

Import and processing of MON89034xNK603

COGEM advice CGM/071022-03

Summary

The present application by Monsanto S.A. (file EFSA/GMO/NL/2007/38) 'Import and processing of MON89034xNK603', concerns the import and processing for use in feed and food of a genetically modified maize line. Cultivation is not part of this application.

The hybrid maize line MON89034xNK603 contains the genes cry1A.105 and cry2Ab2, conferring resistance to certain lepidopteran insects. In addition, this maize line contains the genes cp4 epsps and cp4 epsps L214P, resulting in tolerance to glyphosate containing herbicides.

Previously, COGEM issued a positive advice on cultivation of maize line NK603. Simultaneously with the current application, COGEM has been asked to advice on import and processing of maize line MON89034. COGEM is of the opinion that the molecular data provided for parental maize line MON89034 is incomplete.

During the 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 traits introduced will increase the potential of maize to establish feral populations. The genes introduced in MON89034xNK603 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 MON89034xNK603 most likely poses negligible risks to man and the environment. However, because of the incomplete molecular analysis of MON89034, COGEM cannot advice positively on import and processing of maize line MON89034xNK603.

In addition, COGEM is of the opinion that the applicant should describe in more detail how the general surveillance plan will be organized. Furthermore, the applicant should ensure that information is obtained and that direct and indirect effects are reported annually.

Introduction

The present application by Monsanto S.A., file EFSA/GMO/NL/2007/38, concerns the import and processing of hybrid maize line MON89034xNK603 for use in feed and food. This line contains the cry1A.105, cry2Ab2, cp4 epsps and cp4 epsps L214P genes, which are constitutively expressed. As a result MON89034xNK603 is resistant to certain lepidopteran insects and tolerant to glyphosate containing herbicides.

Previous COGEM advices

In 2006, COGEM issued a positive advice on cultivation of maize line NK603 (1). Simultaneously with the current application COGEM has been asked to advice on import and processing of maize line MON89034. As the molecular data concerning MON89034 contained flaws, COGEM did not advice positively on import and processing of MON89034 (2).

Aspects of the crop

Maize (*Zea mays*) is a member of the *Poaceae* family (grasses). Maize was domesticated in Central America and is nowadays cultivated throughout the world (3). Although maize is tolerant to a wide range of temperatures, it is typically grown in temperate regions due to the moisture level and the number of frost-free days required to reach maturity (3). Depending on cultivar and climate the period from planting to harvesting ranges from 70 to 200 days (4). The minimum germination temperature is 10°C. Usually, the stem emerges from the soil four to six days after planting and flower initiation occurs 20 to 30 days after germination. The tassel of a four-month cultivar emerges 50 to 60 days after planting and the silk appears about a week later (4). Fertilization occurs through cross-pollination, and maize pollen is usually distributed by the wind (3). Hybridization with other species cannot occur since wild relatives of maize are not present in Europe (3).

Molecular characterization

Maize line MON89034xNK603 was produced by traditional crossing of the two genetically modified parental maize lines MON89034 and NK603. The molecular characterization of these parental lines will be briefly discussed. A more detailed description of the inserted genes can be found in the COGEM advices concerning the individual parental maize lines (1, 2).

Properties of the introduced genes conferring insect resistance

Maize line MON89034 was genetically modified by the insertion of the *cry1A.105* and the *cry2Ab2* genes. The *cry1A.105* and *cry2Ab2* genes encode δ -endotoxins specific for insects of the order Lepidoptera. The δ -endotoxins are solubilized in the midgut of susceptible insects and are activated by midgut proteases to release a toxin fragment. The toxin fragment binds to specific receptors on the epithelial surface of the midgut. Subsequently, pores are formed in the membranes of the gut cells of the insect, enabling midgut bacteria to enter the body cavity, which leads to septicemia and death (5).

Properties of the introduced genes conferring herbicide tolerance

Maize line NK603 was genetically modified by the insertion of the *cp4 epsps* and *cp4 epsps L214P* genes, which encode CP4 EPSPS proteins. 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. Maize line NK603 expresses the CP4 EPSPS protein, which is not inhibited by glyphosate (6) and is therefore tolerant to glyphosate containing herbicides.

Molecular analysis

Previously, the molecular aspects of parental maize line NK603 have been positively assessed (1, 2), However, COGEM is of the opinion that the molecular data provided for parental maize line MON89034 is incomplete (2).

Environmental risk assessment

During the long process of domestication, maize has lost the ability to survive in the wild. In addition, maize needs human intervention to disseminate its seed. Maize kernels exhibit no dormancy and only survive under a narrow range of climatic conditions. Furthermore, maize is very sensitive to weed competition and cannot persist as a weed (3, 4). In the Netherlands, volunteers are rarely found and establishment of maize plants in the wild has never been observed. The applicant performed laboratory experiments and field studies to assess phenotype, agronomical characteristics and ecological interactions of MON89034xNK603. However, the studies on ecological interactions reported qualitative instead of quantitative differences. These results do not indicate an increase in the potential of MON89034xNK603 to establish feral populations in the case of incidental spillage. However, COGEM wants to remark that qualitative data hampers a reliable statistical analysis. The lack of quantitative data on ecological interactions, thus hindering reliable statistical analyses, could pose a problem if this application would concern cultivation.

In conclusion, the results on phenotypic and agronomical characteristics, as well as on ecological interactions, indicate that there is no reason to assume that the expression of the *cry1A.105*, *cry2Ab2*, *cp4 epsps* and *cp4 epsps L214P* genes increases the potential of maize to establish feral populations.

General surveillance plan

A general surveillance plan is supplied by the applicant. General surveillance will be performed either by selected networks and/or specific company stewardship programs. However, the applicant does not indicate which networks or organizations will be involved in general surveillance and does not describe how the general surveillance will

be organized. In addition, key stakeholders and networks are requested to participate in the general surveillance plan and are asked to inform the consent holder if any unanticipated adverse effects occur. However, it is unclear how these adverse effects are monitored if key stakeholders and networks do not assist. In addition, the applicant makes a distinction between reporting direct and indirect effects in the monitoring plan. According to the applicant direct effects will be reported annually, whereas indirect effects will only be reported at the stage of re-evaluation or at the end of a given permit. As stated in previous advices, COGEM is of the opinion that the applicant should report both direct and indirect effects annually.

In conclusion, in COGEM's opinion the applicant should describe in more detail how the general surveillance will be organized and should indicate which organizations are involved. In addition, the applicant should ascertain that information on adverse effects is obtained. Furthermore, direct and indirect effects should be reported annually.

Advice

COGEM has been asked to advice on import and processing for use in feed and food of hybrid maize line MON89034xNK603.

Maize has lost the ability to survive in the wild. In the Netherlands, volunteers are rarely found and establishment of maize plants in the wild has never been observed. In addition, maize needs human intervention to disseminate its seed. There is no reason to assume that the expression of the *cry1A.105*, *cry2Ab2*, *cp4 epsps* and *cp4 epsps L214P* genes in MON89034xNK603 increases the potential of maize to establish feral populations. Introgression of the genes introduced into closely related species cannot occur, since wild relatives of maize are not present in Europe. In view of the above, COGEM is of the opinion that incidental spillage of maize will not pose a risk to man and the environment.

A general surveillance plan has been provided by the applicant. However, it does not specify which organizations will be involved in general surveillance, nor does it describe how general surveillance will be organized. Moreover, it is unclear how the applicant ensures that information is obtained. In addition, the applicant proposes that indirect effects will be reported at the stage of re-evaluation or at the end of a given permit. In COGEM's opinion the applicant should describe in more detail how the general surveillance will be organized and should indicate which particular organizations are involved. In addition, the applicant should ascertain that information on possible adverse effects is obtained. Furthermore, direct and indirect effects should be reported annually. Previously, COGEM has outlined the standards that have to be met by a post-market monitoring system and identified organizations which could be involved in post-market monitoring in the Netherlands (7).

In COGEM's view, the molecular analysis of parental maize line NK603 was adequate (1). However, COGEM is of the opinion that the molecular data provided for parental maize line MON89034 is incomplete (2).

In view of the above, COGEM is of the opinion that import of MON89034xNK603 most likely poses negligible risks to man and the environment. However, because of the incomplete molecular analysis of MON89034 COGEM cannot advise positively on import and processing of maize line MON89034xNK603.

References

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