

Import and processing of genetically modified maize line 1507x59122xMON810xNK603

COGEM advice CGM/120402-01

Introduction

The present application (file EFSA/GMO/NL/2011/92) concerns import and processing for use in feed and food of the genetically modified maize line 1507x59122xMON810xNK603. Cultivation is not part of this application.

Maize line 1507x59122xMON810xNK603 expresses the cry1F, cry1Ab, cry34Ab1, cry35Ab1, cp4 epsps and pat genes. As a result, the maize line is resistant to certain lepidopteran and coleopteran insects and tolerant to glyphosate and glufosinate-ammonium containing herbicides.

Maize line 1507x59122xMON810xNK603 was produced by means of conventional breeding between the four genetically modified parental maize lines. Previously, COGEM issued positive opinions on the cultivation, import and processing of parental lines and various crosses between these lines.

During its long domestication process, maize has lost its ability to survive in the wild. In the Netherlands, the appearance of maize volunteers is rare and establishment of volunteers in the wild has never been reported. There are no reasons to assume that the introduced traits will increase the potential of maize to establish feral populations. The introduced genes cannot spread to closely related species since wild relatives of maize are not present in Europe.

In view of the above, COGEM is of the opinion that incidental spillage of 1507x59122xMON810xNK603 poses a negligible risk to the environment. Since 2008, COGEM abstains from giving advice on the potential risks of incidental consumption in case a food/feed assessment is already carried out by other organisations.

COGEM considers the risks associated with import and processing of maize line 1507x59122xMON810xNK603 to be negligible.

Introduction

The scope of the present application (EFSA/GMO/NL/2011/92) filed by Pioneer Hi-Bred International, Inc. concerns import and processing of maize line 1507x59122xMON810xNK603. Maize line 1507x59122xMON810xNK603 expresses the *cry1F*, *cry1Ab*, *cry34Ab1* and *cry35Ab1* genes conferring resistance to certain lepidopteran and coleopteran insects. In addition, the *cp4 epsps* and *pat* genes are expressed resulting in tolerance to glyphosate and glufosinate-ammonium containing herbicides.

Maize line 1507x59122xMON810xNK603 was produced by conventional crossbreeding of four genetically modified parental maize lines. In the United States of America the individual genetically modified parental maize lines were authorized for use as food and/or feed in 1996 (MON810), 2000 (NK603), 2001 (1507) and 2004 (59122).¹ They were also authorized for cultivation in 2001 (1507), 2004 (59122), 1995 (MON810) and 2000 (NK603).¹ In Europe,

parental maize lines 1507, 59122, MON810 and NK603 were authorized for import and processing in respectively 2006, 2007, 1998 and 2004.¹

Previous COGEM advices

COGEM advised positively on import and processing of four parental maize lines^{2,3,4,5} and on import and processing of hybrid maize lines 1507xNK603, 59122x1507, 59122x1507xNK603 and NK603xMON810.^{6,7,8,9} COGEM also advised positively on cultivation of parental lines 1507, MON810, NK603 and 59122^{10,11,12} and hybrid lines 1507xNK603, 1507x59122, NK603xMON810.^{13,14,15} In case of parental line 59122, COGEM was of the opinion that cultivation of this line poses a negligible risk to human health and the environment, under the condition that specific monitoring for ladybird beetles is incorporated.¹⁶

Aspects of the crop

Maize (*Zea mays* L.) is a member of the grass family *Poaceae*. Maize is a highly domesticated crop, originating from Central America. Although pollinating insects visit maize plants and therefore insect pollination cannot be completely excluded, maize is predominantly wind pollinated.^{17,18} According to the literature, pollen viability varies between 30 minutes and 9 days.^{18,19,20} In Europe, no wild relatives of maize are present and therefore hybridization with other species cannot occur.

Throughout the world the appearance of volunteers is very rare. Seed kernels are the only survival structures of maize.²¹ Due to the structure of the corn cob (ear on a stiff central cob enclosed in husks) natural dissemination of the kernels rarely occurs. Maize needs human intervention to disseminate its seed.²¹ In addition, kernels exhibit poor dormancy resulting in a short persistence. Besides, maize can only survive within a narrow range of climatic conditions and, as maize is originally a subtropical crop, it is frost-sensitive.²² Maize is very sensitive to weed competition.²³ During the long process of domestication, maize has lost the ability to survive in the wild.²¹ Establishment of maize plants in the wild has never been observed in the Netherlands and COGEM is not aware of any reports of wild maize plants elsewhere in Europe.

Molecular characterization

Maize line 1507x59122xMON810xNK603 was produced by crossing four genetically modified parental maize lines. COGEM evaluated the molecular characterization in previous applications concerning import and processing of the genetically modified parental lines and concluded that the molecular characterization of the individual parental lines was adequate.

Properties of the introduced genes conferring insect resistance

Maize line 1507x59122xMON810xNK603 contains the *cry1F*, *cry1Ab*, *cry34Ab1* and *cry35Ab1* genes. Each of these genes encodes a different delta-endotoxin (δ -endotoxin), which affects lepidopteran insects, such as the European corn borer (*Ostrinia nubilalis*) or coleopteran insects, such as corn rootworm larvae (*Diabrotica* spp.)

δ -endotoxins are solubilized in the midgut of susceptible insects and are activated by midgut proteases to release a toxin fragment. This toxin fragment binds to specific receptors on the epithelial surface of the midgut and causes pores to open. This leads to disruption of the movement of solutes across the gut epithelium and allows gut bacteria to escape the midgut and enter the hemolymph where they cause septicaemia and death.^{24,25}

Properties of the introduced genes conferring herbicide tolerance

Maize line 1507x59122xMON810xNK603 contains the *pat* gene encoding the enzyme phosphinothricin acetyltransferase protein (PAT). Expression of PAT confers tolerance to glufosinate-ammonium containing herbicides.²⁶ The active ingredient in glufosinate-ammonium is L-phosphinothricin (L-PPT), which binds to glutamine synthetase in plants. The detoxification of excess ammonia is thereby prevented, leading to plant death. The PAT enzyme catalyses the conversion of L-PPT to an inactive form, which does not bind glutamine synthetase. Therefore, the application of glufosinate-ammonium containing herbicides to maize line 1507x59122xMON810xNK603 will be ineffective.²⁷

Maize line 1507x59122xMON810xNK603 also expresses the *cp4 epsps* gene. The *cp4 epsps* gene encodes the CP4 EPSPS protein. EPSPS is an enzyme involved in the biosynthesis of aromatic amino acids. Glyphosate inhibits EPSPS, resulting in a lack of amino acids essential for growth and development of plants. In contrast to EPSPS, the CP4 EPSPS protein is not inhibited by glyphosate and therefore the plant is tolerant to glyphosate containing herbicides.²⁸

Environmental risk assessment

The current application concerns import and processing. In case of spillage, maize kernels may be released into the environment. Maize kernels can only survive within a narrow range of climatic conditions. The introduced traits do not increase the ability of maize kernels to survive in the environment. There is also no reason to assume that maize line 1507x59122xMON810xNK603 has an increased potential to establish feral populations in case of incidental spillage.

Since 2008, COGEM abstains from giving advice on the potential risks of incidental consumption in case a food/feed assessment is already carried out by other organisations.²⁹ This application is submitted under Regulation (EC) 1829/2003, therefore a food/feed assessment is carried out by EFSA. Other organisations who advise the competent authorities can perform an additional assessment on food safety although this is not obligatory. In the Netherlands a food and/or feed assessment for Regulation (EC) 1829/2003 applications is carried out by RIKILT. Regarding the risks for food and feed, the outcome of the assessment by other organisations (EFSA, RIKILT) was not known at the moment of the completion of this advice.

General surveillance plan

General surveillance (GS) has been introduced to be able to observe unexpected adverse effects of genetically modified (GM) crops on the environment. The setting or population in which these

effects might occur is either not, or hardly predictable. The GS plan states that unanticipated adverse effects will be monitored by existing monitoring systems which include the authorisation holder and operators involved in the handling and use of viable maize 1507x59122xMON810xNK603.

In 2010, COGEM formulated criteria for GS plans concerning applications for import and cultivation of GM crops.³⁰ COGEM concluded that the GS plans could be improved by a guarantee that operators will monitor for unanticipated effects. In the present GS plan on maize line 1507x59122xMON810xNK603 the authorization holder states that the operators have agreed to provide information relevant to the monitoring of 1507x59122xMON810xNK603 to the authorisation holder. More important, it is stated that the authorisation holder will be able to give evidence that the operators collect this information. This is in line with the criteria laid down by COGEM.³⁰

In the EFSA guidance document, EFSA states that raw data and analysis of monitoring data should be made available by the applicant to the Competent Authorities and the European Commission.³¹ COGEM agrees with this request and points out that the General Surveillance plan of 1507x59122xMON810xNK603 maize could be improved by a statement of the applicant on this point.³²

Advice

COGEM has been asked to advice on import and processing of maize line 1507x59122xMON810xNK603. This maize line expresses the *cry1F*, *cry1Ab*, *cry34Ab1*, *cry35Ab1* genes, thus conferring resistance to certain lepidopteran and coleopteran insects. In addition, the *cp4 epsps* and *pat* genes are expressed resulting in tolerance to glyphosate and glufosinate-ammonium containing herbicides.

Maize line 1507x59122xMON810xNK603 was created by conventional crossbreeding of four genetically modified parental maize lines. In the past, COGEM advised positively on import and processing of these four parental maize lines.

Maize has lost the ability to survive in the wild. In the Netherlands, volunteers are rare and establishment of maize plants in the wild has never been observed. There is no reason to assume that the introduced traits increased the potential of maize 1507x59122xMON810xNK603 to establish feral populations. In addition, introgression of the introduced genes into closely related species cannot occur, as wild relatives of maize are not present in Europe.

In view of the above, COGEM is of the opinion that import and processing of maize line 1507x59122xMON810xNK603 poses a negligible risk to the environment.

Additional remark

The use of genetically modified crops for cultivation is a matter of debate in the European Union. An argument that is often used is that cultivation of genetically modified crops might adversely affect non-target organisms. Several European countries have banned the cultivation of the only genetically modified maize variety which is currently authorized for cultivation in the European Union (MON810). The discussion on putative effects of the cultivation of genetically modified

crops on non-target organisms is not relevant to this application since the current application only concerns import and processing.

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