

PERCEPTIONS OF BRAZILIAN SMALL-SCALE FARMERS ABOUT GENETICALLY MODIFIED CROPS

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The GM controversy

Genetically modified (GM) crops or ‘transgenics’, as they are popularly known in Brazil, represent the most rapidly adopted agricultural technology in recent history, according to the International Service for the Acquisition of Agri-biotech Applications (ISAAA) (JAMES, 2012). Seventeen years after they were introduced in 1996, GM varieties are cultivated in 28 countries, with a total cultivated area of 170.3 million hectares. For the first time, in 2012, developing countries planted more GM crops (52%) than industrialized nations (48%). In addition, ISAAA estimates that 90% of the 17.3 million farmers who cultivated GM crops in 2012 were smallholders in developing countries.

Despite the numbers and high adoption rates, the cultivation of GM crops is far from being widely accepted. In some countries, attempts to introduce and establish GM food crops have led to disputes between different interest groups. This has led to the

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introduction of legislation to regulate the use and sale of new biotechnical products (DURANT *et al.*, 1998; BAUER and GASKELL, 2002).

In Brazil, contrary to neighboring Argentina, where GM crops were adopted in 1996 without opposition (MASSARANI *et al.*, 2013); GM crops have been a controversial issue. Attempts were made in 1998 to produce this type of crop on a commercial scale, but legal battles led by the Consumer Defense Institute (IDEC) and Greenpeace managed to block the sale and delay official approval for cultivation of GM crops for nearly seven years. However, despite the legal obstacles, in February 2003 it became public knowledge that most of the soy produced in Brazil was genetically modified and planted illegally in the State of Rio Grande do Sul.

In this context, a new government took office and was under pressure to find a rapid solution to the problem. The many different interests involved and short-term demands made by pressure groups led to a turbulent process, which resulted in a new Biosecurity Law being passed in 2005. In general terms, the new law made it possible to produce Monsanto RR® soy on a commercial basis and create mechanisms to evaluate case by case requests to cultivate other GM varieties.

In the midst of this intense controversy and complex business and decision-making deals, few efforts were made to understand the viewpoints of different sectors of society in relation to GM products (GUIVANT, 2006; ALMEIDA and MASSARANI, 2011), especially compared to the many initiatives in developed countries (see, for example, EUROPEAN COMMISSION, 1997; INRA, 2000; EINSIEDEL *et al.*, 2001; MARRIS *et al.*, 2001; STEERING BOARD, 2003; GASKELL *et al.*, 2003, 2006, 2010; TODT *et al.*, 2009).

Quantitative research conducted at the time with representative samples of the Brazilian population instigated by Greenpeace revealed broad public rejection of genetically modified organisms (GMOs) and the desire that they be banned (IBOPE, 2001, 2002, 2003).

Even fewer attempts were made to understand the position of smallholders with respect to GMOs, who, according to the ISAAA and other defenders of the technology, are the main beneficiaries (JAMES, 2011; MONSANTO, 2010; SYNGENTA, 2013). Besides being directly affected by the introduction of GM crops in Brazil, this group plays an important role in promoting this cultivation in the country and is partly responsible for the future of Brazilian agricultural biotechnology.

Guehlstorf (2008), who addressed the silencing of farmers in the formulation of public policies related to GMOs in the United States, considers it regrettable that these actors should be excluded from the discussions and decision-making processes on agricultural biotechnology. Their first-hand knowledge could be useful in adapting the new technology to their real needs and could help to resolve the disputes between defenders of GM crops and their critics more objectively.

The scope of this study is to establish how smallholders in Brazil evaluate GMOs. In addition, we would like to better understand if and how these actors seek to be involved in the decision-making processes related to new agricultural technologies.

What do farmers think about GM crops?

The literature on what farmers think about GMOs is not conclusive. It is still difficult to understand why certain farmers decide to use and continue to plant varieties of GM crops, while others decide not to experiment and others try them but are dissatisfied and abandon the technology. Even in the countries that are the largest producers of GM crops in the world, opinions are varied and often conflicting.

Studies carried out in the United States – the world's largest producer of GM crops – reveal a broadly positive view of GMOs among American farmers. It should be stressed that most of these studies are quantitative and based on closed questionnaires; in addition, they make no distinction between small and large-scale producers.

For producers living in states where the cultivation of GM varieties of corn and soy is widely disseminated, the main benefits gained by adopting these varieties are lower production costs (DARR and CHERN, 2002; VAN DER SLUIS and VAN SCHARREL, 2002; CHIMMIRI *et al.*, 2006), a reduction in the use of pesticides (DARR and CHERN, 2002; VAN DER SLUIS and VAN SCHARREL, 2002) and a simple and efficient system of weed control which only requires one pesticide to control a broad variety of weed. (CARPENTER and GIANESSI, 1999; PILCHER *et al.*, 2002; VAN DER SLUIS and VAN SCHARREL, 2002; MERRILL *et al.*, 2005; CHIMMIRI *et al.*, 2006). In addition, some studies show that an increase in productivity is associated with Bt maize (PILCHER *et al.*, 2002; CHIMMIRI *et al.*, 2006) and herbicide-tolerant soy (ERS, 2004).

Such advantages of GM crops over conventional varieties are not, however, perceived overall, nor do they necessarily determine the technological absorption rate, or explain the wide range of views on GM crops. A series of other factors appear to be relevant, such as concerns regarding the safety of these crops for health and the environment (DARR and CHERN, 2002; VAN DER SLUIS and VAN SCHARREL, 2002; GUEHLSOTRE, 2008), the increased dependence of farmers on large corporations, and the production of agricultural surpluses (CHIMMIRI *et al.*, 2006). In addition, the payment of royalties, the ban against keeping seeds for the following harvests, the lawsuits filed by seed-producing companies against farmers, and the negative attitudes shown by foreign consumers towards GM crops in general have all had a negative effect on decisions in relation to GMOs (VAN DER SLUIS and VAN SCHARREL, 2002; CHIMMIRI *et al.*, 2006).

Few studies have evaluated the perception of GM crops among farmers in developing countries. However, we found more qualitative surveys dealing with the issue, which concentrate more on small-scale production. Several of these are highlighted in the following paragraphs.

In Argentina, the third largest GMO producer in the world (JAMES, 2012), studies show that these crops were generally viewed positively during the first years after the introduction of the technology (VARA, 2005). Argentine farmers tended to associate GM crops with better weed control, a reduction in herbicide costs, and easier and time-saving crop management. However, few associated GM crops with increased production (VARA, 2005).

Focus groups involving Argentine smallholders, conducted by Massarani *et al.* (2013) 11 years after legal authorization of GM soy in the country, show that, despite a general perception of economic benefits, there was concern about the social changes ensuing from significant expansion of this crop. Most of the profits made from GM soy by these farmers came from renting out their land for commercial production and not from the crop itself. For them, this led farmers to be more dependent on other agents and to an increase in the rural exodus and the loss of their skills and identity as farmers. Concerns about the environmental impact of GM crops were also found among Argentine farmers, especially with the appearance of herbicide-resistant weeds (MASSARANI *et al.*, 2013).

In 2001, opponents of GMOs organized two Citizen Juries in Brazil, involving smallholders and low-income people from Brazil's North and Northeast, where GM crops had not yet been planted. In both cases, GMOs were rejected as an alternative for smallholders, for the poorer population and for Brazilian society in general, based on the argument that these products could not help solving the problem of hunger and that there was still insufficient evidence about the health and environmental consequences of GMO crops to justify their release (TONI and BRAUN, 2001; CAMPOLINA, 2011). In addition, the participants demanded greater transparency on the potential risks of GMOs and in activities related to the formulation of public policies involving these products, easier access for farmers and workers to information on the issue, greater involvement of civil society in decision-making processes and, finally, more attention to alternative agricultural methods (TONI and BRAUN, 2001; CAMPOLINA, 2011).

However, qualitative research conducted in 2004 in the south of Brazil with RR soy producers shows that this technology was well accepted among these actors (LIMA, 2005). The majority faced problems with invasive weeds, which they managed to control with GM soy crops. This was the main reason why these farmers decided to adopt and continue cultivating RR soya crops. Another advantage mentioned was a reduction in expenses with herbicides. Although some farmers reported an increase in productivity with GM crops, Lima (2005) argues that this varies according to a series of other factors and that transgenic crops in themselves do not affect levels of production. Some of the concerns raised included the appearance of new types of herbicide-resistant weeds and the fact that, at that time, it was illegal to plant GM seeds.

Even though they are inconclusive, the few attempts to understand the sundry factors that help farmers form their opinions about GMOs reveal the complexity of the issue. However, a significant part of literature on the subject is limited to providing a quantitative analysis of some of the pragmatic and economic factors involved, while ignoring other relevant aspects that represent the dilemma of farmers faced with new technological options, which is what we aim to cover in this study.

The corpus of analysis

In accordance with international guidelines proposed by different authors (DEBUS, 1990; BARBOUR and KITZINGER, 1999; KRUEGER, 2002), this study was conducted

using focus group methodology. This method consists of group discussions on a given topic, mediated by moderators-researchers.

Fifteen focus groups, involving a total of 111 farmers, were conducted between February and November 2006 – one year after the new Brazilian Biosecurity Law was approved – in three states in Brazil: (1) Rio Grande do Sul (RS), responsible for almost 90% of all GM soy produced illegally in Brazil in 2004, sown from seeds smuggled from Argentina (FUTEMA, 2004); (2) Paraná (PR), a state neighboring Rio Grande do Sul, where the local government, an opponent of GM crops, made various attempts to contain the production of GM crops in the state including the application of state laws and local supervision (PELAEZ and ALBERGONI, 2004); and (3) Acre (AC), in the North of the country, where GM crops had not been introduced at the time of our field research. Five focus groups were conducted in each state, involving between 5 and 11 participants.

The farmers that formed the *corpus* of this survey have the same profile as Brazilian smallholders outlined in the last Agricultural Census (IBGE, 2006). They included 83 men and 28 women, aged between 17 and 69, with a low educational level, owning land between 1 and 110 hectares on which they plant a variety of crops for their own consumption and for local sale. Some also plant GM crops.

The 15 focus groups were recorded and transcribed in full. The results shown below represent the main interaction on the issues discussed: familiarity and practical experience with GM crops; advantages and disadvantages of GM crops in relation to conventional crops; risks related to the cultivation and consumption of GM products; engagement in the decision-making process on GM crops and other issues related to agriculture.

Key questions and arguments

Familiarity and practical experience

With the exception of some farmers from Acre, where GM crops were not yet available, most of the smallholders consulted had heard about GM crops before the focus groups. However, we observed different levels of familiarity with the subject. In general, smallholders from regions where GM crops were already being planted were more familiar with the questions and debates involved. It was noted that, within the same regions, farmers with a higher level of familiarity with the issue were those who cultivated or had already cultivated GM crops or were members of social movements or agricultural cooperatives. The farmers most familiar with GM crops, especially those who had some practical experience in their cultivation, had a more sophisticated and empirical understanding of these products.

The formal knowledge that these actors had about the techniques involved that enabled these products to be developed was limited. In the specific case of RR soy, some of the farmers showed a certain understanding of the fact that scientists had genetically manipulated the plant to make it glyphosate-resistant but none of the farmers consulted knew exactly how this process worked. A lack of understanding about the process and scientific concepts upon which it is based, are generally seen as the reason why this tech-

nology is rejected (HASSEINI and REZAEI, 2010). However, it was clear from our study – as well as from the focus groups on the subject conducted in five European countries (MARRIS *et al.*, 2001) – that a lack of scientific knowledge is not enough to explain the different views that farmers have in relation to GM crops. Their practical knowledge, their experience in daily rural life and their pragmatic viewpoint centered on concrete needs, seem to be more important in forming their opinions, in the evaluation of alternative technologies available to them and in decision-making about adopting them or not.

Advantages and disadvantages of GM soy

All farmers unanimously agreed that a reduction in the cost of herbicides was the main advantage of using GM soy, which corroborated data from Darr and Chern (2002), Van der Sluis and Van Scharrel (2002), Vara (2005), Chimmiri *et al.* (2006), Hall (2008), and Massarani *et al.* (2013). Previous studies carried out in Brazil also show that this is perceived to be the main advantage of GM over conventional crops (LIMA, 2005; FURLANETO *et al.*, 2008; CÉLERES, 2010).

Opinions differ with respect to the productivity and profitability of GM soy. Some farmers declared that their yields increased when they adopted this new technology, which confirms data by Céleres (2010) and Massarani *et al.* (2013). Others state that GM soy productivity was higher in the beginning but then began to fall, which supports the findings of research that show a worse performance for GM soy in relation to conventional crops (VAN DER SLUIS and VAN SCHARREL, 2002; FURLANETO *et al.*, 2008).

The contradictory statements of the farmers consulted leaves the productivity question open, though the fact that this refers to a single crop being produced in the same place and during the same period reinforces the idea that this is a complex measurement, involving different factors – as noted by Lima (2005) – including soil and seed quality, the proper use of agrochemicals and the level of weed infestation. In addition, it is likely that the fact that the transgenic soybean has been planted illegally for years in Rio Grande do Sul has negatively affected their production levels, since the variety cultivated was not adapted to the region and the crops were planted in secret, without technical assistance.

Irrespective of the question of productivity, there were differences of opinion about if it is more lucrative to plant GM soy. Some farmers stated that they were obtaining higher profits at the end of the harvest, as noted by Céleres (2010) and Massarani *et al.* (2013). Others claimed that it was not viable due to the royalties paid to Monsanto. On this divergence, it should be noted that there are other factors that influence the final value of a harvest, such as the market rate for soy and the dollar exchange rate. For smallholders whose main source of income comes from soy, dealing with these issues is difficult. When unforeseen events occur, they find they are unable to repay loans and incur further debt. For those with more capital and other investments, better business management skills, private technical assistance and the ability to buy the best available seeds for every harvest, it is easier to maintain higher-quality crops and to deal with factors unrelated to production.

According to the farmers interviewed, some of the other advantages offered by GM soy included easier cultivation and better pest control, as noted in other surveys (VARA, 2005; CHIMMIRI *et al.*, 2006; MASSARANI *et al.*, 2013). According to declarations, adopting the crops reduces manual labor in the fields, especially with the use of pesticides.

Better pest control was mentioned by farmers in Rio Grande do Sul, who faced a serious problem of pesticide resistance when cultivating regular crops, as one of the main reasons for using GM soy. GM soy, which called for the use of a different pesticide, resolved this problem in the beginning. On the other hand, invasive weeds, now resistant to glyphosate, were highlighted by farmers from Rio Grande do Sul and Paraná as being one of the main problems they faced when planting GM soy. In both states, there were reports of glyphosate-resistant weeds.

Another problem mentioned by these farmers was the contamination of conventional crops, an issue for producers and consumers alike in different contexts (EINSIEDEL *et al.*, 2001; HALL 2008; MASSARANI *et al.*, 2013) already identified in earlier studies carried out in Brazil (SILVA, 2009), Mexico (QUIST and CHAPELA, 2001; PIÑEYRO-NELSON, 2009; DALTON, 2008, 2009), Chile (ESTRADA, 2008) and Uruguay (GALEANO *et al.*, 2009). This problem is already a reality for farmers in the South and a major concern to those who still cultivate conventional soy. There were reports of incidents in the state of Paraná that ended with the payment of a fine to Monsanto by conventional soy producers. In Rio Grande do Sul, farmers said that the risk of contamination made it practically impossible to plant conventional crops within the state.

In addition to the shared use of equipment, which farmers said was the principle vehicle of contamination, Brazil still does not have an efficient and effective system of crop segregation that enables farmers to plant conventional and GM crops at the same time. According to reports, crop segregation is only controlled until tests are carried out to determine if crops are indeed conventional. After this, precautions are minimal: conventional and GM crops are unloaded, stored and transported together.

Risks related to the cultivation and consumption of GM products

The potential health and environmental risks of GMOs were treated as a secondary, although important issue, in the discussions held with smallholders. Only a few farmers argued this point with any confidence. In general, they voiced their anxieties and sometimes showed their frustration about not knowing “the truth”; however, they were skeptical about such risks.

The farmers argued that, since they used less toxic pesticides and in lesser amounts, they could not see how these could do any harm. They even claimed positive changes in the surrounding environment. From the point of view of some of these farmers, it would therefore be contradictory to cause harm. This reveals a decidedly pragmatic view about the risks: if they are not tangible, immediate or visible, they cannot be real.

Faced with the many health and environmental uncertainties in relation to GMOs, the farmers adopted different attitudes according to their social roles. As consumers, they adopted a hypothetical position of caution: if they could avoid GM food, they would,

and were prepared to pay more for non-GM products. However, they were resigned to the fact that they were probably unknowingly consuming GM products, since they knew that these products were on the market, that animals were reared on GM-based feed and that there was no production segregation system. In other words, although they showed concern, in reality they did not avoid consuming them.

As producers, the uncertainties about these risks assumed different importance. When faced with the real possibility of planting GM crops, there were other factors considered more relevant, such as financial aspects related to agricultural practices. The producers tend to adopt this position quite openly, even perceiving the contradictions that this implied, but also regarded the issue as a question of survival. "However much I care about my health, if GM crops are financially more advantageous for me, I will have to plant them," said a farmer in Palmeira, in the state of Parana (February 9, 2006). However, when hypothetically considering the possibility of cultivating GMO varieties – as in the case of farmers in the state of Acre – the discussions tended to put health concerns in first place.

Although most farmers were able to deal with these contradictions, we noted that, for some producers, this became something of a moral dilemma, as was the case of one of the farmers who planted GM soy in Ivaí, in the state of Parana:

"For someone like me planting crops, I am thinking about the profits and money I will make. The trouble is that we are not thinking ahead for the next 15 or 20 years. I plant and say to myself, this is wrong, all wrong ... this is not right, we are planting something that has been genetically modified (...)." (February 8, 2006)

Socio-cultural risks associated with biotechnological agriculture

Farmers more critical of GM crops, especially those linked to social movements, presented a different viewpoint about the risks of GM crops. In the first place, they were more convinced about the harmful effects that these crops pose for health and the environment. Secondly, they tended to underline the negative socio-cultural impact that this technology represents. In their view, the negative side of GM crops was that they threaten the independence of smallholders and the way that companies control the production of GM seeds and smallholders in general.

The farmers' loss of independence is one of the concerns also raised in the debates of NGOs, the most critical sectors of different social groups and farmers from other countries (CHIMMIRI *et al.* 2006; PIMBERT *et al.*, 2011). In the case of smallholders in Brazil, the impression one gets is that they do not have much control over their own production, irrespective of whether these are GM crops or otherwise. They rely heavily on the subsidies, technical assistance and infrastructure offered by the government; they depend on the companies that supply seeds and agricultural inputs. The ban on replanting seeds in subsequent harvests is not exclusive to GM crops; it extends to other certified seeds, even those produced by Brazilian companies.

We acknowledge that the rapid dissemination of GM crops may well aggravate the situation and severely threaten the freedom of farmers. However, this is still far from being the only factor responsible for the difficulties faced by smallholders. There are basic social and infrastructure issues that need to be addressed, such as the Brazilian land tenure system and the national economy, which is largely dependent on agricultural exports and on major landowners.

Among the most critical farmers, some highlighted the negative consequences that are directly attributed to the dissemination of GM soy in the south of Brazil. One was the fact that agricultural food production had been replaced almost exclusively by GM soy. With the fluctuation of the market price of soy and as a result of the droughts that severely affected the state of Rio Grande do Sul in the 2000s, which seriously jeopardized the entire grain harvest, many farmers were forced into debt. The widespread adoption of GM soy in the South, which requires less manpower during cultivation, also led to the breakup of families and unemployment in the interior – a concern also mentioned by Bt cotton producers in Colombia (ZAMBRANO *et al.*, 2011) and in relation to GM soy in the Argentine (MASSARANI *et al.*, 2013). Again, these are situations that can be aggravated by GM soy, but are not new and make the vulnerability of the smallholder all the more apparent.

Political engagement

The farmers consulted defended the view that smallholders should take part in decisions related to agriculture. The general contention was that only they understand the real needs of smallholders and, therefore, only they should defend their interests. However, the level of participation shown by farmers in initiatives seeking to influence decision-making processes was decidedly low. We observed few cases where farmers decided to take action in this sense; as well as a state of inertia, a sense of impotence and skepticism in relation to the real power they had to influence decisions. In general, they acknowledged their inaction and justified this by seeing themselves as victims: “we are never given a chance”; “the government gives us no voice”; “only the bigholders have a say”.

Irrespective of the justifications, the general impression is that the farmers consulted are not committed to change the situation. The desire to be heard does not seem to represent an issue for them, as opposed to what occurs in other contexts, where farmers and consumers strongly assert their right to participate in the regulation of biotechnology (EUROPEAN COMMISSION, 1997; INRA, 2000; PERRIÈRE and SEURET, 2000; EINSIEDEL *et al.*, 2001; TONI and BRAUN, 2001). Moreover, this behavior reflects the general attitude of civil society in Brazil, where there is little tradition of participation and a low level of trust in institutions, as has also been noted by Massarani and Moreira (2005). The exception to this is seen only in the case of a minority involved in social movements.

On the other hand, farmers who were consulted showed willingness, albeit discreetly, to debate issues that represent their interests, such as GM crops and agricultural technologies. While the focus groups were being held, the farmers enthusiastically engaged

in discussions and showed an enormous capacity to articulate their ideas, negotiate their points of view and debate this complex issue in-depth. They gave the impression that, overall, they valued the fact that their voices were heard and their opinions were taken into consideration.

In addition, we noted that the farmers interviewed in the three different states always mentioned, even if rather unassumingly, the associations to which they belonged, the meetings they had been to, the talks they had attended, the TV programs they had seen ... In short, they showed a willingness to discuss, learn and to keep informed about matters of interest to them. There is still a huge gap between this type of action and an attempt to influence decisions, but these are signs that farmers are not disinterested and there are opportunities to construct a space for dialogue.

Final considerations

In line with the findings of other research studies about the public perception of GMOs, our survey showed that putting the debate as a matter of being “in favor” or “against” is a simplistic way of trying to understand or explain the differences of opinion and positions taken in relation to this issue. This polarization tends to be present in decision-making environments and in the media, but is not replicated in a broader social context, although it ends up being reproduced in some quantitative studies that seek objective answers to how society views GM products. However, qualitative studies – such as this one – show that people tend to see more than one side of a question, weigh up the pros and cons, evaluate the personal and collective risks and benefits, both hypothetical and realistic, to construct and reconstruct their opinions, in a dynamic and complex way. To shed light on some aspects of this process, as we have attempted to do here, is a complex challenge.

In the specific case of the smallholders interviewed within the scope of this study, rather than having well-defined opinions about GMOs, their accounts showed signs of doubts, uncertainties and contradictory feelings about the matter. During our focus groups meetings, few people had well defined opinions in relation to GM crop cultivation. In the few rare cases when someone expressed strong feelings against GMOs, this attitude was generally associated with strong ideological beliefs and active involvement in social movements. This should not be interpreted, however, as a sign that farmers lacked interest or did not reflect on these issues. Our investigations showed that many of them analyzed and formed opinions on the subject.

With regards to GM soy, the only GM crop legally commercialized in Brazil during the period when these focus groups were staged, we noted that opinions varied in accordance with a variety of factors, some pragmatic relating directly to the practical and financial advantages and disadvantages of cultivating these crops, others which revolved around a perception of the risks associated with these crops, while others involved moral and ethical issues. Cultivating the same GM crops in the same region does not lead to the same conclusions for everyone, showing the diversity of factors that influence harvest yields and the degree of satisfaction resulting from this form of agricultural technology. In

the specific case of GM soy, the impression is that, in the beginning these crops resolved problems related to pest control, reduced manual labor and production costs, but that the pests later re-appeared and costs increased.

The question of the potential risks of GMOs to health and the environment is a particularly complex one for these social actors. Although society in general has genuine concerns about the effect of these products, and more critical opponents underline the negative effects that the rapid spread of GM crops and the resulting indiscriminate use of pesticides have on nature and biodiversity in general, the farmers themselves perceive these risks differently. If, on the one hand, the controversy regarding this topic generates doubts and mistrust among farmers, on the other, they cannot understand how GM crops could be harmful. The fact that they use less-aggressive pesticides when cultivating these crops – compared to those used in conventional cultivation – and that they have noticed a positive response in the surrounding environment as a result of this use means that a great number of these farmers see GM products as beneficial. Based on these apparent contradictions and considering the fact that they coexist on a daily basis with a series of proven and widely recognized risks, which directly affect their daily lives, farmers tend to prioritize other issues when taking a decision about planting GMOs.

We also noted that many of the socio-economic problems highlighted by farmers more critical of GM crops, particularly those linked to social movements, are not necessarily related to the fact that soy is genetically modified or not. In most cases, the problems they mentioned are linked to the cultivation of soy per se – expensive, extensive, mechanized, geared to the export market and vulnerable to market fluctuations – and the widespread expansion of soy cultivation in Brazil over the last decade. Other negative effects associated with GM crops, such as a dependence on companies supplying seeds and agricultural inputs, indebtedness and unemployment in the countryside also demonstrate some of the social problems that are intrinsically linked to smallholders and the agrarian situation in Brazil. We should say, therefore, that GM crops in themselves are neither the solution nor are they solely responsible for the difficulties experienced by smallholders.

On the other hand, we saw how the widespread, illegal and uncontrolled use of GM soy in Brazil created a series of practical problems for farmers, the consumers and for the Brazilian market. Firstly, because this led to the spread of a variety of non-adapted soy in a region that produces a significant percentage of the country's annual grain harvest, thereby placing its quality at risk. Secondly, the lack of an effective system to segregate varieties of GM and non-GM soy meant that many farmers were unable to plant conventional soy in the region, making it impossible to establish a differentiated market for these products. This also took away the power of choice of the consumers, since they are not given reliable information about the food they consume.

While most of the smallholders defended the importance of having their voices heard in decision-making processes related to agricultural issues, in practice, we observed that there is little political commitment on the part of these actors. Some justified their lack of participation by arguing that they had not had the opportunities to do so or that they did not know how to do this. Others, however, feel that it is not their role to participate in such decisions. It is worth highlighting that having low levels of commitment

is a strong political and cultural trait of the Brazilian people. Traditionally, Brazilian government and decision-making authorities do not have the habit to consult their citizens, while the latter are not in the habit of involving themselves in the formulation of public policies. Profound transformations are required in the dynamics of the process to elaborate and execute these policies, so that members of the public can have a greater level of participation in matters related to science and technology.

Finally, we noted marked interest among Brazilian smallholders, many of whom are illiterate, to discuss the issue of GMOs, even when they are not familiar with the topic. They declare that they would like to have greater access to quality and “impartial” scientific information about GMOs to enable them to make well-grounded decisions on the issue. Thus, it is necessary to develop and apply new strategies when disseminating scientific knowledge directed towards this sector of society. These should be based on more communicative processes of dialogue, which take into consideration, not only the basic scientific facts involved, but also the different social, economic, cultural and geographic contexts in which these farmers live, as well as their knowledge, opinions, concerns and uncertainties. Such initiatives will certainly offer a valuable contribution towards civic education and will no doubt be welcomed by smallholders in Brazil.

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Submitted on: 11/12/2013

Accepted on: 20/10/2014

<http://dx.doi.org/10.1590/1809-4422ASOC891V1812015en>

PERCEPTIONS OF BRAZILIAN SMALL-SCALE FARMERS ABOUT GENETICALLY MODIFIED CROPS

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Resumo: O objetivo deste artigo é investigar as percepções de pequenos agricultores brasileiros acerca dos cultivos geneticamente modificados com base em 15 grupos focais, envolvendo 111 indivíduos. A análise do *corpus* revela percepções heterogêneas em relação a essas culturas, moldadas por diversos fatores, incluindo as perspectivas econômicas e preocupações com o impacto sobre a saúde e o meio ambiente. Há muitas dúvidas sobre esses efeitos entre os agricultores, que estão interessados em receber informação neutra sobre o tema. Essas incertezas os afeta mais como consumidores, visto que preferem comer alimentos não transgênicos, do que como produtores, quando privilegiam outros aspectos, especialmente econômicos, ao decidir o que cultivar. Embora a maioria acredite que deva ter voz em tomadas de decisão referentes a questões agrícolas, poucos têm feito esforços nesse sentido.

Palavras-chave: Controvérsias na ciência; Percepção Pública; Cultivos geneticamente modificados; Agricultores; Brasil.

Abstract: The aim of this paper is to investigate the perceptions of small-scale farmers in Brazil towards genetically modified (GM) crops based on a sample of 15 focus groups involving 111 individuals. The analysis of the *corpus* shows heterogeneous perceptions regarding these crops, shaped by diverse factors, including economic prospects and concerns with the impact on health and the environment. There are many misgivings about these effects among the farmers, who are keen to receive unbiased information on the topic. These uncertainties affect them more as consumers, as most would prefer eating GM-free food, than as producers, as they consider other aspects, especially economic feasibility, when deciding what to grow. Although most farmers believe they should have a voice in decision-making on agricultural issues, few have made concerted efforts to be heard.

Keywords: Controversies in science; Public Perception; Genetically Modified Crops, Farmers, Brazil.

Resumen: El objetivo de este artículo es investigar las percepciones de pequeños agricultores brasileños acerca de los cultivos transgénicos, con base en 15 grupos focales, involucrando a 111 individuos. El análisis del corpus revela percepciones heterogéneas con respecto a estos cultivos, debido a muchos factores, incluyendo las perspectivas económicas y preocupaciones con el impacto sobre la salud y el medio ambiente. Los agricultores expresan deseo de recibir información imparcial sobre el tema, sobre el cual tienen muchas dudas. Las incertidumbres los afecta más como consumidores, visto que afirman preferir comer alimentos no transgénicos, que como productores, momento en que privilegian otros aspectos, especialmente económicos, al decidir lo que cultivar. Aunque la mayoría acredite que deba tener voz en las tomadas de decisión referentes a temas agrícolas, pocos han hecho esfuerzos en esta dirección.

Palabras claves: Controversias en la ciencia; Percepción Pública; Cultivos genéticamente modificados; Agricultores; Brasil.
