

Marcia A. Melo¹, Ederson A. Kido², Paulo P. Andrade³

Post Market Monitoring: Legal Framework in Brazil and First Results (Contribution to the 4th International Workshop on PMEM of Genetically Modified Plants, Quedlinburg)

Monitoring von GVO in Brasilien: gesetzliche
Vorgaben und erste Erfahrungen
(Beitrag zum 4. internationalen Workshop
zum Anbaubegleitenden Monitoring von
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Abstract

Brazil is presently (2010) the second largest producer of genetically modified (GM) crops. The legal framework to support both research activities and the commercial release of Genetically Modified Organisms (GMOs) is, however, very recent, as the Biosafety Law dates back from 2005. After the indispensable risk analysis, done by National Technical Commission for Biosafety (CTNBio), a GM plant can be approved for commercial release. Nevertheless, as stated in the Normative Resolution Nr. 5 (NR-5), of 2008, the post-market monitoring is mandatory. However, the first GM crop in Brazil, the herbicide tolerant soybean, was harvested in 2005. The CTNBio then asked for a monitoring plan and the applicant designed a complex study focused on case-specific monitoring. After four years the detailed field studies proved that no harm derived from this crop. The costs, nevertheless, were enormous. In June 2010, 21 GM plants were already approved for commercial release in Brazil, corresponding to different

events in soybean (6), cotton (8) and maize (9). Single and stacked events tolerant to herbicides or insect-resistant are presently been planted. If, for each single event and for the stacks, a laborious post market monitoring plan were to be executed, the total costs would be unbearably high. The applicant is legally and financially responsible for the monitoring in Brazil. It is also responsible to produce an adequate monitoring plan. Since the NR-5 rules are far from being clear, the applicants either proposed an elaborated plan for case-specific monitoring or, conversely, submitted a very simple plan, targeting some potential adverse effect that can be more easily evaluated in commercial fields. It is not clearly stated either in the Biosafety Law or in the NR-5 that monitoring should be split in case-specific monitoring and general surveillance, as adopted in Europe. If case-specific monitoring plans are difficult to design, a sensible suggestion for the general surveillance was not yet achieved. Nevertheless, the info-concentrating Brazilian Biosafety Information System may be a valuable source for the general

Institute

Federal University of Campina Grande, Laboratory of Molecular Biology, CSTR/UFCC, Av. Universitária s/n, 58708-110, Patos, PB, Brazil¹

Federal University of Pernambuco, Laboratory of Molecular Genetics, CCB/UFPE, Av. Moraes Rego s/n, 50670-901, Recife, PE, Brazil²

National Technical Commission for Biosafety (CTNBio), Setor Policial Sul-SPO Área 5 Quadra 3 Bloco B, 70610-200, Brasília, DF, Brazil³

Correspondence

Prof. Dr. Marcia Almeida de Melo, Federal University of Campina Grande, Laboratory of Molecular Biology, CSTR/UFCC, Av. Universitária s/n, 58708-110, Patos, PB, Brazil, E-Mail: marcia.melo@pq.cnpq.br

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surveillance, once it starts to operate. The general surveillance is presently either not contemplated in the monitoring plans or only minimally treated. It is important to keep in mind that the applicants are responsible to produce most of the data, even for the general surveillance, and this can be extremely difficult in a scenario where many different events are cultivated, frequently in neighbouring fields. A conceptual framework for post market monitoring must therefore be established following a dialog with all stakeholders. CTNBio is aware of these challenges and has already started to adjust the NR-5 to better guide the applicants in their writing of monitoring plans.

Key words: Genetically modified organism (GMO), transgenic crops, post market monitoring, Brazil, CTNBio, regulations on GMO

Zusammenfassung

Brasilien war 2010 der zweitgrößte Anbauer von gentechnisch veränderten Pflanzen. Die rechtliche Basis für die Forschung und kommerzielle Freisetzung von gentechnisch veränderten Organismen geht zurück auf das Jahr 2005. Nach der notwendigen Risikobewertung durch die nationale Technische Kommission für Biologische Sicherheit (CTNBio), kann eine Genehmigung für die kommerzielle Verwertung einer gentechnisch veränderten Pflanze erteilt werden. Allerdings erfordert die Normregel Nr. 5 (NR-5) aus dem Jahre 2008 ein begleitendes Monitoring. Allerdings wurde bereits im Jahre 2005 die erste transgene Pflanze, eine Herbizid-tolerante Sojabohne, in Brasilien angebaut. CTNBio forderte die Ausarbeitung eines Monitoringplanes, dem die Antragsteller mit einem komplexen, fallspezifisch fokussierten Monitoringdesign nachkamen. Nach vier Jahren detaillierter Feldstudien konnten keine Schäden durch den Anbau der transgenen Pflanzen nachgewiesen werden. Der Kostenaufwand war jedoch enorm. Im Juni 2010 waren bereits 23 gentechnisch veränderte Pflanzen mit verschiedenen transgenen Merkmalen für die kommerzielle Nutzung in Brasilien zugelassen: Soja (6 Zulassungen), Baumwolle (8) und Mais (9). Einzelne oder gekoppelte Merkmale für Herbizidtoleranz und Insektenresistenz werden derzeit genutzt. Müsste für jedes einzelne Merkmal oder gekoppelte Merkmale ein eigenständiges Monitoringprogramm durchgeführt werden, wären die Kosten praktisch untragbar. Die Antragsteller sind nach brasilianischem Recht für die Planung und Durchführung des Monitoring verantwortlich. Da die Normregel Nr. 5 keine klaren Vorgaben macht, reichen die Antragsteller entweder sehr detaillierte, fallspezifisch orientierte oder sehr einfache, allgemeine Monitoringpläne ein, die sich auf einfach nachzuweisende, mögliche Effekte im kommerziellen Anbau beziehen. Im Gegensatz zum europäischen Recht unterscheidet weder das brasilianische Biosicherheitsgesetz noch Normregel Nr. 5 ein fallspezifisches Monitoring und eine Allgemeine Beobachtung. Sollte ein fallspezifischer Monitoringplan schwer herzu-

leiten sein, gibt es keine verbindlichen Vorgaben für eine Allgemeine Beobachtung. Hier kann ein zukünftiges brasilianisches Informationssystem für Biosicherheit wertvolle Unterstützung bieten. Derzeit jedoch ist eine Allgemeine Beobachtung gar nicht oder nur sehr begrenzt in den Monitoringplänen vorgesehen. Es ist zu beachten, dass die Antragsteller in jedem Fall für das Monitoring verantwortlich bleiben. Dies kann jedoch bei zunehmendem Anbau transgener Pflanzen mit verschiedenen (ähnlichen), einzelnen oder gekoppelten Merkmalen auf benachbarten Feldern zu großen Schwierigkeiten bei der Interpretation der einzelnen Monitoringdaten führen. Deshalb ist es notwendig, eine breit angelegte und mit verschiedenen Interessengruppen kommunizierte Monitoringstrategie zu entwickeln. CTNBio ist sich dieser Herausforderungen bewusst und hat in einem ersten Schritt die Normregel Nr. 5 überarbeitet, um den Antragstellern klarere Vorgaben für den Entwurf von Monitoringplänen zu bieten.

Stichwörter: Gentechnisch veränderte Organismen (GVO), GVO-Monitoring, Brasilien, CTNBio, Gentechnikrecht

Introduction

Brazil is presently (2010) the second largest producer of GM crops (JAMES, 2009). However, until 2005 there was a lack of legal framework to support both research activities and the commercial release of GMOs (CAPALBO et al., 2003; FONTES, 2003). After the approval for commercial release of Roundup Ready® soybeans by the National Technical Commission for Biosafety (CTNBio), back in 1998, a long and sterile debate extended for more than 6 years, until the approval by the National Congress of the new Biosafety Law in March 2005, authorizing the first harvest of the transgenic soybean. During these years, as observed by REIS et al. (2006), discussions were centred in non-scientific issues or, sometimes, on misquoted scientific data. Other purely scientific activities, as laboratory experiments and field trials were largely prohibited.

This scenario has radically changed in 2005, by the decree of law nr. 11.105 nicknamed Biosafety Law (NAVES and FREIRE DE SÁ, 2005; TANUS JOB, 2008), which provides for safety norms and inspection mechanisms for the construction, culture, production, manipulation, transportation, transfer, import, export, storage, research, marketing, environmental release and discharge of genetically modified organisms – GMOs and their by-products, among other measures. After the indispensable risk analysis, a GM plant can be approved for commercial release. However, as stated in the CTNBio Normative Resolution nr. 5, of 2008, the post-market monitoring is mandatory, as it is elsewhere (CFIA, 2000; EFSA, 2006). Here we present the Brazilian experience and the uncertainties on monitoring, acutely felt by the members of the National Technical Commission for Biosafety (CTNBio), as well as by the other stakeholders.

Legal framework and commercial releases

The commercial release of Genetically Modified Organisms (GMO) and their derivatives must comply with the rules of NR-5, of 2008 (available at <http://www.ctnbio.gov.br/index.php/content/view/12857.html>). Its Article 10 obliges the applicant, following approval for commercial release of a GMO by its internal biosafety commission, to submit to CTNBio a monitoring plan, according to the Annex I of the resolution (see Tab. 1). However, the first GM crop in Brazil, the herbicide-tolerant Roundup Ready® soybean, was harvested in 2005. The CTNBio specifically asked for the monitoring of commercial production areas of soybean cultivars derived from the authorized breeding line GTS 40-3-2 for a period of five years, with the objective to develop compared studies about the plant species, insects and microorganisms present in the fields (Communication n. 54/1998, available at <http://www.ctnbio.gov.br/index.php/content/view/220.html>). As the preliminary risk analysis did not point to any relevant risk for the environment or health, CTNBio issued a rather broad requirement for case-specific monitoring, solely focused on potential environmental risks. As a consequence, the applicant designed a complex case-specific monitoring. After four years the detailed field studies produced a huge amount of data and decisively proved that no harm derived from this crop. The costs, taken by the applicant, as elsewhere (PAULAUSKAS et al., 2008), were nevertheless enormous. A general surveillance system was not required by CTNBio nor proposed by the applicant.

In May 2010 a query at the CERA and CTNBio databases returned 21 results for Brazil, corresponding to different events in soybean (4), cotton (6) and maize (11) (Tab. 1). Single and stacked events tolerant to herbicides or insect-resistant are presently been planted for all three crops. If, for each single event and for the stacks, a laborious post market monitoring plan were to be executed, the total costs would be unbearably high. The applicant, i.e. the seed company in the case of the three common crops, is legally responsible for the monitoring in Brazil. It is also responsible to produce an adequate monitoring plan. However, since the rules in Annex I are far from being clear (cf. Tab. 2 for a summary of requests), the applicants either propose an elaborated plan for case-specific monitoring or, conversely, submit a very simple plan, targeting some potential adverse effect that can be more easily evaluated in commercial fields.

Some considerations on the monitoring plan format and on its implementation

Monitoring is also a responsibility of some Brazilian federal agencies, as stated in the Biosafety Law. Registration and inspection agencies and entities under the Ministry of Health, the Ministry of Agriculture, Cattle Raising and Supply and the Ministry for the Environment and the Ministry for Aquaculture are responsible for, among other duties, “keeping updated information in the Biosafety

Information Systems (SIB)”. The SIB is, therefore, the organization, affiliated to the Ministry of Science and Technology, that receives, organizes and shares information on monitoring. However, it is not yet operational and therefore monitoring results are sent to and analyzed by CTNBio.

Nineteen monitoring plans have been submitted to CTNBio. Even for the same crop and similar transgenic traits the set of proposed actions differed widely. Tab. 3 summarizes six proposed plans for insect-resistant corn and cotton and for herbicide-tolerant soybeans. Clearly some plans are oversized, as the prior risk analyses did not identify relevant risks either for the environment or for human or animal health. On the other hand, no clear actions were delineated for a general surveillance, and only undemanding initiatives were suggested, either focused on crop traits or in official health reports.

It is not clearly stated neither in the Biosafety Law nor in the NR-5 that monitoring should be split in case-specific monitoring and general surveillance, as adopted in Europe. If case-specific monitoring plans are difficult to design, a sensible suggestion for the general surveillance was not yet achieved. Nevertheless, the info-concentrating SIB may be a valuable source for the general surveillance, once it starts to operate.

Concluding remarks

Due to the lack of clear information about how to produce an adequate monitoring plan, applicants either tended to unnecessarily enlarge the monitoring scope or shorten it to a few objectives. The general surveillance is not contemplated in the monitoring plans or minimally treated. It is important to keep in mind that the applicants are responsible to produce most of the data, even for the general surveillance, as well as bear the costs, and this can be extremely difficult in a realistic scenario where many different events are cultivated, frequently in neighbouring fields.

SANVIDO et al. (2005) established the conceptual framework for a post market monitoring plan, composed of case-specific monitoring (CSM) and general surveillance, focused on anticipated effects of a specific GM plant and on unanticipated effects on general safeguard subjects, such as natural resources, respectively. CSM follows a conceptual line which is also used by CTNBio and by the applicants in Brazil. Since trying to detect the unexpected is an inherent challenge, the authors suggested that general surveillance should concentrate on environmental subjects needed to be preserved. However, since the term environment is unspecific, there is a further need for defining specific safeguard subjects, which will be the focus of general surveillance. This is by itself also a challenge and the regulatory agency, as well as applicants, must keep an enlightening dialog as to better reach this goal. The proposed conceptual framework could be of assistance to the different stakeholders, when assessing GM plants during commercialization.

Tab. 1. Genetically modified crops approved for commercial use in Brazil

Crop	Gene(s)	Trait(s)	Applicant	Approval in Brazil (year)	Countries where the events were also approved
Corn	Pat	Glufosinate tolerance	Bayer	2007	AR, AU, BR, CA, CH, EU, JP, KO, ME, PH, SA, TW, US
	pat, cry1Ab	Glufosinate tolerance, resistance to lepidopterans	Syngenta	2007	AR, AU, BR, CA, CH, CO, EU, JP, KO, ME, PH, RU, SA, SZ, TW, UK, US, UY
	Cry1Ab	Resistance to lepidopterans	Monsanto	2007	AR, AU, BR, CA, CH, CO, EU, JP, KO, ME, PH, SA, SZ, TW, US, UY
	Cp4-epsps	Glyphosate tolerance	Monsanto	2008	AR, AU, BR, CA, CH, CO, ES, EU, JP, KO, ME, PH, SA, TW, US
	Epsps	Glyphosate tolerance	Syngenta	2008	AR, AU, BR, CA, CH, EU, JP, KO, ME, PH, RU, SA, TW, US
	pat, cry1Fa2	Glufosinate tolerance, resistance to lepidopterans	Dow	2008	AR, AU, BR, CA, CH, CO, ES, EU, JP, KO, ME, PH, SA, TW, US
	pat, epsps, cry1Ab	Glufosinate and glyphosate tolerance, resistance to lepidopterans	Syngenta	2009	BR, CA, JP, KO, ME, PH
	Cp4-epsps, cry1Ab	Glyphosate tolerance, resistance to lepidopterans	Monsanto	2009	AR, BR, CA, ES, EU, JP, KO, ME, PH, SA, TW
	Vip3Aa20	Resistance to lepidopterans	Syngenta	2009	AU, BR, CA, JP, ME, PH, TW, US
	Cry1A.105	Resistance to lepidopterans	Monsanto	2009	AU, BR, CA, CO, EU, JP, KO, PH, TW, US
pat, cp4-epsps, cry1Fa2	Glufosinate and glyphosate tolerance, resistance to lepidopterans	Dow	2009	AR, BR, CA, EU, JP, KO, ME, PH	
Cotton	Cry1Ac	Resistance to lepidopterans	Monsanto	2005	AR, AU, BR, CA, CH, CO, EU, IN, JP, KO, ME, PH, SA, US
	pat	Glufosinate tolerance	Bayer	2008	AU, BR, CA, CH, EU, JP, KO, ME, US
	cp4-epsps	Glyphosate tolerance	Monsanto	2008	AR, AU, BR, CA, CH, CO, EU, JP, KO, ME, PH, SA, US
	pat, cry1F	Glufosinate tolerance, resistance to lepidopterans	Dow	2009	BR, CA, JP, ME, US
	cry1Ac, cry2Ab	Resistance to lepidopterans	Monsanto	2009	AU, BF, BR, CA, CH, EU, IN, JP, KO, ME, PH, SA, US
	cry1Ac, cp4-epsps	Glyphosate tolerance, resistance to lepidopterans	Monsanto	2009	AR, AU, BR, CO, EU, JA, KO, ME, PH, SA
Soybean	cp4-epsps	Glyphosate tolerance	Monsanto	1998	AR, AU, BR, CA, CH, CO, CZ, EU, JP, KO, ME, PA, PH, RU, SA, SZ, TW, UK, US, UY
	csr1-2	Imidazolinone tolerance	BASF/Embrapa Soja	2009	BR
	pat	Glufosinate tolerance	Bayer	2010	BR, CA, JP, ME, US
	pat	Glufosinate tolerance	Bayer	2010	AU, BR, CA, CH, EU, JP, KO, ME, PH, TW, SA, US

Source: CTNBio website (<http://www.ctnbio.gov.br/index.php/content/view/14785.html>); CERA GMO database (<http://cera-gmc.org>). AR = Argentine, AU = Australia, BF = Burkina Faso, BR = Brazil, CA = Canada, CH = China, CO = Colombia, CZ = Czech Republic, ES = El Salvador, EU = European Union, IN = India, JP = Japan, KO = Korea, ME = Mexico, PA = Paraguay, PH = Philippines, RU = Russia, SA = South Africa, SZ = Switzerland, TW = Taiwan, UK = United Kingdom, US = United States, UY = Uruguay

Tab. 2. Post Market Monitoring requirements to the applicants in Brazil. Essential information was extracted from Annex I of Normative Resolution n.5.

Document	Monitoring plan	Upon delivering the application for commercial release
Objective	To oversee the effects resulting from commercial release of a GMO on the environment and human and animal health.	Case-specific monitoring and general surveillance
Follow up	Supervisory agencies and entities	Agencies at the Ministries of Health and Environment, the Ministry of Agriculture and CTNBio (Law n° 11.105, of 24 March 2005, art. 16, § 1)
Reports	Yearly	For at least 5 years

Tab. 3. Synopsis of contrasting monitoring plans submitted to CTNBio. A follow up of crop traits. In some cases an education program were also suggested

Trait	First Application	Second Application
Insect-resistant cotton	Monitoring of target insects Protein degradability in soil Soil chemical parameters Soil physical parameters Gene flow to conventional crop Stover degradability Soil microbial diversity Diversity of micorrhiza fungi Diversity of soil arthropods Non-target arthropods (visual) Non-target arthropods (traps) Aquatic NTO Bioaccumulation in NTO Human and animal health	Monitoring of target insects Protein degradability in soil Resistance among target insects
Insect-resistant corn	Monitoring of target insects Protein degradability in soil Soil chemical parameters Soil microbial diversity Gene flow to conventional crop Diversity of soil arthropods Non-target arthropods Aquatic NTO Bioaccumulation in NTO Human and animal health	Resistance among target insects
Herbicide-tolerant soybean	Weed population (incl. diaspores) Resistant weeds Soil chemical parameters Soil physical parameters Herbicide-degrading microorganisms Human and animal health	Weed population Resistant weeds

NTO = Non-target organism

The EuropaBio suggestions for general surveillance, namely a farmer questionnaire and a network of surveillance systems, which are not GM crop focused (WANDLSTADT et al., – The EuropaBio approach to general surveillance for cultivation of GM crops. Available from Nature Precedings

<<http://dx.doi.org/10.1038/npre.2010.4451.1>> (2010)), are interesting and could be implemented in Brazil, but some difficulties can be anticipated: farmers may be unable to meaningfully answer the questions and the network has a very restricted number of potential participants in Brazil.

Moreover, integrating data from different sources may also be challenging. REUTER et al. (2010) developed the structure for an Information System for Monitoring GMO (ISMO) combining three interrelated components: a knowledge database on relevant information to GMO monitoring and on scientific hypotheses on cause-effects; a monitoring database with monitoring data and meta-data, linked with data from other monitoring programs which are relevant for GMO-related questions; and a database covering administrative and procedural data. As stated by the authors, neither national nor international approaches to an ISMO exist yet.

CTNBio is aware of these challenges and has already started to adjust the NR-5 to better guide the applicants in their writing of monitoring plans.

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