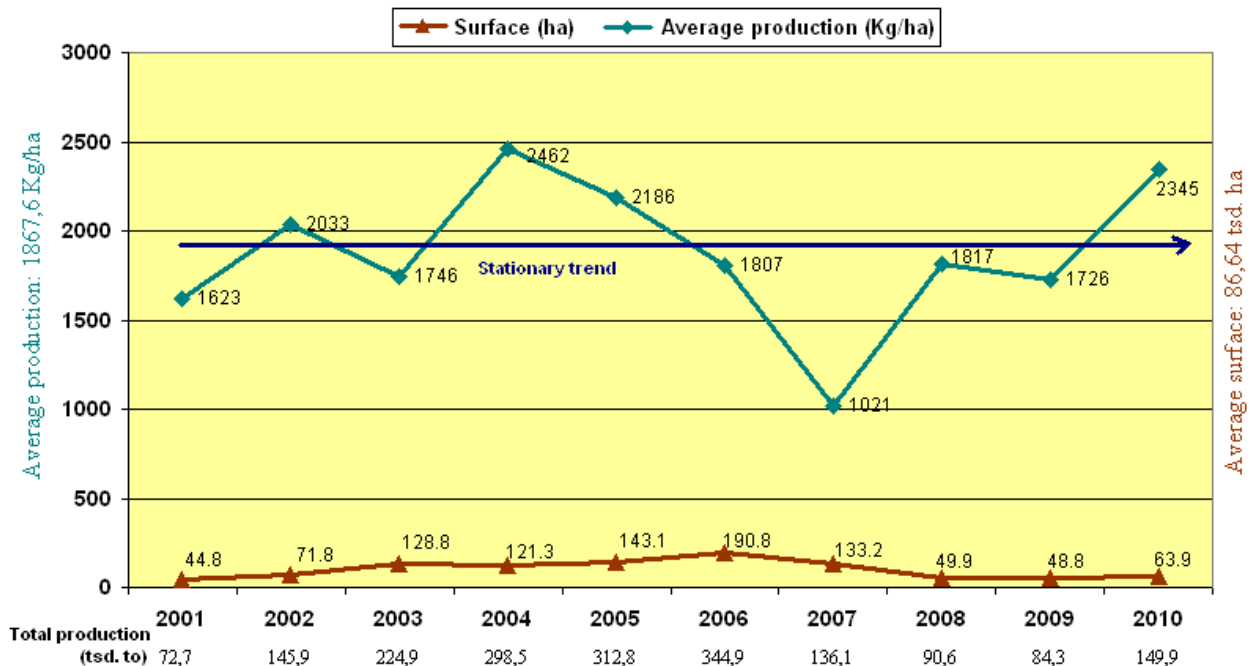
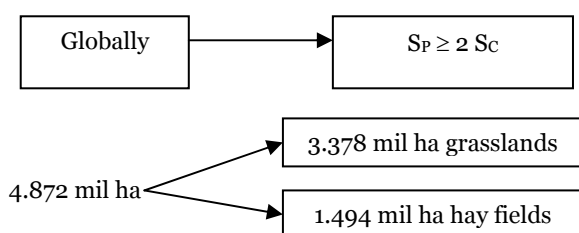


Fig. 8. The evolution of soybean culture parameters - 1st decade of 21st century (Profile Decade I).

### 3.4. What can be obtained from the mountain area in Romania

Sub-mountainous and mountainous area is packed with grasslands and hay fields, in one word pastures with very different quality in terms of floristic composition, depending on soil, altitude and human care for them.

On the globe, grasslands occupy 23% of Earth land surface area. In absolute numbers there are over 3 billion ha, a surface of approximately 2 times larger than the area occupied by arable lands.



where:  $S_p$  = surfaces with pastures  
 $S_c$  = surfaces with crops (arable).

In Romania, pastures area occupies [8]:

According to the Ministry of Agriculture, surfaces would be around 400,000 ha smaller.

GRASSLANDS AND HAYS OCCUPY 33.8% from the entire agricultural area, i.e. 20.5% of the country, with about 1.5% below the world average. The largest surface, over 65%, is located in hilly and mountain areas (59% only in the mountains = 2,565,000 ha) [10]. Pastures' current state is so severe that we can say it cannot be taken into account in the general equation of meat production.

#### 3.4.1. 1<sup>st</sup> scenario (actual)

Therefore, supposing that the data published by Doiniță et al. [10] are real, it appears that the average of pasture capacity, respectively that of grasslands production in Romania is of 0.15 LU/ha. Transformed in meat (also see the data of Lucian Blaga University [8]), means a total meat production of:

$$4,872,000 \times 0,15 \times 7 = 51,156 \text{ tonnes meat}$$

With this meat, it may cover the physiological need at European level for 639,450 Romanian people. Such a production represents 3.1% of Romania's consumption, much too little to matter in the equation of animalistic production needed for the national supply.

#### **3.4.2. The 2<sup>nd</sup> scenario - extensive - ecological**

However, if we want to think about the future, it is interesting to find out what can be done to grasslands and hays with minimal investments. After EU rules, it might get a pasturing capacity of 1 LU/ha, which means 69 kg meat/ha, for an extensive pasturing.

In this case we could get a meat production of

$4,872,000 \times 69 = 335,168$  to, is the necessary for 4.2 million Romanians or meat for 21% of population

Technologically, the 2<sup>nd</sup> Scenario involves [11]:

- cleaning of grasslands of bio-invasions or tree species and useless or harmful weeds;
- fighting against erosion forms and spatial planning (land management) for modern pasture and for mowing;
- overseeding with valuable species, especially valuables grasses and leguminous plants (reopens clover for pastures and *Trifolium pratense* for hays);
- applying organic fertilizers, composts;
- upgrading of the pasturing system and using of hays including as silage.

The costs of this scenario, which seems to be unbelievable for Romania, would be of 2.53344 billion EUR. High or low prices, it is up to the reader to analyse that. We consider that it would be completely worth.

#### **3.4.3. The 3<sup>rd</sup> scenario**

It leaves the ecological area and accepts, in addition to the measures taken above, others too, including an intensive growth of biomass on grasslands. Two of them are added to the technologies from the 1<sup>st</sup> Scenario, namely:

- moderated application of certain chemical fertilizers and of weed control;
- adjusting of hydric regime in the system.

There are also taking all the appropriate measures to prevent the pollution of the production system on grasslands and of the ecosystem, as a whole.

It can produce fodder for 4.2 LU and a meat production of 290 kg/ha.

Calculating, we reach:

$4,872,000 \text{ ha} \times 290 \text{ kg meat/ha} = 1,412,880$  tonnes meat

### RESULTS IN FOOD STRATEGIC PLAN

1. It would fully cover the meat necessary of Romania.

2. It would make available around 200,000 tonnes of meat for export, the purpose being Romania's participation in feeding the population of the world.

3. It would release about 1.2 million ha with concentrated fodder crops (corn, barley etc.), which could be used for other purposes and especially for export.

#### **3.4.4. Optimistic scenario, but possible**

It is offered by the intensive pasturing (see the work of the University of Sibiu), in which case it would obtain 480 Kg meat/ha.

Calculations within the country show that:

$4,872,000 \text{ ha} \times 480 \text{ kg meat/ha} = 2,338,560$  tonnes meat

1. The results, in the strategic plan of global nutrition, consisting of a 1,100,000 tonnes surplus of quality meat, equivalent to about 2.3 billion EUR at current prices, amount that would cover 95% of the initial investments and would provide meat for 17 million consumers from the European area and worldwide. Of course such real scenarios seem to be incredible for the current agricultural policies. They fall, however, in the vision of some great specialists of the country and of the world.

2. The adjustment of mountain ecosystems, the optimization of their functioning, the erosion control and the beautification of the Landscape after Swiss and Austrian model.

3. The increase of social welfare, spirituality and culture in rural areas. Overcoming the urban living conditions by the rural ones.

### **3.5. What population could Romania feed with the average productions from EU**

We go beyond the current status and we come back with the calculations to the main field crops in order to achieve the desideratum already exposed by one of the agriculture ministers from Romania (food for 80 million consumers) - borrowed from the EU.

#### **3.5.1. What can the wheat crop offer**

We start from the parameters of 2010:

- cultivated surface = 2,174,000 ha
- EU production = 5425 kg
- Romania's production it would be 11,793,950 t
- human consumption necessary: 3,180,000 t available: 8,613,950 t

That means bread for another 54 million inhabitants.

In total, Romania could provide good bread for 74 million inhabitants (we did not take into account the losses).

Strategically, to the present prices (160 EUR/t) 1.376 billions EUR could be collected from the world market.

### 3.5.2. What can the corn crop offer

Given the assumption that the average size of 1<sup>st</sup> decade remains around 2.7 million ha and that, unusually for Romania, could obtain a yield of 8 t/ha, an average production achieved and exceeded in Europe, we would be in the fortunate position of reaching the next level of total productions:

$$2.7 \text{ million ha} \times 8 \text{ t/ha} = 21.6 \text{ million t}$$

We can assume that 2.6 million tonnes are necessary for internal consumption, for completing the foraging process and for industry. We recall: meat can be obtained from the natural pasture system, so only the poultry (and, partially, the pig) should be feeding with corn, barley and soy.

Therefore, 19 million tonnes remain available for Europe and the whole world.

Taking into account the weighted average of prices for the last 4 years, as well as for the international prices trend in the next 30-40 years, we expect to collect at least 160 EUR/t on a very good quality.

The calculations show:

$$19 \text{ million t} \times 160 \text{ EUR/t} = 3,040 \text{ billion EUR}$$

With this quantity of corn it could be obtained, for the hungry of the world, 2.25 million tonnes of meat (in equivalent), which means that could supply the meat, to a consumption of 62 kg/year/person, in addition to what is consumed in Romania, around 36 millions starving people, with very high quality hulls.

### 3.5.3. What can the barley crop offer

Barley is the last grain culture that can play an important role in the balance of energetic materials for animals feeding.

The parameters of the 1<sup>st</sup> decade indicate:

- an annual average surface of 447,100 ha;
- an average production/ha of 2385 kg;
- a total production of 1,007,540 t.

Mostly, the barley entered in the early feeding of animals and birds for meat and eggs (approximately

25%). A significant amount was used as barley for making beer (30%). A quantity of almost 120.000 tonnes was exported (12%), while about the rest, used in industry or others utilities, not much is known.

If from the same surface would be achieved the European Union annual average production (6303 kg/ha), Romania would make barley:

$$447,100 \text{ ha} \times 6303 \text{ kg/ha} = 2,818,071 \text{ tonnes}$$

which is an extra of 1.8 million tonnes. Approximately 400.000 tonnes could be used to feed the supplementary effectives of poultry and swine 1.4 million tonnes remain available.

Estimation of price for barley is given by corn price - 10% (medium). For the last 4 years we can consider a price of 145 EUR/tonne ex work (to the factory gate) as very good. Calculating, we get:

$$1.4 \text{ t} \times 145 \text{ EUR/t} = 203 \text{ million EUR}$$

which are added to the patrimony of Romania's contribution to the population nutrition, because this value is equivalent of about 205,000 tonnes meat or over 3 million eaters of good meat, to a consumption of 62 kg/capita.

### 3.6. The prognosis model of Romania's participation in feeding the world

The prognosis model for total cereals productions of Romania, in dynamic, during 2000-2050, is presented in Figure 9.

This model was calculated as a result of Romania's agricultural policy evaluations, advanced by the Romanian delegation to the International Forum in Berlin - January 2012.

We repeat that this forum was dedicated to European and world capacity of feeding the earth population in 2050 (also see figure 10).

From the analysis of scenarios, which concerns the possibility of Romania to feed its own citizens in peace conditions, but also in conditions of agricultural policy different from today, shows the following:

#### 1<sup>st</sup> Scenario

If Romania's agricultural policy follows the EU's agricultural and food growth policies established by it, by EU and presented at The Forum of Berlin (1,3% per year) would reach to nourish its whole population in 2030. This would be the moment of equalization the import/export food balance, so that in the next 20 years to produce for other 5 million people.

**2<sup>nd</sup> Scenario**

Is the one required by a normal „global growth” (1,8% per year) for nourishing the population, case in which Romania could feed slightly over 25 million people in 2030, 32 millions in 2040 and approximately 33 million in 2050, 13 millions more than its population.

**3<sup>rd</sup> Scenario**

Is the optimistic one, which involves an international harmony, that would allow a much sustained development of agricultural and food productions in the third world and especially in China, Pakistan, Africa, Latin America (increases of 2.8% per year). Watching this extremely optimistic scenario, Romania could feed 30 million people in 2030, 36 millions in 2040 and nearly 40 million in 2050.

**4<sup>th</sup> Scenario**

This is the over optimistic scenario of the Romanian current policy, which considers that, if Romania would achieve the average yields of developed countries, could be feeding 80 million consumers, bringing, in this way, a tremendous contribution of Europe and world’s nutrition.

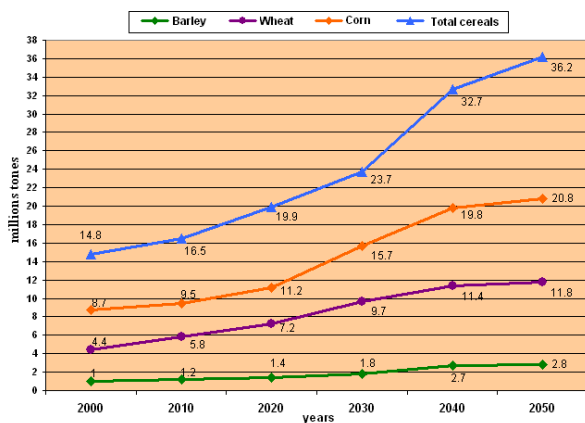


Fig. 9. Prognosis of the evolutions for Romania’s total cereals productions during 2010-2050.

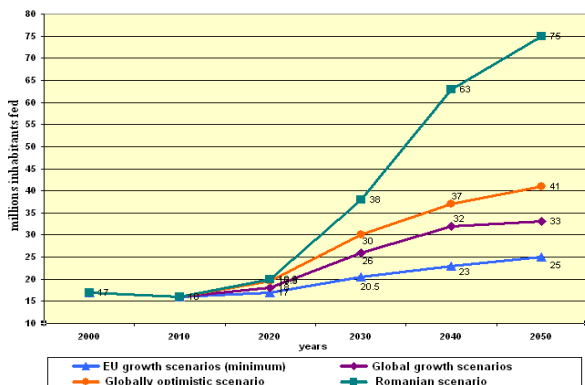


Fig. 10. Four scenarios of Romania’s possibilities to contribute in feeding its own and global population.

Of course such a scenario is possible. A calculation not enough elaborated shows that would be necessary investments costs that exceed 700 billion EUR only in improving the reconstruction infrastructure of resources, technology and management.

The following factors require a special attention:

- 1). Changing the mentality, but also political and public thinking - favourable decisions to agriculture’s and food industry’s development.
- 2). Transforming state institutions in non-bureaucratized and efficient entities.
- 3). Respect and controlled support for the owner and the agricultural producer.
- 4). Eliminating energy’s monopolies and other resources.
- 5). Realization of cadastre and merging of surfaces in technological plots, accepted by the new technologies.
- 6). Regulation of soil hydric regime and elimination of the risk caused by drought.
- 7). Regulation of thermal regime through the creation of massive forestation and of some efficient protection curtains, according to scientific results [12].
- 8). Greening of all soils, humus restoring, of biological activity and of plant-soil-climate relationship.
- 9). Minimization or elimination of erosion, soil and water losses.
- 10). Bringing to the agricultural circuit and including in the agro-ecosystems of all degraded or abandoned lands.
- 11). The creation of modern infrastructures of transport, storage and communication - for reducing the costs and increasing the efficiency.
- 12). The use of all agricultural lands to maximum optimized parameters (field crops, grasslands).
- 13). People’s health and education is crucial in achieving this great project; without trained people no scenario isn’t achievable.
- 14). Good management, national harmony, love for country, „national interest”, the return of ethic and of social morality.
- 15). The development of a strong research sector, without the project is unimaginable.

**„0” Scenario**

Assumes that Romania continues its policy of chaos and economic disaster, especially in the agricultural area, which will lead to further degradation of natural and human resources; next, is for the state institutions to approach new restrictions and abuses to humans and country, a premise for a dissolution of the nation. In this case, the normal nutrition of its own population is no longer an issue. World’s evolution to

new political and economical crisis, perhaps armed conflicts, would be the only excuse for the deplorable performances in economical and agricultural policies. Because the so-called macro structural policies, through which the blood is taken out from the functional installation of economy, leads to the country's transformation into an embalmed dead body, eventually stable, but ineffective, motionless.

For these reasons the country's present policy and partially the world's is also a macabre one. This is the „o” Scenario, which applies now in Romania.

### 3.7. Comparative analysis of the 1<sup>st</sup> and 5<sup>th</sup> decade on the contribution of main plant sectors for Romania's and world's feeding with foods calculated in meat and equivalent

Romania's meat physiological need in 2010 is [13]:

$$62 \times 20,000,000 = 1,240,000 \text{ tonnes}$$

Inputs	- grasslands	51.156 t
	- agricultural crops (corn, barley, soy)	554.307 t
	Total inputs, national	605.463 t
	Inputs - import	468.285 t
	<b>GRAND TOTAL INPUTS</b>	<b>1.073.748 t</b>
	Exports - outputs	216.900 t
	Available, including the mountain	856.848 t
	General deficit	383.153 t

Assuming that other Romanians eat in the normal limits, 6 million Romanians did not have any gram of meat in the 1st decade of the 21<sup>st</sup> century.

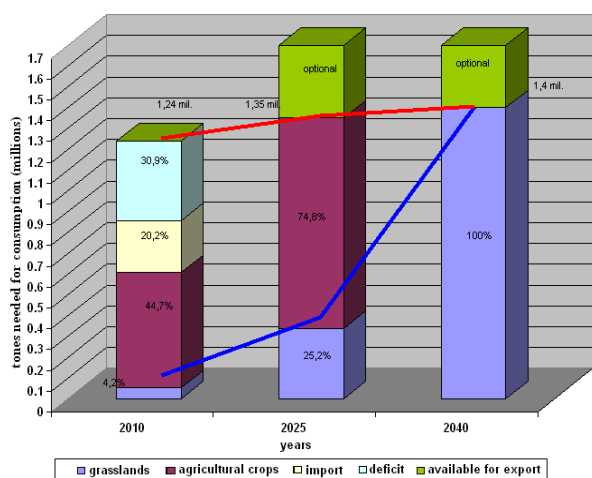


Fig. 11. Meat substitution in population consumption from the plant sector to the grasslands in 2010-2040.

Calculations made on the basis of the three scenarios obtained from research (Figure 11), show us that such a large surface of pastures and hays cannot be provided. Presently, more than 51,156 tonnes meat equivalent, that is only 4,2% from needed, are used for Romanians' nutrition, because grasslands are in a catastrophic condition.

In 15 years, through strong measures of grasslands' ecological and technical improve, in respect for the proposals scientifically demonstrated of the research, grasslands contribution increases with their production up to 69 kg meat equivalent, which is 336,168 tonnes.

In 2025, by the financial efforts previously presented, the mountain and the hill, through their pastures, can cover 25.2% of the country's meat necessary, also increasing by about 90.000 tonnes.

In 2040, meaning other 15 years later (3<sup>rd</sup> Scenario to grasslands), meat production reaches 290 kg/ha, i.e. a total of 1,412,880 tonnes. It's covered, in this way the whole necessary.

If we continue the scenario with the results of 2055, there would be possible to obtain 2,34 millions tonnes meat on pastures that is an extra to nourish not even 17 million consumers from outside the country.

To these results would add a perfect balance of the landscape and of the environment, as a whole.

### 4. CONCLUSION

1). Romania holds a remarkable economic potential, which by the year 2050, according to the most optimistic globally scenario could feed 40 million consumers, twice as its current population.

2). According to the global average scenario, made for feeding the 9,3 billion people in 2050, Romania could provide food for 35 million consumers.

3). As a result of a minimum scenario of EU's crop production increase, Romania could feed, in 2050, only 25 million consumers: *in 2010, Romania can feed, to the physiological need, at most 15-16 millions consumers.* Preventing chronic deficit is realized by massive imports.

4). The contribution of rural economy in mountain and hill areas cannot cover (in meat equivalent) than maximum 4.2%.

5). The implementation of research and of some ambitious investments resulting from an innovative thinking of policy makers could lead, by 2040, to the covering of necessary meat only by the production of the 4.5 millions ha grasslands, releasing field crops for food, industry and export.

6). There is also a possibility for Romania to entry on the „o” Scenario, in which no increase is not possible in the field of agricultural and food production.

Such a vision is possible due to the country's dependence on developed economies, non-permissive for the secondary members of the EU.

7). Super optimist scenario, launched by the Ministry of Agriculture, to achieve the EU production until 2050, would lead to the nutrition of 75 million consumers. In our view, it remains unrealistic because of the enormous funds that it requires and that the country cannot support.

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