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ROUNDUP READY SOYBEAN, A ROMANIAN STORY

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Abstract. Romania is one of the few European countries with favourable conditions for soybean production. Herbicide tolerant (HT) soybeans (Roundup Ready, RR) were grown commercially beginning with 1999 and accounted for 68% (or, in absolute figures, 137 thousand hectares) of all soybeans planted in 2006. Farmers who used RR soybeans indicated that this crop was the most profitable arable crop grown in Romania, with gains derived from higher yields and improved quality of seed coupled with lower costs of production. Other advantages: increased convenience and management flexibility; small saving on harvest cost; significant benefits in the crop rotation pattern. In a representative sample of commercial farms, the profit margin per hectare ranked between EUR 100 and 187, corresponding to a production range varying from 3 to 3.5 tonnes/ha, while, in the same market year (2006), conventional soybean growers were running losses. The incremental income was the result of herbicide cost reduction (on average, 1.9 treatments applied to RR soybeans and, respectively, 4.3 treatments to the conventional one) as well as the higher yields (3-3.5t/ha for RR versus 2 t/ha for the conventional product). In 2006, Romania stood among the eight countries that cultivated this crop worldwide. In 2007, as a Member State of European Union, it banned cultivation of this crop, although growing HT soybeans in Romania generated substantially higher net farm income gains per hectare than in any of the other country using the technology. As a result, in only two years, the area planted to soybeans has shrunk with 70%, while Romania became a net importer of vegetable protein, just like the European Union itself. At the national economy's level, hard currency losses (as a result of increased imports) are estimated to exceeded $US100 million per year, while domestic farmers are deprived from using a unique opportunity to produce an export crop and lower the cost of animal feed, increasing their competitiveness in the global marketplace.

The existence of a legal framework is the necessary, but not the sufficient condition for adopting the right decisions in a certain field and at a certain time. Of equal importance is the enforcement - on a scientifically sound basis and in good will - of the existing laws, for the use of a certain social group and, at the end of the day, of the whole society. At the same time, an excessive legal framework, enforced without responsibility, may trigger dramatic socio-economic consequences.

INTRODUCTION

Romania adopted its initial legislation on bio-engineered products in 2000. This first law was the Government Ordinance 49/2000 that, due to its specificity regarding the regulatory process, aided the adoption of some genetically modified crops by Romania's agriculture. Thus, the National Biosafety Commission (NBC), made of representatives of relevant regulatory agencies, but also comprising members of public research institutions, had a major role in making decisions. Especially the academics' presence in the NBC led to a science-based approach, while the fact that the country had made important steps in setting up a legal framework encouraged the technology developers to enter the Romanian market with products already approved elsewhere. Among the first were the notifications submitted by Monsanto, for Roundup Ready soybean and Superior NewLeaf potato environmental release, products approved by NBC for commercial cultivation.

Law 214/2002 approved Ordinance 49/2000, bringing a number of changes and

additions, including the fact that the Biosafety Commission became the scientific authority with a consultative role. Under the new circumstances, decisions regarding the environmental release of bioengineered crops (either for commercial cultivation or experimental purposes), although requiring the endorsement of the Biosafety Commission, would be more susceptible to be politically influenced. One of the results was the fact that, within the Government Meeting of January 25, 2006, it was agreed that GM soybean cultivation would be forbidden from January 1, 2006, for the purpose of keeping a tight conformity with the European *acquis*. Notably, Romania had never asked a waiver or a transition period for this GM crop, which does not have a permit for commercial cultivation, but it is largely imported within the Union. This paper examines the farm and national level impact of abruptly removing RR soybeans from Romania's crop pattern.

SOYBEAN PRODUCTION IN EUROPE

In Europe, soybean production is fairly limited, mainly because of the less favourable climatic conditions. The major EU soybean growers are described in Table 1. Since Europe has a large protein deficit, it is highly dependent on soybean imports. In 2006, the European bloc imported about 14 million MT of soybean and 17 million MT of soybean meal.

Table 1

Soybean producers in Europe

Year 2006	Countries					
	Romania	France	Republic of Serbia	Italy	Ukraine	Russian Federation
Area harvested (ha)	190 800	45 263	156 680	177.909	725 000	810 130
Production (tonnes)	344.900	122 995	429 639	551 292	889.000	806 570
Yield (kg/ha)	1807,0	2717,34	2742,14	3098,73	1226,21	995,61

Source: FAOSTAT 2006

In 1955 Romania was producing 14,000 tonnes, but this declined steadily to a low of 1,000 tonnes in 1965. A renewed interest in soybean production in Eastern Europe was registered starting with 1966, with Romania leading the way. Production jumped from 20,000 tonnes that year to 298,000 tonnes in 1974, then rose to 448,000 tonnes in 1980 (Shurtlef & Aoyagi, 2007). In 1989, the reported production was 303,900 tonnes (FAOSTAT, 2006).

Table 2

Soybean production in Romania

Year	Harvested area (ha)	Production (tonnes)	Yield per hectare (kg/ha)
1989	512,000	303,900	593.32
1990	190,228	141,173	742.13
1999	99,800	183,400	1838.0
2000	117,000	69,500	994.02
2001	44,800	72,700	1623.0
2002	71,800	145,900	2033.0
2003	128,800	224,900	1840.06
2004	122,400	298,506	2452.0
2005	143,100	312,800	2186.0
2006	190,800	344,900	1807.0
2007	113,100	107,400	949.0
2008	53,000	90,000*	1700.0*

Sources: FAOSTAT 2006; Ministry of Agriculture and Rural Development (MARD), 2008
*Current official estimates

Table 3

Romania's trade with soybeans (calendar years)

	2005		2006		2007	
	'000 USD	MT	'000 USD	MT	'000 USD	MT
IMPORTS						
Soya beans	989	1,165	4,244	11,945	33,968	68,559
Soya meal	24,451	88,133	21,851	81,554	74,500	108,604
EXPORTS						
Soya beans	12,444	49,800	12,886	54,200	6,334	22,100
Soya meal	4,155	6,503	1,654	6,585	23,616	65,944

Source: GTI (Global Trade Atlas).

A GLOBAL PERSPECTIVE

Soybean is one of the world's most important and fastest expanding crops and it contributes considerably to overall human nutrition. The main soybean producers are USA, Brazil, Argentina, and China.

Since 1996, the first year of global commercialisation of biotech crop, herbicide tolerant soybean is the most grown engineered crop. In 2007, the global area planted to herbicide tolerant soybean was 58.6 million hectares, equivalent to 64% of the global 91 (FAOSTAT, 2005) million hectares of soybean (James, 2007).

The introduced resistant-glyphosate trait provides the farmer with an additional option for in-season broad-spectrum weed control in soybean. No specific harvesting techniques are required. Traditional harvesting equipment and post-harvest storage techniques and conditions remain applicable (Badea & Otiman, 2006).

Roundup Ready soybean (event 40-3-2) is approved for marketing in EU. After clearance in the US in 1994, consent for importation into the European Union was also given with Commision Decission 96/281/EC dated 3 April 1996. This decision allows for the importation of seed into EU for industrial processing into non-viable products including animal feeds, food and any other products in which soybean fraction are used, only. RR soybean is approved for marketing only in Australia, China, Korea, Swiss, Philippines, Japan and Russia.

Table 4

Countries that cultivated RR soybean in 2006-2007

Country	Soybean hectarage (million)	
	2006	**2007**
USA	30.3	24.2
Argentina	15.8	16.0
Brazil	11.4	14.5
Paraguay	2.0	2.6
Canada	0.75	0.69
Uruguay	0.37	0.47
South Africa	0.16	0.14
Mexico	0.05	0.04
Romania	0.14	-

Source: James, 2007

The varieties derived from the event 40-3-2 were the first generation of RR soybean. This event was approved for market release in Romania from 2000 until 2006. Now, there is on the market the second generation of the popular Roundup Ready® technology in soybeans, Roundup Ready 2 Yield, approved in the United States, Canada, Mexico, Taiwan, Japan, the Philippines, Australia and New Zealand. The U.S. Department of Agriculture reported in 2008 that 92% of the nation's field soybeans crop were biotech varieties. In addition, the

European Food Safety Authority (EFSA) has issued in 2008 a positive scientific opinion concluding Roundup Ready 2 Yield is safe for import as food or feed.

ROUNDUP READY SOYBEAN IN ROMANIA

In Romania, the commercial cultivation of RR soybean was approved in 1999. Beginning with that year, area devoted to this crop expanded constantly, peaking in 2006 (the eighth year of use of the technology) at 137 thousand ha. In 2006, 6 varieties were marketed (5 of Monsanto and a Pioneer one). One of the issues for the regulators was the fairly widespread use of saved seed, although in the year preceding country's EU accession the legislation required the use of certified seed for traceability purposes.

The growing of GM HT soybeans in Romania resulted in substantially greater net farm income gains per hectare than any of the other countries using the technology (Brookes & Barfoot, 2008). According to Brookes & Barfoot (2008), yield gains of an average of 31% have been registered. The average net increase in gross margin in 2004 was $264/ha (an average of $157/ha over the six years of commercial use); at the national level, the increase in farm income amounted to $28.6 million in 2006. Cumulatively since 1999 the increase in farm income has been $92.7 million (in nominal terms); in added value terms, the combined effect of higher yields, improved quality of beans and reduced cost of production on farm income in 2006 was equivalent to an annual increase in production of 33% (124,000 tonnes). In spite of these obvious benefits, it was decided by the Government, in its meeting of 25 January 2006, that a moratorium on RR soybeans plantings was going to be introduced

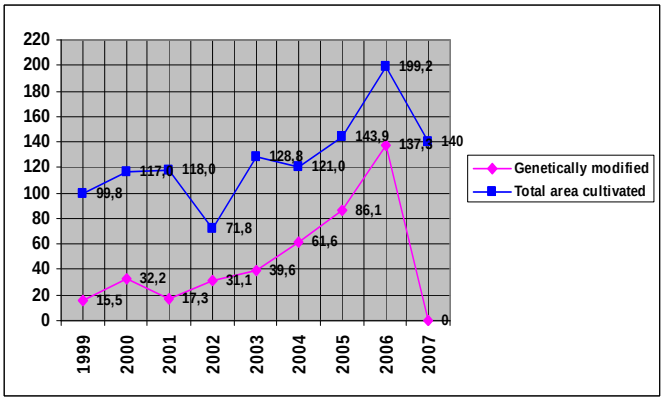

Fig. 1 Soybean area in Romania

from the beginning of the following year, as the product was not in conformity with the EU legislation. Romanian's role as a biotech promoter was clearly in jeopardy in anticipation of the European membership, despite the continued support from farmers and scientists. Given the pressure from the EU, and Romania's weakened bargaining position at the time, the country never tried to negotiate with the European Commission a transitory mechanism for saving the unique opportunity to produce an export crop and lower the cost of producing animal feed.

THE IMPACT OF DISCONTINUING RR SOYBEAN CULTIVATION

Official statistics indicated that in 2005, the RR varieties accounted already for two thirds of Romania's total soybean area of 130 000 ha. As already mentioned, in an attempt to intensify the pace of bringing its biotech regulatory capacity into line with the *acquis communautaire*, the authorities were already in January 2006 highly committed to discourage biotech plantings, which resulted in a broadly disseminated announcement about a subsidization program for conventional soybeans for that year (The level of subsidization was RON 500./MT, that is approx. EUR142/MT).

Nevertheless, the hectarage of transgenic soybeans went up to 137 thousand, from a total of 199 thousand. For the second year in a row, with a production close to 350000 tonnes,

Romania started shipping its exportable surplus of soya beans to countries like Turkey, Italy, Hungary, while its imports of soybean meal went down substantially. At a normal pace of expansion, biotechnology would have made easily the country self sufficient in vegetable protein (as already in 2005 soybean meal imports halved compared to the previous years).

With no access to the RR technology, the soybean area has started to decline in 2007, reaching 113 thousand ha, while in 2008 only 53,000 ha were planted to this crop (MADR). This is equivalent with a 70% reduction in only two years.

In 2006, the average productivity of RR soybeans was 1950 kg/ha, compared to 1467 kg/ha for conventional soybeans, or, in other words, the transgenic product yielded with 33% more than the conventional one. Romania is one of the few Member States with favorable climatic and soil conditions for soybeans, with a potential assessed by the Ministry of Agriculture at half a million hectares. Resuming farmers' access to the cutting-edge technology could contribute significantly to country's intra-EU deliveries. The European bloc imported in the marketing year 2006/07 a total of over 37 million tonnes of beans for crushing and soybean meal, from Argentina, Brazil, US and Paraguay, countries largely producing RR soybeans.

In value terms, the effects of discontinuing the technology are even more dramatic on Romania's trade balance. With agricultural prices going up to unprecedented levels in 2007, the import bill for soybean meal was close to US$75 million, from 22 million in the previous year. On the background of a limited domestic production from the 53,000 ha allocated to the crop in spring, the vegetable protein deficit of the country is expected to go up to 175,000 MT annually, which corroborated with the price trend registered in 2008 (Futures price: 590 USD/MT, CIF Rotterdam) will result in over US$ 100 million import worth.

At the same time, Romanian farmers are deprived from a crop with significant trade potential. Considering just the production on a hypotethic area of 200 thousand ha (on which RR soybean could have easily expanded) with an average productivity of 2000 kg/ha, and at a market price of roughly US$580/tonne, the estimated gross income loss stands at US$230 million. Of course, the analysis should be expanded further to determine the net gain loss, by taking into consideration the production costs at the current market levels.

The results of a survey conducted at the end of 2006 (Study prepared by Ask (www.askbmi.com) and commissioned by Monsanto Europe) on a sample of 160 soybean growers (Of which all 160 cultivated RR soy, but 54 planted conventional soy as well)(operating commercial farms, with the appropriate input mix and technology) in 14 key counties show a number of interesting facts, as follows: (i) conventional soya was treated on average 2.3 times with herbicides per campaign with about 10% of growers making four applications. RR soya was treated on average 1.63 times – but two was maximum number of treatments; (ii) farmers mentioned spontaneously many more disadvantages than advantages for the conventional soya, especially linked to the higher production costs, the lower yield, the lower production quality, the greater difficulties to control weeds efficiently, the lower profit, the greater care needed and the lower flexibility; (iii) RR technology was rated much more positively, with more than 10 attributes mentioned as key advantages by more than 75% of the respondents and spanning a very wide spectrum: excellent weed control, high yield, higher profitability, quality of the crop, convenience, better for the environment; (iv) growing RR brought a considerable higher income than growing conventional soya - when buying the RR package and doing two herbicide treatments, the net income came to around 170 euro/ha, while with conventional seeds yields a net income of about 85 euro/ha – but when four treatments were needed, net income was as low as 25 euro/ha.

ESTIMATED IMPACTS AT FARM LEVEL: CASE STUDY

TCE 3 Brazi srl is Romania's largest commercial farm that adopted RR soybeans already in 2001 on 9350 ha, while in 2006 the crop was expanded on 17 thousand hectares. By introducing two genetically modified varieties, average productions grew from 1060 kg/ha in 2001 to 3870 kg/ha in 2005.

Reduction in production costs. The farm is located in the floodplain of the Danube River on the „Big Braila Island" (eastern part of Romania). This region has a large weed reserve, extermely tough to control (*Sorghum halepense*, *Cirsium*, *Phragmites*, *Agropiron repens*, etc.). As a consequence, the number of treatments in 2006 was, on average, 1.9 for RR soybeans and 4.3 for the conventional one, or, in absolute figures, the conventional technology incurred herbicide costs with EUR 115/ha higher than the GM one (for the latter, the herbicide-application bill stood at EUR 35/ha). Because of the difficulties in weed control, conventional soybeans proved to be economically unviable on the „Island", despite the very good soil and favorable climate conditions. With all technology in place and under irrigation, the record high was around 2000 kg/ha, bringing a gross income of EUR 355/ha at the 2006 farmgate prices. Nevertheless, after deducting the production expenses of roughly EUR 600/ha, the ultimate financial result was a loss of 248 Eur/ha. By comparison, RR soybeans cultivation resulted in significant margins at farm level. According to the statistics registered at TCE 3 Brazi, based on calculations on various parcels, for a production varying between 3000 kg/ha to 3500 kg/ha, the corresponding net income ranges between EUR 100 ha and 187, respectively. Following the discontinuation of the RR technology, in 2007 the farm allocated 8000 ha to conventional soybeans. Unfortunately, the financial results were disastrous and determined manager to totally eliminate soybeans from the production pattern in 2008.

CONCLUSIONS

Total soybean cultivated area in Europe is small in comparison to the potential this crop has in Romania. Area cultivated could go up to 500,000 ha which, at a normal yield, would result in an exportable surplus 800,000 - 1 million tonnes of beans, meal and cakes. Another opportunity generated by the current dynamics of the global market is the use of soybean oil for biodiesel production. In spite of all these possibilities, Romania is currently increasingly dependent of soybean imports.

The existence of a legal framework is the necessary, but not the sufficient condition for adopting the right decisions in a certain field and at a certain time. Of equal importance is the enforcement - on a scientifically sound basis and in good will - of the existing laws, for the use of a certain social group and, at the end of the day, of the whole society. At the same time, an excessive legal framework, enforced without responsibility, may trigger dramatic socio-economic consequences.

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