Public information.

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Multi-year Experimental program for the development of Roundup® Ready sugar beets (tolerant to glyphosate) - Belgium, 1999-2002

Experimental programme 2001

European notification number
B/BE/95/WSP4

After advise from the Belgian Biosafety Council and the Service of Biosafety and Biotechnology of the Scientific Institute of Public Health – Louis Pasteur, the Belgian Ministry of Agriculture has granted consent to MONSANTO EUROPE S.A. to perform trials from the year 1999 till 2002, in accordance with their application B/BE/95/WSP4.

In the year 2001 this program will be conducted at one site in Flanders, and will be released in the municipality of Wommersom during the normal period of cultivation of sugar beet (*Beta vulgaris*) that goes from the month April till November 2001.

Responsible person for additional information about the trials:
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1. Plant description who are genetically modified

Since 1993 Monsanto has conducted several years experimental field trials with genetically modified sugar beets, tolerant to glyphosate.. The transformation technique involves recombinant DNA where bacterial EPSPS is introduced into the plant.

The sugar beet, *Beta vulgaris*, is an indigenous plant and can be found in a continental, Atlantic or a Mediterranean ecosystem. Morphological characteristics can be used to distinguish the sugar beet from other *Chenopodiaceae*.
The purpose of the genetic transformation is to add an additional characteristic to the sugar beet: tolerance to the herbicidal glyphosate.
Using a vector, a plasmid from *Agrobacterium*, the CP4syn gene, based on the EPSP gene from *Agrobacterium sp. Race CP4*, has been introduced into the sugar beet.
This gene codes for an enzyme which has a limited affinity to glyphosate, as opposed to the endogenous EPSP enzyme already present in sugar beet plants which is inhibited by

glyphosate. This allows conventional plant, after treatment with glyphosate, to be controlled while a transformed plant will persist. This is based on the normal mode of action of the herbicide, glyphosate.

Experimental lines, with a different progenydue to the transformation with 3 different plasmides (pMON 17204, pMON 17209, pMON 17227), may be cultivated.

2. Trail purpose

This field trial program for 4 years (1999-2002) has the objective to generate sufficient scientific and agronomic data to support a permit, according to the Belgian law "Agréation d'un produit phytopharmaceutique" for the herbicide Roundup® Ready, and the use of this herbicide in the culture of sugar beets containing the Roundup Ready® gene.
The experimental program contains different trials:

- the confirmation (qualitative and quantitative) of the agronomic performances of the sugar beets, tolerant to Roundup®.
- a study of the efficacy of the herbicidal programs with sugar beets, according to different doses and stages of application.
- production of vegetative material (beets tolerant to Roundup®) for analytical measures.
- the use of fields in technical demonstration trials.

3. Benefits for the environment, farmer or consumer

Due to the fact that sugar beets are poor competitors in the environment, the conventional culture of the sugar beet needs intensive treatment against weeds, especially during summer. The current weed programs are preventive and use different selective programs (with 7 to 8 active substances), which must be carefully followed.
The climatic conditions are of no influence on the weed program.
Using the new Round-up program, there is a decreasing use of pesticides (at European, Belgian level 30-50%). The farmer uses a safer pesticide, for the farmer and the environment, and applies only when it is needed (when there are weeds).

4. Biology and life-cycle of the plant

4.1 The plant as a weed

The sugar beet, *Beta vulgaris*, is an indigenous plant and can be found in a continental, Atlantic or a Mediterranean ecosystem. The morphological characteristics can be used to

distinguish the sugar beet from other *Chenopodiaceae*. Other plants from the Beta species may appear as a weeds, but this is rarely obsevered in agriculture. It is known that a gene flow could happen between the Beta species, but only during simultaneous flowering.

Beta vulgaris ssp. Vulgaris is a biennial plant. After the first season, a big root (beet) is formed. During the following year the peduncle appears and flowering can occur. During the following cultivation, regrowth of the sugar beet is possible due to parts of the root or the plant. These regrowths are treated like weeds. The known beet is not a weed and is not invasive to the environment.

4.2. Surviving and the dispersed seed

The possibility of weediness developing, or cross pollination could occure during the second part of the life-cycle and after a cold period. After that period flowers are formed and cross pollination with the wind could happen. On the branch, little irregular packages of seed are formed, which detach when mature. These seeds can survive 10 years in soil.

5. Possible effect or risk to the environment

5.1. Outcrossing and introduction into natural ecosystems

· **Dispersion of the transgenic pollen**

Pollen is produced during the second year after flowering. During the trials, the peduncle will be eliminated before flowering. Eventual annual flowering peduncles will also be eliminated before flowering.

· **Dispersion of the transgenic seed**

As the seed could be released into the environment due to transport or sowing. The seeds will be packed in hermetic closed sacks and transported in closed boxes. Elimination of the peduncle will avoid any dispersion of pollen and seed. The observation and de destruction of eventual regrowths during the following trials, is planned.

· **Selective benefits**

We have observed that only the transformed plants who are treated with glyphosate have selective benefits. In most rotation cultures of beets, selective substances are used to eliminate the *Chenopodiaceae*, just like other weeds.

5.2. Interactions with target-organisms

In the culture of beets, the use of herbicides is a necessity for a productive harvest. When using herbicides, based on glyphosate, in conjunction with GM beet, the weeds are

susceptible, with only the beets surviving these treatments. This is in effect comparable to the conventional herbicide programs, where selective herbicides are used to control weeds while not affecting sugar beets, however without using glyphosate during the growth of the culture.

5.3. Interactions with non-target-organisms

The effect of the treatments of herbicides containing glyphosate (who are registered since a long time) is known due to extensive studies and a long history of use.. These treatments will not produce unknown effects.

5.4. Impact of extended and long-term use

The intensive use of products containing glyphosate during 25 years in Belgium to date, has not resulted in plants or weeds tolerant to glyphosate, what is the case for example for triazines. Tolerance is seen, for example in Australia where the farmers have appropriate techniques for resolving this kind of problem.
The insensitivity of weeds can ultimately occur with any herbicide and therefore monitoring is continuous.
It is also known that long-term applications without variation can lead to a changes weed populations.

6. Restriction control and observance measures

6.1. Control on the dispersion of the pollen

The dispersion of the pollen is possible via the wind.
As beet is a biennial plant; its flowering occurs in the second season after a cold period. The peduncle will be eliminated before flowering.

6.2. Control on the dispersion of the seed

The seeds will be packed in hermetic closed sacks en transported in closed boxes. Elimination of the peduncle will avoid any dispersion of pollen or creation of seed. The observation and the destruction of eventual regrowths during the following trials, is planned.

6.3. Post-harvest treatment

The trials will not be harvested. After evaluation of the mode of action of the herbicide, the trial will be destroyed by ploughing, at the experimental site.

7. Monitoring

The monitoring will be done as described in the internal SOP's. The manipulation of the transgenic seed will only be done by qualified people.
On a regular basis, observations will be done concerning the agricultural behaviour of the sugar beets and concerning the expression of tolerance against Roundup. Each unusual observation will be reported.
The peduncles in and around the field will be destroyed.
A complete rapport will be sent to the authorities.

8. Destruction of the transgenic material

At the end of the trial period, the field with the sugar beets and the surrounding zone will be chopped and worked into the soil.
The next crop will be a cereal who will be sewed and treated following the local agricultural practices. Experience shows that any regrowth of sugar beets is well controlled with the normal herbicides against dicotyledons, used in cereal crops.

9. Emergency situations

In an emergency situation it is always possible to destroy the trials with another herbicide, not glyphosate based, which remains efficient against the Beta species.

10. Inspection

The 'Inspection-générale des Matières premières et du Secteur végétal du Ministère des Classes Moyennes et de l'Agriculture' is responsible for the control of the trial fields with transgenic plants in Belgium. The announcer must inform the Insepction-générale about the date of the sewing and the harvesting so that it can organize the inspections. The controllers monitor execution of the protocols and the permit of the Minister regarding the sewing and the harvesting. Additionally controllers take plant samples that will be analyzed in official labs.

11. Socio-economic aspects

The Roundup Ready® sugar beet is not registered yet in the European Union. Nevertheless it is good to look at the future socio-economical aspects.

Comparing to the traditional methods, the Roundup Ready® technique gives the opportunity to the farmer to decrease the amount of applied herbicides. According to published results, this reduction could go up to 30-50%.
This is an advantage for the farmer and sustainable agriculture.

The low toxicity of Roundup®, the possibility to increase the yield, the reduction of the herbicide cost are all advantages for the farmer. However, the minor impact of Roundup on the environment and the reduction of the amount of applied herbicides is a big advantage for the environment.

In a globalized market and with constant decrease of the quotas, it is the aim to produce with the lowest cost possible and have best agricultural efficacy.

The company plays an active role in scientific congresses and gives an extra dimension to the public debate.
The introduction occurs sensibly by giving an explanation to the farmer and by monitoring.
The company has an active dialogue with all the stakeholders and tries to reach a consensus, taking in to account all opinions. Using media, Monsanto will try to share all the possible information to the public.

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