

PROTECTED CROPS, AN EFFICIENT SOLUTION FOR ROMANIAN VEGETABLE DEVELOPMENT

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Abstract

In the years 2001-2010, in Romania, the average temperature raised by 0.8 °C. Growing vegetables in these conditions, in the open field, is very risky. With a mean production, open field and protected crops, of 32.5 t/ha, in present, we can not ensure a min. consumption of 150 kg/capita. We believe that there are many "pro" arguments for increasing the area of plastichouses from about 7,500 ha to 21,000 ha by year 2020. Are listed in these sense: placing Romania in the European zone B solar radiation, possibility of growing vegetables throughout the year, demand more and more local vegetables in any season, a complete range of raw materials all the technological chain, obtaining high yields and quality, economic efficiency and higher possibility of using cutting-edge technology by applying the latest scientific research results, reducing imports and increasing export availabilities. The paper refers to possible development of these domains: crops, areas and yields, predicting the ensure of vegetables in 2020. Also, we are in view the necessary founds and how these will be recover.

Keywords: protected vegetable, development, grants, efficiency.

Motto:

"Protected vegetable crops must be considered the best and the cheapest assurance against climatic changes"

Global and regional climate change also damaged strong and the vegetable crops in Romania. Last 15 years have been the warmest. In the last century the global temperature raised with $0.74 \pm 0.18^\circ\text{C}$ (IPCC 2007). The period 2001-2010 the average temperature in Romania raised by 0.8 °C (Sandu and Mateescu, 2012). Growing vegetables in these conditions, mainly in the open field, is very risky. However the area cultivated with vegetables in the field was significantly reduced. In our opinion the total area of vegetables is no more than 85,000 ha, of which approximately 4,500 ha are protected vegetables (glass and plastic houses) (Table 1 and 2).

With an average of 32.5 t/ha, at this time, we can not ensure minimum consumption of 150 kg/capita, unless we import 200-250,000 t/year. In these circumstances import-export balance is negative. Remember that, for example, in 1985, Romania exported 600,000 t of fresh and processed vegetables, being the largest exporter of processed tomatoes in Eastern Europe!

The drought, low or sometimes high relative humidity due to heavy rain and the big difference between day and night temperatures, transformed, in the last years, the vegetable growing in open field, in a real adventure. The incidence of blossom end rot and sunscald of tomatoes, sweet, long

and round peppers, egg plants and cucumbers fruits, flowers abortion, incomplete pollinated and deformed fruits of tomato and pepper and cracked tomato fruits, are increasing (Lăcătuș et al., 2010; Lăcătuș, 2011a).

Table 1. The „real” situations of vegetable production in Romania (year 2012)

Crop	Area Ha	Mean yields t/ha	Total yield t
Cabbage	23,000	37	851,000
Tomatoes	12,250	45	551,250*
Root crops	10,000	26	270,000
Peppers	9,500	30	285,000*
Anion	8,000	33	264,000
Eggplants	5,000	36	180,000*
Cucumbers	4,500	50	225,000*
Garden beans	3,000	5	15,000*
Garden peas	1,000	3	3,000
Garlic	500	10	5,000
Ather vegetables	5,700	6	34,200*
TOTAL	82,450	32,5	2.683,450

From the point of view of plant health to the cultivation of vegetables grown in drought conditions, increase the attack of pests – *Tetranychus urticae* and *Polyphagotarsonemus latus*, different species of thrips, aphids, *Trialeurodes vaporariorum* and various caterpillars (Lăcătuș, 2010; Lăcătuș et al., 2010) and the miner leaf of tomato, *Tuta absoluta* (Lăcătuș, 2010). The trouble with these pests is that most of the fruits have no commercial aspect, but even worse is that some of them are viral vectors. Significantly increases the incidence of viruses with negative repercussions on production (Lăcătuș, 2011b). Although to a lesser extent, there are some problems with pathogens. In drought conditions increase mildew attack on cucumbers, melons, squash, pumpkins, peppers, tomatoes, carrots, okra. To some extent increase the incidence of *verticillium dahliae* to peppers, eggplants, tomatoes and okra (Costache and Lăcătuș, 2012 a, b).

Climate change globally and regionally, significant and permanent increase in demand for fresh vegetables and quality, achieving very high yields, achieving high coefficient of fossil energy production, the possibility of practicing advanced technologies and "friendly" to the environment and consumer, making the best possible research results, to which we add both reducing imports, especially availabilities for export growth are decisive arguments regarding vegetable development strategy in Romania, namely, increasing the area of protected crops, the greenhouses and to some extent of the heated, in view of the market and special offer everything needed for the construction and use of solar (Baudoin, 1999; Boulard and Antipolis, 2005).

.A tripling of the plastic houses surface may be one of objectives, knowing that vegetables are the best insurance against climate damage (Lăcătuș and Cârstea, 2012). It is necessary to increase the surface at about 21,000 ha by 2020 (year in which grants will be awarded), with an annual rate of 1,500-2,000 ha. Such comments and feedback I found other authors referring to trends in the sector worldwide (Robinson and Brae, 1991; Boulard, 2008; Castilla and Leonardi, 2010). Moreover, in the world there are 16 million hectares of protected crops, of which China has more than 10 million hectares, increasing its surface 7 times after 1990 (Cantliffe and Vansickle, 2009). In Europe the trend of increasing the area of protected crops is very clear, which is about 700,000 ha with an average increase of 1.5-2 times. Spain has around 200,000 ha, Greece increased the area 10 times

during 2000-2010 reached 5,000 ha (Papadopoulos and Demers, 2002), Turkey has over 55,000 ha, of which 33 % low tunnels (Sezen et al., 2006; Yilmaz and al., 2005) , even Moldova has increased area six times during 2000-2009, reaching 462 ha of which 412 ha plastic houses (Rosca and al ., 2009) . In these countries we add Israel to an increase of 6.5 times reached 35,000 ha and 90,000 ha United States an increase of 4 times.

Also there is an interest to increase the area of heated greenhouses. Although discussions on their effectiveness in terms of harsh winters in our country, new types of construction, facilities to reduce at maximum heat loss, spectacular genetic progress at biological material and new technologies, changing optical economic analysis. Especially if the area of a farm is at least 10 ha and production is valued mainly for export, thus avoiding price fluctuations as a result of the fact that in our market do not work, but also because purchasing power.

Table 2. Protected vegetable crops development in Romania (ha)

Crop	Year		
	2014	2017	2020
Tomatoes, spring season	4,000	7,250	10,000
Tomatoes, autumn season	2,500	5,000	7,500
Cucumbers spring season	500	1,000	1,250
Cucumbers autumn season	1,750	3,500	5,250
Squash spring season	750	1,000	1,250
Garden beans, spring season	750	1,000	1,500
Pepper, prolonged cycle	1,000	1,500	2,000
Eggplants, prolonged cycle	1,000	1,500	2,000
Cabbage and cauliflower, spring season	500	1,000	1,500
Cabbage and cauliflower, autumn season	750	1,500	2,250
Ather vegetables, prolonged cycle	500	1,000	1,500
TOTAL	14,000	25,250	39,000
From wich, spring season	6,500	11,250	15,500
autumn season	5,000	10,000	15,000
prolonged cycle	2,500	4,000	5,500

Usually the yields under plastic house are three or four times more than in open field. For example:

- tomatoes, spring-summer season: 5,5-6,5 kg/m²;
- tomatoes, summer/autumn season: 3,5-4,5 kg/m²;
- tomatoes, prolong season: 10-12 kg/m²;
- cucumbers, autumn season: 4-6 kg/m²;
- sweet pepper, prolonged season: 7-9 kg/m²;
- egg plant, prolonged season: 9-10 kg/m²;

On average, currently we get between 10 and 15 kg/m²/year. These yields are smaller than in Holland, where they get for tomatoes 40-45 kg/m², for cucumbers 55-60 kg/m²; for sweet peppers 25-30 kg/m² and for green beans 30-34 kg/m² (Baudoin, 1999). The difference is make more by the technology and less by the weather conditions.

Talking about the whole vegetable Romania, in the field, green and plastic houses, we propose the following dynamics of development (Table 3):

Table 3. The dynamic of vegetable areas and possible yields in 2014-2020 period

YEAR	Area, thousands ha		Yield, thousands tones		
	Open field	Protected ^a	Open field	Protected ^b	TOTAL
2014	85,0	9	1.955	866	2.821
2015	87,5	11	2.012	941	2.953
2016	90,0	13	2.070	1.083	3.153
2017	92,5	15	2.127	1.279	3.424
2018	95,0	17	2.185	1.511	3.696
2019	97,5	19	2.340	1.725	4.065
2020	100,0	21	2.400	1.939	4.339

^a) about 7,000 ha come from the before years;

^b) about 441 thousands t from the existed system in 2013.

Under these conditions, the Romanian vegetable production in 2020 would look like:

- average consumption of vegetables: about 190 kg/capita/year;
- population: about 19.1 million people;
- need of fresh vegetables: 3.629 million t/year;
- mean import vegetables necessary: about 200,000 t/year;
- total domestic production: 4.339 million t/year, of which:
 - o from open field 100,000 ha x 24 t / ha = 2.4 million t/year;
 - o from protected areas (glass and plastic houses) 21,000 ha x 92 333 t/ha = 1.939 million t/year;
- in addition for export: 910,000 t/year.

Table 4. Providing the necessary vegetables and export availabilities

YEAR	Providing the necessary vegetables				Vegetable yeald	
	Mean consumption, kg/hab.	Total nedeed, thousand t	From local production, thousand t	From import, thousand t	TOTAL thousand t	Disponibility for export, thousand t
2014	154	2,941	2,721	220	2,821	100
2015	158	3,018	2,803	215	2,953	150
2016	164	3,132	2,922	210	3,153	231
2017	170	3,247	3,047	200	3,424	377
2018	176	3,362	3,162	200	3,696	534
2019	183	3,495	3,295	200	4,065	770
2020	190	3,629	3,429	200	4,339	910

At present, on the market, there is a very rich and diverse offer on constructive models of plastic houses and even greenhouses, at prices ranging between 6 and 30 €/m² depending on building characteristics (height, width, diameter and quality of pipes, area) equipment, ventilation and irrigation, duration of use of the plastic film, etc.

In this situation requires an analysis both relevant and responsible when we decide to purchase a plastic house. We believe that if our proposal would be considered and would be launched this program, similar to those in viticulture and fruit growing, vegetable growing program to save Romania will be required many detail. For example, such a program must take place in a precise

and organized framework, and material necessarily supported by the government and especially the European Union. Thus we will be able to impose criteria of solidity of construction, of area and of organization who would benefit from financial support. It is mandatory that tanning skeleton to withstand snowfall and to wind. Surface of a plastic house minimum is 1000 m² and 200-400 ha, relative to in the same location. Another element is the form of organization of producers. They have to understand that government can not work effectively on high performance than the producers gathered in a manufacturing organization, carefully recorded and taxable!

In such a framework, government or NGOs representing producers, could bid the construction of such green and plastic houses, negotiating not only an advantageous price, but a particular type of plastic house or 2-3 types of these. In our opinion, at present, such a price would be about 15 €/m². In this case, to achieve that goal would require a fund of 2.1 billion €, which provide 50 % of the EU, 25 % from government and 25 % of the own funds of producers (Table 5). After such a scheme, the producers would pay just € 3.75/m²!

Table 5. Needs and providing funds for the development of protected vegetable sector

YEAR/Period	Area, ha	Necessary funds, mil. €,			
		TOTAL	From UE	From government	From farmers
2014	2.000	300	150	75	75
2014-2020	14.000	2.100	1.050	525	525

Sure that the sharing of funding sources is a proposal, which can be changed in relation to the realities of protected vegetable production in Romania, especially our farmers, who today are not at all easy to develop efficient from their own funds. But no longer tolerate the construction of plastic houses totally condemned by our climatic conditions. Heavy snow this year and in previous years, particularly affecting timber construction, which not only have this disadvantage. The reduced height of 2.5-3.5 m from the ridge, sometimes amid great lengths just unbelievable, it's hundreds of feet, lack of ventilation, physiological causes great problems for plants in summer. If we add to this the quality of the plastic film, we see that basically these producers of vegetables in plastic houses, year after year, taking almost from scratch!

Table 6. Balance of income and cost of protected vegetable sector

YEAR	Area th. ha	Cost th. €	Income, thousand €		tax 16 % on income, thousand €	Profit,	
			total	from export		total thousand €	€/ha
2014	9	376,020	697,000	370,500	111,520	209,460	23,273
2015	11	459,580	992,000	663,000	158,720	373,700	33,973
2016	13	543,314	1.226,000	864,000	196,160	486,526	37,425
2017	15	626,700	1.459,000	1.063,500	233,440	598,860	39,924
2018	17	710,260	1.692,000	1.263,000	270,720	711,020	41,824
2019	19	651,320	1.907,000	1.435,500	305,120	950,560	50,029
2020	21	719,880	2.121,000	1.606,500	339,360	1.061,760	50,560
TOTAL	21	4.087,074	10.094,000	7.226,000	1.615,040	4.391,886	277,008

Average (weighted) expenditures (construction, foil, irrigation system, seeds, organic and mineral fertilizers, pesticides, labor, miscellaneous materials, etc.), and income from the sale of wholesale for domestic but also external, a balance that results shown in Table 5.

Expenditure per ha in the first five years were considered to be about 41.780 € and 34.280 € further. May we find in Table 6 that the revenue and hence profit per unit area increases from one year to another. This increase is due to increased exports from 53 % in 2014 to 76 % in 2020. Regarding taxation walked on current provisions imposing a tax of 16 % on income. Of course it adds to the tax on land, but do not consider it significant. Regarding a possible tax on actual construction, we believe that it is questionable, but anyway it would not greatly alter the balance of income and expenses.

Based on these considerations and economic figures, we calculated that would payback the financial effort made by the Government for the Romanian vegetable development program (Table 7).

Table 7. Recovery the financial founds of Government invested in protected vegetable crops

YEAR	Government support, thousand €	Recovery from tax on income, thousand €	Differences thousand €	Cumulative difference, thousand €
2014	150,000	111,520	- 38,480	- 38,480
2015	150,000	158,720	+ 8,720	- 2,760
2016	150,000	196,160	+ 46,160	+ 16,400
2017	150,000	233,440	+ 83,440	+ 99,840
2018	150,000	270,720	+ 120,720	+ 220,560
2019	150,000	305,120	+ 155,120	+ 375,680
2020	150,000	339,360	+ 189,360	+ 565,040
TOTAL	1.050,000	1.615,040	+ 565,040	+ 565,040

We see from Table 6, although with our approximations, that basically since 2016 in the 3rd year of release development program protected vegetable crops - PROLEGPRO - money invested by the Government are recovered through taxation by 16 %. Moreover, at the end of the program, year 2020, the government realized a profit of more than half a billion euro.

Analyzing "cold" this proposal, sure enough question marks appear. One of the questions would be about "interest" EU to fund such a program. We think so, especially if most of the investment would have purchased all of the EU – plastic house itself, plastic film, irrigation system, seeds, pesticides, fertilizers, etc. Another question would refer to the manufacturer's ability to grow. We believe that manufacturers are currently having this possibility. Evidence is increasing, however, the area protected crops, which has doubled in the last 15 years. If we take into account that now the cost of self-constructed plastic house, which is relatively poorly, stands at 4-6 € / m², it is clear that the program becomes extremely attractive offer (3.75 € / m²). But perhaps the most difficult question as the related markets. The program is subject to export! But as in the past managed to export hundreds of thousands of tons of vegetables? Although it is not easy in the current international conditions, we believe that it is perhaps more difficult to organize in producing these vegetables. With some effort could revive some external relation to the export of fresh vegetables and quality.

In May 1999, Pope John Paul II visiting our country, made the statement that "*Romania is the Garden of the Virgin*". Of course this statement has a meaning very complex, including the fact that Romania has fertile land, water sources and not least light, our country being in the European B sunshine. If we add the fact that we have a tradition in this sense, we proved that we can, we have

vegetable gardeners who want to develop, agriculture may be economic to get us out of the crisis, we do not only have to believe, to we have political will and to do so.

REFERENCES

- Baudoin, W. O. (1999) Protected Cultivation in Mediterranean Region. *Acta Horticulturae*, 486, 23-30.
- Boulard, T. (2008) Peut-on concilier production sous serre et development durable? Serres horticoles et énergie, quelle avenir? *ASTREDHOR*, 37 p;
- Boulard, T., Antipolis, S. (2005) Viabilité des systèmes de cultures protégées dans un contexte d'agriculture durable: ECOSERRE (Internet).
- Bauwe, H., Hagemann, M., Fernie, A.R. (2010) Photorespiration: players, partners and origin. *Trends Plant Sci*, 15, 330–336.
- Cantliffe, D. J., Vansickle, J.J. (2009) Competitiveness of the Spanish and Dutch Greenhouse Industries With the Florida Fresh Vegetable Industry. Univ. of Florida, from <http://edis.ifas.ufl.edu>
- Castilla, N., Leonardi C. (2010) Greenhouse vegetables production strategies in Europe: alternative crops. Canada Greenhouse Conference.
- Castilla, N., Lopez-Galvez, J. (1994) Vegetable crops responses in improved low-cost plastic greenhouses. *J Hort Sci*, 69(5), 915-921.
- Costache, M., Lăcătuș, V. (2012a) Agenți patogeni “de sezon” la culturile de tomate din solarii. *AGRICULTORUL ROMÂN*, 6, 12-14.
- Costache, M., Lăcătuș, V. (2012b) Agenți patogeni cu importanță economică la culturile de castraveți din solarii și controlul acestora. *AGRICULTORUL ROMÂN*, 7, 18-19.
- Lăcătuș, V. (2006) Soil agrochemical peculiarities for vegetable. The 4-th UEEA Meeting & International workshop on “soil fertility and future of agriculture in Europe”. Bucharest.
- Lăcătuș, V. (2008) Dezvoltarea durabilă a culturilor protejate, o cerință stringentă a legumiculturii românești. *AGRICULTORUL ROMÂN*, 8, 22-26.
- Lăcătuș, V. (2010) Tuta absoluta – un dăunător nou în cultura tomatelor. *HORTINFORM*, 6 (182), 19-20.
- Lăcătuș, V. (2011a) O dereglare fiziologică de sezon în legumicultură – CARENȚA DE CALCIU. *AGRICULTORUL ROMÂN*, 6, 20-22.
- Lăcătuș, V. (2011b) Virozele fac ravagii în culturile de tomate din solarii. *AGRICULTORUL ROMÂN*, 8, 13-15.
- Lăcătuș, V., Cârstea, L.N. (2007) Drip fertilization of protected vegetable plants. International Symposium “The restoration of soil fertility through different fertilization systems in sustainable agriculture”, Timișoara, 22-23 June, 307-323.
- Lăcătuș, V., Costache M., Badea, R. (2009) And in drought conditions it can cultivate vegetables. *HORTICULTURA*, 9-10, 3-5.
- Lăcătuș, V., Glăman, G., Țuțianu V., Costache M., Cârstea, N.L. (2010) Comercial disorders of tomato fruits – posibil causes and control. I. Disorders depending of climate, genetic and technological factors. II. Disorders depending of technological and pathological factors. *USAMV Iași. Lucrări științifice, Seria horticultură*. 53, 1, 287-298.
- Lăcătuș, V., Cârstea, L.N. (2012) Plastic protected vegetables crops, the best assurance against climatic changing. Proceedings of the 2nd international workshop of The Environment & Agriculture in arid and semiarid regions. Constanța, 6-7 sept., 353-360.
- Papadopoulos, A. P., Demers, D.A. (2002) Greenhouse Horticulture, from www.answers.com/topic/greenhouse-horticulture;
- Robinson, D. W., Brae, B. (1991) Developments in Plastic Structures and Materials for Horticultural Crops. FOOD AND FERTILIZER TECHNOLOGY CENTER, Taiwan.
- Roșca, V., Gogu, L., Belschi, Al., Zaharia, N., Fritsch, C. (2009) Protected cultivation of vegetables in Moldova. Agribusiness Development Project.
- Sezen Metin S., Gulendam Celikel, A. Yazar, A., Mendi, Y.Y., Sahinler, S., Tekin, S., Gencel, B. (2006) Effects of Drip Irrigation Management and Different Soilless Culture on Yield and Quality of Tomato Grown in a Plastic House. *Pakistan J of Biol Sci*, 9(4), 766-771.
- Sandu, I., Mateescu, E. (2012) Extreme weather events in Romania in the context of current and expected climate change. XX-th National Conference of Soil Science with International participation-Quality status of soil resources and environment protection in Oltenia region, Craiova. Oral communication.
- Yilmaz, I., Sayin, C., Ozkan, B. (2005) Turkish greenhouse industry: past, present and future. *New Zealand J of Crop and Hort Sci*, 33, 233-240.