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**Datasheet for the decision  
of 5 December 2017**

**Case Number:** T 0736/12 - 3.3.04

**Application Number:** 01973471.4

**Publication Number:** 1322773

**IPC:** C12N15/82, C12N15/10, A01H5/12

**Language of the proceedings:** EN

**Title of invention:**  
Glyphosate tolerant wheat plant 33391 and compositions and  
methods for detection thereof

**Applicant:**  
Monsanto Technology LLC

**Headword:**  
Glyphosate tolerant wheat plant/MONSANTO

**Relevant legal provisions:**  
EPC Art. 56

**Keyword:**  
"Main request - Inventive step (yes)"

**Decisions cited:**

**Catchword:**



**Beschwerdekammern**  
**Boards of Appeal**  
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Case Number: T 0736/12 - 3.3.04

**D E C I S I O N**  
**of Technical Board of Appeal 3.3.04**  
**of 5 December 2017**

**Appellant:** Monsanto Technology LLC  
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**Representative:** Uexküll & Stolberg  
Partnerschaft von  
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**Decision under appeal:** Decision of the Examining Division of the  
European Patent Office posted on 17 October 2011  
refusing European patent application No.  
01973471.4 pursuant to Article 97(2) EPC

**Composition of the Board:**

**Chairman** M. Montrone  
**Members:** R. Morawetz  
L. Bühler

## Summary of Facts and Submissions

- I. The appeal of the applicant (hereinafter "appellant") lies against the decision of the examining division refusing European patent application No. 01973471.4, entitled "*Glyphosate tolerant wheat plant 33391 and compositions and methods for detection thereof*", published as WO 02/27004 (hereinafter "application as filed").
- II. The following documents are referred to in this decision:
- D1 US 5,948,956 (1999).
- D3 US 5,633,435 (1997).
- D5 Zhou H. *et al.*, Plant Cell Reports (1995), vol. 15, pages 159-163.
- D7 Saroha M.K. *et al.*, J. Plant Biochemistry and Biotechnology (1998), vol. 7, pages 65-72.
- D11 Zhou H. *et al.*, Crop Sci. (2003), vol. 43, pages 1072-1075.
- III. The examining division held that document D1 represented the closest prior art to the subject-matter of claim 1 of the main request before it and that the problem to be solved was the provision of an alternative method of improving glyphosate tolerance in a wheat plant. The claimed solution was considered to be an arbitrary selection from an infinite number of equally obvious possible solutions, and the application was refused for lack of compliance with the

requirements of Article 56 EPC.

- IV. With the statement of grounds of appeal the appellant filed an amended set of claims as main request and arguments with regard to inventive step.
- V. The appellant was summoned to oral proceedings and was subsequently informed of the board's preliminary opinion in a communication under Article 15(1) RPBA.
- VI. With a letter dated 28 November 2017 the appellant filed a new main request and auxiliary requests 1 to 4 and further arguments with regard to inventive step.
- VII. In the course of the oral proceedings held on 5 December 2017 the appellant replaced all pending claim requests with a new main request.

Claim 1 of the new main request reads as follows:

"1. A method of improving glyphosate tolerance in a wheat plant comprising:

(1) constructing a DNA construct comprising a first and a second expression cassette, wherein said first expression cassette in operable linkage comprises (i) a rice actin 1 promoter; (ii) a rice actin 1 intron; (iii) a chloroplast transit peptide encoding DNA molecule; (iv) a glyphosate tolerant EPSPS encoding DNA molecule; and (v) a transcriptional terminator DNA molecule; and

said second expression cassette comprising in operable linkage (a) a CaMV 35S promoter; (b) a Hsp70 intron; (c) a chloroplast transit peptide encoding DNA molecule; (d) a glyphosate tolerant EPSPS encoding DNA molecule; and (e) a transcriptional terminator DNA molecule; and

- (2) transforming a wheat cell with said DNA construct;  
and
- (3) regenerating said wheat cell into a wheat plant;  
and
- (4) treating said wheat plants with an effective dose  
of glyphosate; and
- (5) selecting fertile wheat plants that are vegetative  
and reproductive tolerant to glyphosate."

The subject-matter of claim 2 relates to a fertile glyphosate-tolerant plant obtainable by the method of claim 1 wherein the plant comprises the DNA construct of claim 1, while the subject-matter of claims 3 and 4 relates respectively to cells and seeds of the wheat plant of claim 2.

At the end of the oral proceedings the chairman announced the board's decision.

- VIII. The appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of the claims of the main request filed during the oral proceedings.

## **Reasons for the Decision**

### *Main request*

### *Amendments (Article 123(2) EPC)*

1. The board is satisfied that the subject-matter of claims 1 to 4 finds a basis in claims 1 to 3 of the application as filed.

*Inventive step (Article 56 EPC)*

*Closest prior art*

2. For the assessment of inventive step the boards of appeal apply the problem-solution approach which, as its first step, requires the definition of the closest prior art. The closest prior art for assessing inventive step is normally a prior art document disclosing subject-matter conceived for the same purpose or aiming at the same objective as the claimed invention and having the most relevant technical features in common, i.e. requiring the minimum of structural modifications (see Case Law of the Boards of Appeal of the European Patent Office, 8th edition 2016, section I.D.3.1).
3. The present invention is directed to a method of improving glyphosate tolerance in a wheat plant comprising transforming a wheat cell with a DNA construct comprising two expression cassettes, each characterised by a specific promoter, a specific intron, a chloroplast transit peptide, a glyphosate-tolerant 5-enolpyruvyl-3-phosphoshikimic acid synthase (EPSPS) gene and a transcriptional terminator, and selecting fertile wheat plants that are vegetative and reproductive tolerant to glyphosate.
4. Document D1 was considered in the decision under appeal to represent the closest prior art (see Reasons, point 4.3). This document discloses a double expression construct, termed pMON25496, which contains the CP4 EPSPS gene from *Agrobacterium sp.* strain CP4, under the control of the cauliflower mosaic virus (CaMV) 35S promoter with the rice actin intron and a nos 3' terminator and a further CP4 gene under the control of

the rice actin promoter and a nos 3' terminator (see column 10, lines 18 to 25, and Figure 4).

5. Document D1 thus discloses a DNA construct which shares several structural features with the DNA construct used in the method of claim 1. However, no particular results or effects caused by this construct are reported in document D1. Moreover, although document D1 does mention wheat as being among the plants according to the invention (see column 5, line 64), it does not disclose a single transgenic wheat plant, let alone a fertile wheat plant that is vegetative and reproductive tolerant to glyphosate. The St. Augustine grass plantlets which were transformed with pMON25496 were only advanced to an early stage and have not been fully analysed for fertility or glyphosate resistance, in particular reproductive glyphosate tolerance (see examples 8 to 13 and in particular column 11, line 64, to column 12, line 3).
  
6. Document D5 discloses a method for the transformation of wheat plants using a construct having two genes for glyphosate tolerance, the CP4 gene and the glyphosate oxidoreductase (GOX) gene, wherein both genes are under the control of the same promoter, either a duplicated 35S promoter or the maize Ubi1 promoter (see page 159, right hand column, last paragraph, and page 160, left hand column, second paragraph). Wheat plants were transformed by microprojectile bombardment and transgenic plants regenerated using glyphosate selection (see page 160, right hand column, first full paragraph). The glyphosate-tolerant R<sub>0</sub> plants were sprayed with 3 ml/l Roundup<sup>®</sup> at the three-leaf stage. No damage symptoms were observed on vegetative or reproductive tissues, while control plants died within one week when sprayed with the same concentration of



Roundup<sup>®</sup> (see page 160, right hand column, last paragraph, and page 162, left hand column, first paragraph). The transgenic wheat plants were glyphosate-tolerant, fertile and phenotypically normal (see page 163, left hand column, first full paragraph).

7. In the board's judgement, although the DNA construct used in document D5 has fewer structural features in common with the DNA construct of claim 1 than the DNA construct of document D1, document D5 represents the closest prior art because it is directed to the same purpose as the invention, while document D1 is not.

*Objective technical problem and its solution*

8. The subject-matter of claim 1 differs from the teaching of document D5 in the use of a DNA construct with two CP4 EPSPS expression cassettes each driven by a different promoter, rice actin promoter 1 and CaMV 35S promoter, respectively.
9. As regards the effect of this difference, the appellant submitted that document D5 did not describe testing the transgenic plants with commercial-level applications of glyphosate and that document D11 confirmed that transgenic wheat plants of the prior art were partially sterile after application of glyphosate at agricultural rates. According to the appellant, the objective problem thus resided in providing methods of producing wheat plants with improved glyphosate tolerance suitable for use in commercial agriculture and weed control.
10. According to established case law of the boards of appeal, alleged advantages to which the applicant merely refers, without offering sufficient evidence to

support the comparison with the closest prior art, cannot be taken into consideration in determining the problem underlying the invention and therefore in assessing inventive step (see Case Law of the Boards of Appeal of the European Patent Office, 8th edition 2016, section I.D.4.2 and decisions cited therein).

11. The board notes that, according to document D11, "*early transgenic events containing the aroA:CP4 gene driven by the CaMV 35S promoter had excellent vegetative tolerance but were partially sterile (data not published). This could be due to limited expression of the CaMV 35S promoter in reproductive tissues*" (see page 1072, right hand column, second paragraph). Thus, document D11 does not specifically compare transgenic wheat plants generated according to the method of claim 1 with transgenic wheat plants generated according to the teaching of document D5, but refers to an uncharacterised transgenic event containing one CP4 gene under the control of the CaMV 35S promoter. In the board's opinion, document D11 is therefore manifestly unsuitable for demonstrating any improvement of the claimed subject-matter vis-à-vis the disclosure of document D5.
  
12. Considering that the transgenic wheat plants of document D5 were also shown to be fertile as well as vegetative and reproductive tolerant (see point 6 above), the objective technical problem to be solved by the subject-matter of claim 1 vis-à-vis the disclosure of document D5 is formulated as the provision of an alternative method for providing fertile wheat plants that are vegetative and reproductive tolerant to glyphosate. In view of the experimental data disclosed in the application as filed (see example 1 and Table 1), the board is satisfied that the problem is

solved by the claimed subject-matter.

*Obviousness*

13. Contrary to the decision under appeal (see Reasons, point 4.3), the board considers that the claimed combination of features characterising the DNA construct of claim 1 is not an arbitrary selection but is justified by a technical purpose, in that the DNA construct is designed such that the two expression cassettes collectively confer a high level of expression of a glyphosate-tolerant EPSPS in all plant organs and throughout all growth stages, thus ensuring vegetative and reproductive tolerance to glyphosate.
14. The question which remains to be answered is whether the skilled person, aware of the teaching of document D5 and faced with the technical problem defined in point 12 above, would have modified the teaching of the closest prior art document D5 - possibly in the light of other prior art teachings - so as to arrive at the claimed invention in an obvious manner.
15. Although document D5 discloses that "*we are continuously optimizing the glyphosate selection regime and enhancing the expression levels of the CP4 and GOX genes*" (see page 163, left hand column, first full paragraph), it neither teaches nor suggests the use of a second CP4 gene under the control of a rice actin promoter 1 instead of the GOX gene. On the contrary, the only combination of glyphosate tolerance genes envisaged is that of a CP4 gene with a GOX gene (ibid.). Accordingly, the claimed solution is not obvious in view of the teaching of document D5 alone.

16. Document D1 discloses a double gene construct with two CP4 genes under a rice actin promoter and a CaMV 35 S promoter, respectively (see point 4 above). However, document D1 is silent as regards the effects on fertility or vegetative and reproductive tolerance of this construct in St. Augustine grass, the sole plant on which the construct was tested in document D1. Therefore, in the board's opinion, document D1 provides no incentive for the skilled person to modify the construct of document D5 and arrive at something falling within the scope of claim 1 when faced with the problem formulated above (see point 12).
  
17. Document D3 refers to different class II EPSPS enzymes (see column 3, line 54, to column 4, line 12) and to a vast number of promoters which can be used in constructs for the expression of heterologous genes in monocotyledonous plants (see column 7, line 56, to column 8, line 44). However, document D3 provides no pointer towards modifying the construct of document D5 so as to arrive at the specific combination of features characterising the construct of claim 1. Accordingly, the teaching of document D3 does not render the claimed solution obvious either.
  
18. Document D7, a review article on glyphosate-tolerant crops, discloses that for optimising gene expression in plants, the coding sequence for the CP4 EPSPS enzyme is fused to a strong promoter, such as the CaMV 35 S promoter, and that incorporation of an intron sequence between promoter and the coding sequence further enhances the expression of foreign genes in plants (see paragraph bridging pages 69 and 70). According to this document, the fusion of a chloroplast transit peptide, CTP1, and GOX, the CTP1-GOX fusion protein, provides excellent vegetative and reproductive tolerance to

glyphosate when expressed in crop plants (see page 71, right hand column, first full paragraph). However, document D7 neither teaches nor suggests the use of a second CP4 gene under the control of a rice actin promoter 1 to achieve vegetative and reproductive tolerance to glyphosate and thus provides no pointer towards the claimed invention.

19. The board concludes from the above that the specific combination of features characterising the DNA construct of claim 1 is not suggested in the art as a means of achieving fertile wheat plants that are vegetative and reproductive tolerant to glyphosate. Accordingly, the subject-matter of claim 1, having regard to the state of the art, is not obvious to a person skilled in the art.
  
20. The above considerations in respect of claim 1 also apply to the subject-matter of claims 2 to 4. For these reasons the claims of the main request comply with the requirements of Article 56 EPC.

## Order

### For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the examining division with the order to grant a patent on the basis of the following claims and a description to be adapted thereto:  
claims 1 to 4 of the new main request filed during the oral proceedings.

The Registrar:

The Chairman:



D. Hampe

M. Montrone

Decision electronically authenticated