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(71) Applicant (*for all designated States except US*): **MON-SANTO TECHNOLOGY, LLC** [US/US]; 800 North Lindbergh Boulevard, St. Louis, MO 63167 (US).

(72) Inventors; and

(75) Inventors/Applicants (*for US only*): **ABAD, Mark** [US/US]; 800 North Lindbergh Boulevard, St. Louis, MO 63167 (US). **ALIBHAI, Murtaza** [IN/US]; 800 North Lindbergh Boulevard, St. Louis, MO 63167 (US). **AUGUSTINE, Alice, Clara** [IN/IN]; 800 North Lindbergh Boulevard, St. Louis, MO 63167 (US). **BASRA, Amarjit** [IN/US]; 800 North Lindbergh Boulevard, St. Louis, MO 63167 (US). **BELL, Erin** [US/US]; 800 North Lindbergh Boulevard, St. Louis, MO 63167 (US). **BRADSHAW, Terry, L.** [US/US]; 800 North Lindbergh Boulevard, St. Louis, MO 63167 (US). **CASTIGLIONI, Paolo** [IT/US]; 800 North Lindbergh Boulevard, St. Louis, MO 63167 (US). **CHITTOOR-VIJAYANATH, Jaishree** [IN/US]; 800 North Lindbergh Boulevard, St. Louis, MO 63167 (US). **DEIKMAN, Jill** [US/US]; 800 North Lindbergh Boulevard, St. Louis, MO 63167 (US). **DENG, Molian** [US/US]; 800 North Lindbergh Boulevard, St. Louis, MO 63167 (US). **EDGERTON, Michael** [US/US]; 800 North Lindbergh Boulevard, St. Louis, MO 63167 (US). **GABBERT, Karen** [US/US]; 800 North Lindbergh Boulevard, St. Louis, MO 63167 (US). **GOLDMAN, Barry** [US/US]; 800 North Lindbergh Boulevard, St. Louis, MO 63167 (US). **KARUNANANDAA, Balasulojini** [US/US]; 800 North Lindbergh Boulevard, St. Louis, MO 63167 (US). **LELAND, Timothy, J.** [US/US]; 800 North Lindbergh Boulevard, St. Louis, MO 63167 (US). **KJEMTRUP-LOVELACE, Susanne** [US/US]; 800 North Lindbergh Boulevard, St. Louis, MO 63167 (US). **LUND, Adrian** [US/US]; 800 North Lindbergh Boulevard, St. Louis, MO 63167 (US). **LUTFIYYA, Linda** [US/US]; 800 North Lindbergh Boulevard, St. Louis, MO

63167 (US). **MCNABNAY, Marcus** [US/US]; 800 North Lindbergh Boulevard, St. Louis, MO 63167 (US). **NELSON, Donald** [US/US]; 800 North Lindbergh Boulevard, St. Louis, MO 63167 (US). **RUFF, Thomas** [US/US]; 800 North Lindbergh Boulevard, St. Louis, MO 63167 (US). **SAVIDGE, Beth** [US/US]; 800 North Lindbergh Boulevard, St. Louis, MO 63167 (US). **SCHAFFER, Paul** [US/US]; 800 North Lindbergh Boulevard, St. Louis, MO 63167 (US). **SUDARSHANA, Padmini** [IN/IN]; 800 North Lindbergh Boulevard, St. Louis, MO 63167 (US). **SUMATHY, K.** [IN/IN]; 800 North Lindbergh Boulevard, St. Louis, MO 63167 (US). **THAI, Carolyn** [US/US]; 800 North Lindbergh boulevard, St. Louis, MO 63167 (US). **THOMPSON-MIZE, Rebecca** [US/US]; 800 North Lindbergh Boulevard, St. Louis, MO 63167 (US). **URWIN, Carl, P.** [US/US]; 800 North Lindbergh Boulevard, St. Louis, MO 63167 (US). **VEENA, H.G.** [IN/NL]; 800 North Lindbergh Boulevard, St. Louis, MO 63167 (US). **VENKATESH, T.V.** [US/US]; 800 North Lindbergh Boulevard, St. Louis, MO 63167 (US). **VOSS, Steven** [US/US]; 800 N. Lindbergh Boulevard, St. Louis, MO 63167 (US). **XIE, Zhidong** [CN/US]; 800 North Lindbergh Boulevard, St. Louis, MO 63167 (US).

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(54) Title: TRANSGENIC PLANTS WITH ENHANCED AGRONOMIC TRAITS

(57) Abstract: This invention provides transgenic plant cells with recombinant DNA for expression of proteins that are useful for imparting enhanced agronomic trait(s) to transgenic crop plants. This invention also provides transgenic plants and progeny seed comprising the transgenic plant cells where the plants are selected for having an enhanced trait selected from the group of traits consisting of enhanced water use efficiency, enhanced cold tolerance, increased yield, enhanced nitrogen use efficiency, enhanced seed protein and enhanced seed oil. Also disclosed are methods for manufacturing transgenic seed and plants with enhanced trait.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2008/008833**A. CLASSIFICATION OF SUBJECT MATTER***C12N 15/82(2006.01)i, C12N 9/16(2006.01)i, A01H 5/00(2006.01)i*

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC8 C12N 15/82, C07K 14/415, A01H 5/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
N.A.Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKIPASS, WPI, USPTO, PAJ, PubMed, INSPECT "Pfam, protein family module, herbicide, zinc finger domain, C2H2, Dof, HLH, transgenic plant, integration, agronomic traits, environmental change, stress, response, tolerance, etc."**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	GenBank Accession ID: NP_200014 (20 Apr 2007) "a zinc finger (C2H2 type) family protein [Arabidopsis thaliana]", 396 aa identical to SEQ ID NO: 177 - see http://www.ncbi.nlm.nih.gov/entrez/viewer.fcgi?15242250:NCBI:17086388	1, 14, 15
X/ Y	US 2006/0048239 A1 (Sanz Molinero, A.I., BE) 02 Mar 2006 - see abstract; [0004] ~ [0006]; [0040] ~ [0060]; [0095]; [0149] ~ [0196]; and claims	2-5, 8-13, 16/ 1, 14, 15
A	GenBank Accession ID: BAD10188 (05 Feb 2004) "putative transcription factor RAU1 containing HLH domain[Oryza sativa (Japonica group)]", 399 aa identical to SEQ ID NO: 96 - see http://www.ncbi.nlm.nih.gov/entrez/viewer.fcgi?db=protein&val=42408931	1-5, 8-16
X	Plant Cell Physiol. Vol.45(4):386-391 (Yanagisawa, S., JP) 2004 "Dof domain proteins: plant-specific transcription factors associated with diverse phenomena unique to plants" - see abstract; Fig. 1; Table 1; and page 390, the 4th paragraph of the left column ~ the 4th paragraph of the right column	2-5, 8-13, 16

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

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Korean Intellectual Property Office
Government Complex-Daejeon, 139 Seonsa-ro, Seo-
gu, Daejeon 302-701, Republic of Korea

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Authorized officer

SHIN, Weon Hye

Telephone No. 82-42-481-5591



INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2008/008833

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Trends Plant Sci. Vol.7(12):555-560 (Yanagisawa, S., JP) Dec 2002 "The Dof family of plant transcription factors." - see abstract; Figs. 1 & 2; page 557, the 3rd paragraph of the right column ~ page 559, the 1st paragraph of the left column; and Tables 1 & 2	2-5, 8-13, 16
X	Biosci Biotechnol Biochem. Vol.69(5):1042-1044 (Kiribuchi, K., et al., JP) May 2005 "Involvement of the basic helix-loop-helix transcription factor RERJ1 in wounding and drought stress responses in rice plants." - see abstract	2-5, 8-13, 16
A	Plant Physiol. Vol.144(1):43-53. (Mitchell RA, et al., UK) May 2007 "A novel bioinformatics approach identifies candidate genes for the synthesis and feruloylation of arabinoxylan." - see the whole document	1-5, 8-16
A	Proteins. Vol.28(3):405-420. (Sonnhammer EL, et al., UK) Jul 1997 "Pfam: a comprehensive database of protein domain families based on seed alignments." - see the whole document	1-5, 8-16

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2008/008833**Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)**

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☒ Claims Nos.: **6 & 7**
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

Claims 6 & 7 delimit the DNA expressing a protein of claim 4 to one providing tolerance to an herbicide, an agronomic trait, which is not supported by the description of the present application. Moreover, claim 7 is formulated as a dependent claim of claim 5, which is not relevant to a herbicide. Claim 7 is thus considered unclear for the wrong referencing.
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

- see the Extra Sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☒ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

Box No.III Lack of Unity of Invention

This ISA found multiple inventions as follows:

Group 1 : claim 1 is drawn to an invention featuring a recombinant DNA construct comprising a DNA segment encoding an amino acid sequence of SEQ ID NO: 177.

Groups 2 ~ 130 : claims 2~14 (all partial) are drawn to 129 inventions featuring a recombinant DNA construct comprising a DNA segment encoding an amino acid sequence comprising a Pfam domain module selected from the group consisting of 31 domain modules set out in "a"; the SEQ ID NO: 2201 domain module set forth in "b"; and 97 domain modules set forth in "c" (SEQ ID NO: 96 ~ SEQ ID NO: 193 except for SEQ ID NO:177) & "d".

Each Pfam domain module from Groups 1 ~ 130 comprises different amino acid sequences constituting a different chemical structure. Therefore, the single general concept linking the 130 groups is merely "a recombinant DNA construct comprising a DNA segment encoding an amino acid sequence comprising a Pfam domain module for an enhanced agronomic trait".

This concept common to all claims of the present invention is, however, described in US 2006/0048239 A1 (02 Mar 2006, Sanz Molinero, A.I., BE), which relates to the aforementioned general concept linking the 131 groups.

Hence the inventions listed as Groups 1-130 do not concern a single general inventive concept under PCT Rule 13.1 because the above mentioned common concept fails to make a contribution over the prior art within the meaning of PCT Rule 13.2.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2008/008833

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2006-048239 A1	02.03.2006	AU 2003-303350 A1 BR 0317754 A CA 2509100 A1 CN 1732266 A EP 1578976 A2 WO 2004-058980 A2	22.07.2004 22.11.2005 15.07.2004 08.02.2006 28.09.2005 15.07.2004