

Internal distribution code:

- (A) [-] Publication in OJ
- (B) [-] To Chairmen and Members
- (C) [-] To Chairmen
- (D) [X] No distribution

**Datasheet for the decision
of 8 September 2021**

Case Number: T 2794/19 - 3.3.04

Application Number: 17176837.7

Publication Number: 3246408

IPC: C12N15/82, C12N15/52, C12N9/88,
A01H5/00, A01H5/10, C12Q1/68

Language of the proceedings: EN

Title of invention:

Sorghum plants having a mutant polynucleotide encoding the large subunit of mutated acetohydroxy acid synthase protein and increased resistance to herbicides

Applicant:

Advanta Holdings BV

Headword:

Sorghum herbicide-resistant AHAS/ADVANTA

Relevant legal provisions:

EPC Art. 56

Keyword:

Inventive step - all requests (no)

Decisions cited:

T 1742/12

Catchword:

-



Beschwerdekammern
Boards of Appeal
Chambres de recours

Boards of Appeal of the
European Patent Office
Richard-Reitzner-Allee 8
85540 Haar
GERMANY
Tel. +49 (0)89 2399-0
Fax +49 (0)89 2399-4465

Case Number: T 2794/19 - 3.3.04

D E C I S I O N
of Technical Board of Appeal 3.3.04
of 8 September 2021

Appellant: Advanta Holdings BV
(Applicant) Claudius Prinsenlaan 144 A, Blok A
4818 CP Breda (NL)

Representative: Arnold & Siedsma
Bezuidenhoutseweg 57
2594 AC The Hague (NL)

Decision under appeal: **Decision of the Examining Division of the
European Patent Office posted on 21 May 2019
refusing European patent application No.
17176837.7 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman B. Claes
Members: D. Luis Alves
L. Bühler

Summary of Facts and Submissions

- I. The applicant (appellant) filed an appeal against the decision of the examining division to refuse European patent application No. 17 176 837.7, entitled "*Sorghum plants having a mutant polynucleotide encoding the large subunit of mutated acetohydroxyacid synthase protein and increased resistance to herbicides*".
- II. The following documents are referred to in this decision:
- D1: WO 2010/037061
D2: WO 2008/124431
D3: WO 2008/124495
D4: WO 2006/060634
D5: WO 2005/020673
D6: US 2003/097692
D7: Li *et al.*, *Molecular Breeding* 22, 2008, pages 217-225.
D9: Roso *et al.*, *Field Crops Research* 119(1), 2010, pages 174-182.
D10: Chang *et al.*, *Cell* 167, 2016, pages 325-339.
D11: Yu and Powles, *Pest Manag. Sci.* 70(9), 2014, pages 1340-1350.
D12: Zhang *et al.*, *Scientific Reports* 7(16380), 2017.
D13: Menegat *et al.*, *Journal of Plant Diseases and Protection*, 123, 2016, pages 145-153.
D14: Tardif *et al.*, *New Phytologist*, 169, 2006, pages 251-264.
D15: US 2008/0216187
- III. The decision under appeal dealt with a main request and two auxiliary requests.

Claim 1 of the **main request** reads:

"1. A sorghum plant comprising in its genome at least one polynucleotide, wherein said polynucleotide encodes a polypeptide having an alanine to threonine substitution at position 93 of the large subunit of sorghum AHAS protein, said plant having increased resistance to one or more herbicides of the imidazolinone group as compared to wild-type sorghum plants, wherein the imidazolinone herbicide is in particular selected from the group consisting of imazethapyr, imazapir, and imazapic, wherein the at least one polynucleotide comprises in particular SEQ ID No. 1 encoding the polypeptide comprising SEQ ID No. 2."

Claim 1 of **auxiliary request I** differs from claim 1 of the main request in the last lines, which read:

"... wherein the at least one polynucleotide encodes the polypeptide comprising SEQ ID No. 2, and comprises in particular SEQ ID No. 1."

Claim 1 of **auxiliary request II** reads (differences to claim 1 of the main request underlined):

"1. A sorghum plant comprising in its genome at least one polynucleotide, wherein said polynucleotide encodes a polypeptide having an alanine to threonine substitution at position 93 of the large subunit of sorghum AHAS protein, said plant having increased resistance to high application rates of one or more herbicides of the imidazolinone group as compared to wild-type sorghum plants, wherein a high application rate is 4X the recommended dose, wherein the

imidazolinone herbicide is in particular selected from the group consisting of imazethapyr, imazapir, and imazapic, wherein the at least one polynucleotide encodes the polypeptide comprising SEQ ID No. 2 and comprises in particular SEQ ID No. 1."

The examining division held that the subject-matter of the claims of each request did not involve an inventive step (Article 56 EPC) when starting from, *inter alia*, herbicide-resistant plants in which the acetohydroxyacid synthase (AHAS) carrying a mutation corresponding to the position 122 in the large subunit of AHAS in *Arabidopsis* as disclosed in each of documents D1 to D7 and D9 representing the closest prior art. Each of documents D2 and D4 to D6 disclosed the identification of a mutation corresponding to position 122 in *Arabidopsis* in herbicide-resistant plants obtained after random mutagenesis and selection. It concluded, *inter alia*, that although not certain, it was possible to obtain mutants in this position even as a result of random mutagenesis in sorghum. It was thus obvious for the skilled person to provide a sorghum herbicide-resistant AHAS carrying a mutation in the position corresponding to position 122 in *Arabidopsis* AHAS.

- IV. With the statement setting out the grounds of appeal, the appellant re-submitted the main request and auxiliary requests I and II and filed auxiliary requests III and IV. The appellant essentially re-submitted the same arguments in support of inventive step that were rejected in the decision under appeal. Additional arguments were submitted by reference to documents D10 to D14 (which were, however, not filed) and newly filed document D15.

Claim 1 of **auxiliary request III** is identical to claim 1 of the main request.

Claim 1 of **auxiliary request IV** reads (differences to claim 1 of the main request underlined):

"1. A sorghum plant comprising in its genome at least one polynucleotide, wherein said polynucleotide encodes a polypeptide having an alanine to threonine substitution at position 93 of the large subunit of sorghum AHAS protein, said plant having increased resistance to high application rates of up to 4x the recommended dose of one or more herbicides of the imidazolinone group as compared to wild-type sorghum plants, wherein the imidazolinone herbicide is in particular selected from the group consisting of imazethapyr, imazapir, and imazapic, wherein the at least one polynucleotide comprises in particular SEQ ID No. 1. encoding the polypeptide comprising SEQ ID No. 2."

- V. The board appointed oral proceedings and, in a communication pursuant to Article 15(1) RPBA, informed the appellant of the preliminary opinion of the board on some issues in the appeal.

The board concurred with the examining division that the subject-matter of claim 1 of the main request and of auxiliary requests I and III did not involve an inventive step over the disclosures in each of documents D1 to D7 and D9 representing the closest prior art because the claimed plants were, *inter alia*, the obvious result of random mutagenesis and selection. The arguments of the appellant based on the disclosures in documents D10 to D14 were not held persuasive, and the alleged technical effect of the claimed sorghum

plants over the plants disclosed in document D15 was considered not relevant for the assessment of inventive step. As regards claim 1 of auxiliary requests II and IV, the board held that explicitly introducing into the wording of the claim a property of the claimed plant did not in this case lead to claiming a different plant. Therefore, the subject-matter as claimed in the auxiliary requests also did not involve an inventive step.

- VI. In reply to the board's communication, the appellant filed sets of claims of auxiliary requests V and VI. With a subsequent letter, the appellant filed documents D10 to D14, which had been referred to in the statement of grounds of appeal.
- VII. During the oral proceedings, the appellant withdrew auxiliary requests V and VI. They referred in passing to the arguments presented in their statement of grounds of appeal and asked for a decision based on them. At the end of the oral proceedings, the chair announced the board's decision.
- VIII. The appellant's arguments in so far as relevant to this decision may be summarised as follows.

Main request

Inventive step (Article 56 EPC)

The herbicide-resistant sorghum plants based on AHAS carrying mutations corresponding to positions 560 and 574 of the large subunit of AHAS in *Arabidopsis* disclosed in document D15 represented the closest prior art. The claimed sorghum plant differed from these plants in the number and position of the mutations. The experimental report which had been submitted in

examination proceedings on 8 April 2019 showed that the claimed plant had increased herbicide resistance compared to the sorghum plant disclosed in document D15, even at four times the recommended herbicide application rate. The objective technical problem was thus the provision of sorghum plants that are more tolerant to herbicide overdosing. The claimed solution was not obvious. None of the cited documents mentioned this problem or suggested that a mutation in position 93 of AHAS could lead to especially high herbicide resistance.

When starting from the disclosure in any of the documents D1 to D9 as representing the closest prior art, it was not obvious to the skilled person to provide a sorghum plant carrying a mutation in position 93 of the large subunit of AHAS.

Although many positions affecting herbicide resistance in the AHAS of *Arabidopsis thaliana*, a recognised plant model organism, were known in the art (see documents D10 to D12), this did not imply that an effect on herbicide resistance of a given mutation in a position in one species is the same in other species. Document D12 in fact disclosed for a particular herbicide-resistant mutant an effect on plant competitiveness which was the opposite to that disclosed for the plants disclosed in documents D13 and D14 supporting that the effect of a mutation can differ between species.

The skilled person could have explored multiple other mutations known for *Arabidopsis thaliana* than the one claimed, and the best mutation for achieving improved herbicide resistance without detrimental effects in a different plant was not predictable.

A given mutation conferring herbicide resistance could have a detrimental impact on yield or other characteristics of the plant. Document D12 disclosed that, in most weeds studied, mutations in AHAS led to a detrimental effect on plant growth and reproduction in addition to the increased herbicide resistance (see pages 1 to 2, first paragraph). Negative impacts were also disclosed in document D13 for *Arabidopsis thaliana* and document D14 for *Amaranthus powellii*.

The expectation of success in random techniques like mutagenesis could not be rationally evaluated if the circumstances were like in a lottery game (see decision T 737/96). Furthermore, the contribution of a claimed invention over the prior art may lie in the achievement of an effect theoretically anticipated in the prior art (see decision T 694/92).

Auxiliary requests I to IV
Inventive step (Article 56 EPC)

No arguments specific to these requests were submitted.

- IX. The appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of the set of claims of the main request or, alternatively, of one of auxiliary requests I to IV, all filed with the statement setting out the grounds of appeal.

Reasons for the Decision

1. The appeal complies with the requirements of Articles 106 to 108 EPC and the further provisions referred to in Rule 101(1) EPC and is admissible.

Main request and auxiliary request III

Inventive step (Article 56 EPC) - claim 1

2. Documents D1 to D7 and D9, which the examining division considered to represent the closest prior art for the assessment of inventive step, each disclose a herbicide-resistant plant in which the acetohydroxyacid synthase (AHAS) carries a mutation corresponding to the position 122 in the large subunit of AHAS in *Arabidopsis* (see documents D1, paragraphs [0240] and [0241], claims 1 and 2 and Figure 4; document D2, Figure 1 and example 9; document D3, examples 5 to 8, Figure 3, sheet 2; document D4, examples 1 to 3 and paragraphs [0032], [0033] and [0106]; document D5, examples 1 and 2, Figure 3, sheet 2 and Figure 8; document D6, paragraphs [0035], [0040] and [0041] and example 1; document D7, abstract and Figures 1 and 2; and document D9, abstract and Figure 4).
3. The claimed subject-matter (see sections III and IV) differs from each of these disclosures in that it relates to a different crop, i.e. sorghum. Thus, the technical effect of this difference, for each of these disclosures when considered to represent the closest prior art, is that herbicide-resistant sorghum is provided. The objective technical problem may thus be formulated as the provision of yet a further herbicide-resistant plant. The appellant has not

contested the formulation of the objective technical problem in their reply to the communication of the board (see section VII).

4. At least six different herbicide-resistant crops in which the respective AHAS carry a mutation in corresponding positions were known in the art (see point 2.). Multiple of these known herbicide resistant mutant crops were in fact obtained by random mutagenesis and subsequent selection for herbicide-resistance (i.e. sunflower in document D2, example 9; wheat in document D4, example 1 and document D7, abstract and page 220, right-hand column, second paragraph to page 222, first paragraph; rice in document D5, example 1; and *Arabidopsis* in document D6, example 1). Moreover, a number of these documents mention sorghum as a crop of interest for introducing herbicide resistance (see document D1, paragraph [0105] and document D4, paragraph [0106], line 6). Hence, the board concludes that the skilled person would derive from these disclosures the reasonable expectation that applying known mutagenesis and selection methods to a different plant, such as sorghum in this case, would lead to the successful selection of a herbicide-resistant plant equally provided by a AHAS mutant which carries a mutation corresponding to the position 122 in the large subunit of AHAS in *Arabidopsis*.
5. In the appellant's view, the case law of the boards of appeal supported their argument that uncertainties associated with random mutagenesis would demotivate the skilled person from pursuing such a solution to the technical problem. However, in the case at hand, the disclosure in the state of the art of multiple herbicide-resistant plants obtained by random

mutagenesis and carrying a mutation corresponding to the one in the claimed plant disproves this argument.

6. The appellant referred to documents D10 to D14 to argue that the skilled person would not have expected that a mutation corresponding to position 122 in *Arabidopsis* would confer herbicide resistance in sorghum. However, documents D10 to D13 were published after the filing date of the application and thus do not form part of the state of the art. They cannot therefore in principle establish the knowledge and the expectation of the skilled person at the relevant date.
7. Documents D12 and D13 relate to herbicide-resistance in specific plant species and do not review the skilled person's understanding of herbicide-resistant mutant plants in general.
8. The board considers that neither the fact that the herbicide-resistant mutants were studied in a model organism (i.e. *Arabidopsis thaliana*, see document D10) nor the existence of multiple such mutations in this model organism (see document D11) would have guided the skilled person away from applying mutation and selection to further crops, as illustrated by the state of the art discussed in points 4. and 5. above.
9. By reference to document D14, the appellant argued that the skilled person would have concerns about a detrimental impact of mutations in other plant characteristics. However, whether any mutation conferring herbicide resistance may potentially have a detrimental effect on other characteristics of a given plant, as reported in document D14 for *Amaranthus powellii*, is not of relevance to the assessment of the skilled person's expectation in the case at hand -

regardless of whether the claimed plants do not exclude detrimental effects on growth or any characteristics other than herbicide resistance - since Powell's or green amaranth is phylogenically substantially remote from sorghum and no evidence has been presented that the teaching of document D14 would deter the skilled person from seeking to provide a herbicide-resistant sorghum plant by random mutagenesis.

10. The appellant further argued that the claimed subject-matter involves an inventive step when starting from the disclosure in document D15, which in the appellant's view represents the closest prior art. In the board's judgement, this line of argument cannot refute a finding of lack of inventive step when starting from the documents considered by the examining division (see decision T 1742/12, point 10.3 of the Reasons). Indeed, the board holds documents D1 to D7 and D9, considered by the examining division, to be suitable starting points for the assessment of inventive step since they disclose herbicide-resistant plants carrying mutated AHAS. The appellant has not argued to the contrary. Whether other documents constitute a more promising starting point for the assessment of inventive step is immaterial in the present case since the board holds the claimed invention to be obvious when starting from the disclosure in each of documents D1 to D7 and D9.
11. In view of the above considerations, the claimed subject-matter does not involve an inventive step (Article 56 EPC).

Auxiliary request I - claim 1

Inventive step (Article 56 EPC)

12. This claim (see section III) differs from claim 1 of the main request in that the large subunit of sorghum AHAS protein containing the mutation A93T comprises the SEQ ID No. 2. The conclusions reached in points 4. to 11. for the main request took into account the presence of a single mutation as defined in the claim and therefore apply equally to the subject-matter of this claim.

Auxiliary request II - claim 1

Inventive step (Article 56 EPC)

13. This claim (see section III) differs from claim 1 of auxiliary request I in that it additionally defines the herbicide-resistance of the plant by reference to a "*high application rate*" which "*is 4X the recommended dose*". Thus, as for claim 1 of auxiliary request I, the claimed plant is characterised by comprising a polynucleotide encoding a large subunit of AHAS having SEQ ID No. 2. The introduction into the claim of a property of the plant does not in this case lead to claiming a different plant. In fact, the reference to a "*high application rate*" which "*is 4X the recommended dose*", intended to further qualify the herbicide resistance provided by the mutant AHAS, does not translate into an additional characteristic of the claimed sorghum plant. Indeed, the herbicide-resistance results directly from the protein having that mutation.
14. The assessment of inventive step for auxiliary request I is therefore also applicable to this claimed subject-matter.

Auxiliary request IV - claim 1
Inventive step (Article 56 EPC)

15. This claim (see section V) differs from claim 1 of auxiliary request II in a broader characterisation of the herbicide resistance by the feature "high application rates of up to 4x the recommended dose". Accordingly, the conclusions on claim 1 of auxiliary request II apply also to this claimed subject-matter.

Order

For these reasons it is decided that:

1. The appeal is dismissed.

The Registrar:

The Chair:



I. Aperribay

B. Claes

Decision electronically authenticated