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Published:

— *with international search report (Art. 21(3))*

— *with sequence listing part of description (Rule 5.2(a))*

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8 May 2014

(54) Title: MANIPULATING PLANT SENSITIVITY TO LIGHT

(57) Abstract: The present disclosure identifies new genes which have the potential to increase broad acre yield in crops. This disclosure is based upon our fundamental knowledge of light signal transduction and our understanding of the roles these genes play in regulating plant growth and development in response to light. Transgenic plants with gain- or loss-of-function of one of these genes, or in combination, are expected to show significant improvements in broad acre yield and stress tolerance.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 12/38719

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - A01H 5/00, C12N 15/82 (2012.01)
USPC - 800/287, 800/298, 435/468
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)
USPC -- 800/287, 800/298, 435/468, 800/278, 800/295, 435/440

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PubWEST -- PGPB,USPT,USOC,EPAB,JPAB; Dialog Classic Files -- 654, 652, 349, 348, 340, 35, 65, 155; UPTO Web Page; Google Scholar; Search terms -- modified plant trait, recombinant polynucleotide, overexpression, yield, control elements, stable integration, constitutive promoter, stress-induced promoter, transgenic seed, transgenic plants, pine, mon

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X -- Y	US 2002/0160378 A1 (HARPER et al.) 31 October 2002 (31.10.2002) para [0004], [0012], [0015], [0017], [0018], [0024], [0039], [0056], [0077], [0080], [0092], [0105], [0135], [0138], [0139], [0141], [0142], [0144], [0150], [0153], [0155], [0157], [0199], abstract, SEQ ID NO: 2202	1, 4, 5, 8-11, 13-24 ---------- 2, 6, 12
Y	US 2010/0275333 A1 (KREPS et al.) 28 October 2010 (28.10.2010) para [0007], [0018], [0023], [0027], [0029], [0032], [0036], [0117], [0146]	2, 6, 12

☐ Further documents are listed in the continuation of Box C. ☐

* 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 another 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	Date of mailing of the international search report
27 September 2012 (27.09.2012)	05 OCT 2012
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Authorized officer: Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 12/38719

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.:
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:

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:
This application contains the following inventions or groups of inventions which are not so linked to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

SEE CONTINUATION 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 additional fees, this Authority did not invite payment of additional fees.

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.:
1-31 restricted to SEQ ID NO: 1 (specifically claims 1, 2, 4-6, and 8-24)

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.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 12/38719

Continuation of Box III

Group I+ claims 1-31 directed to a method for modifying a trait in a plant, the method comprising the steps of introducing into a target plant at least one recombinant polynucleotide comprising at least one nucleotide sequence that encodes a polypeptide, wherein the nucleotide sequence is selected from any of several claimed sequences wherein the nucleotide sequence is operably linked to a promoter that is expressed in a plant cell; wherein the target plant overexpresses the polypeptide and said overexpression results in the target plant expressing the modified trait with a specified percentage identity and with any of several expressed, modified traits, a method for modifying a trait in a plant the method comprising the steps of introducing into a target plant at least one recombinant polynucleotide that suppresses the expression of at least a polypeptide wherein the polypeptide is encoded by a polynucleotide selected from any of several claimed sequences wherein said polypeptide exhibits a specified percentage identity, wherein the nucleotide sequence is operably linked to a promoter that is expressed in a plant cell, and the expressed trait is any of any of several expressed, modified traits and a recombinant polynucleotide comprising a nucleotide sequence that encodes a polypeptide.

The inventions listed as Groups I+ do not relate to a single inventive concept under Rule 13.1 because under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

The shared technical features of Groups I+ is a method for modifying a trait in a plant, the method comprising the steps of introducing into a target plant at least one recombinant polynucleotide comprising at least one nucleotide sequence that encodes a polypeptide, wherein the nucleotide sequence is selected from any of several claimed sequences wherein the nucleotide sequence is operably linked to a promoter that is expressed in a plant cell; wherein the target plant overexpresses the polypeptide and said overexpression results in the target plant expressing the modified trait with a specified percentage identity and with any of several expressed, modified traits, a method for modifying a trait in a plant the method comprising the steps of introducing into a target plant at least one recombinant polynucleotide that suppresses the expression of at least a polypeptide wherein the polypeptide is encoded by a polynucleotide selected from any of several claimed sequences wherein said polypeptide exhibits a specified percentage identity, wherein the nucleotide sequence is operably linked to a promoter that is expressed in a plant cell, and the expressed trait is any of any of several expressed, modified traits and a recombinant polynucleotide comprising a nucleotide sequence that encodes a polypeptide. However, this is not an improvement over the prior art of US 2002/0160378 A1 to Harper et al. (hereinafter Harper) that teaches the steps of introducing into a target plant at least one recombinant polynucleotide (para [0015], [0017] [0166]), comprising at least one nucleotide sequence that encodes a polypeptide, wherein the nucleotide sequence is SEQ ID NO: 1 (SEQ ID NO: 2202 at 100% homology or percentage identity; para [0011], [0013]) wherein the nucleotide sequence is operably linked to a promoter that is expressed in a plant cell (para [0012], [0016], [0029]), wherein the target plant overexpresses the polypeptide wherein the modified trait is increased yields (para [0137], [0174]) and, optionally, selecting a transgenic plant having at least one of the modified traits as compared to the control plant (para [0175], [0033]). Likewise, Harper teaches the steps of introducing into a target plant at least one recombinant polynucleotide that suppresses the expression of a polypeptide (para [0169], [0170]) wherein the polypeptide is encoded by a polynucleotide comprising SEQ ID NO: 1 (SEQ ID NO: 2202 at 100% homology or percentage identity; para [0011], [0013]), wherein the nucleotide sequence is operably linked to a promoter that is expressed in a plant cell (para [0012], [0016], [0029]), and the expressed trait is increased yields (para [0137], [0174]) and a recombinant polynucleotide comprising a nucleotide sequence that encodes a polypeptide selecting a transgenic plant having at least one of the modified traits as compared to the control plant (para [0175], [0033]). Further, Harper teaches a recombinant polynucleotide comprising a nucleotide sequence that encodes a polypeptide (para [0011], [0012]). The Groups are different because the different polynucleotides represented by SEQ ID NOs : 1,3,5,7,9, 11, 13, 15, 17,
19,21,23,25,27,29,31,33,35,37,39,41,43,45,47,49,51,53,55,57,59,61,63,65,67,69, 71, 73, 75, 77,
79,81,83,85,87,89,91,93,95,97,99,101,103,105,107,109,111,113,115, 117, 119, 121, 123, 125, 127,
129,131,133,135,137,139,141,143,145,147,149,151,153,155, 157, 159, 161, 163, 165, 167, 169, 171,
173,175,177,179,181,183,185,187,189,191,193,195, 197, 199,201,203,205,207,209,211,213,
215,217,219,221,223,225,227,229,231,233;435,437,439,441,443,445,447,449,451,453,455,
457,459,461,463,465,467,469,471,473,475,477,479,481,483,485,487,489,491,493,495,497,
499,501,503,505,507,509,511,513,515,517,519,521,523,525,527,529,531,533,535,537,539, 541, 543, 545, 547, 549, 429, 431, or 433 are different structures that are not common to one another but are different because they are composed of unique nucleic acid sequences. Likewise, the different polypeptide sequences represented by SEQ ID Nos: 2,4,6,8, 10, 12, 14, 16, 18,20,22,24,26,28,
30,32,34,36,38,40,42,44,46,48,50,52,54,56,58,60,62,64,66,68, 70, 72, 74, 76, 78,80,82,84,
86,88,90,92,94,96,98,100,102,104,106,108,110,112,114, 116, 118, 120, 122, 124, 126, 128, 130,
132,134,136,138,140,142,144,146,148,150,152,154,156, 158, 160, 162, 164, 166, 168, 170, 172,
174,176,178,180,182,184,186,188,190,192,194, 196,198,200,202,204,206,208,210,212,214,
216,218,220,222,224,226,228,230,232,234,436,438,440,442,444,446,448,450,452,454,456,
458,460,462,464,466,468,470,472,474,476,478,480,482,484,486,488,490,492,494,496,498,
500,502,504,506,508,510,512,514,516,518,520,522,524,526,528,530,532,534,536,538,540, 542,544,546,548,550, or any of SEQ ID NO: 235 to 427 are different structures that are not common to one another but are different because they are composed of unique amino acid sequences.

This ISA will establish the ISR for the first group mentioned, specifically, Group I claims 1-31 restricted to SEQ ID NO: 1 (specifically claims 1, 2, 4-6, and 8-24) without payment of additional fees. In order for all inventions to be examined in Group I+, applicants must designate with specificity the particular sequence(s) to be searched and the appropriate examination fees must be paid for each additional sequence.