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UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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*Ex parte* LUIS RAFAEL HERRERA-ESTRELLA, DAMAR LISBETH  
LÓPEZ-ARREDONDO, and ALFREDO HERIBERTO  
HERRERA ESTRELLA<sup>1</sup>

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Appeal 2019-003456  
Application 13/560,618  
Technology Center 1600

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Before ULRIKE W. JENKS, TIMOTHY G. MAJORS, and  
MICHAEL A. VALEK, *Administrative Patent Judges*.

VALEK, *Administrative Patent Judge*.

DECISION ON APPEAL

Pursuant to 35 U.S.C. § 134(a), Appellants submit this appeal under 35 U.S.C. § 134(a) involving claims to a method of controlling weeds. Examiner rejected claims 1–9 and 15–18 for lack of written description and claims 1–9 and 11–18 as obvious. We have jurisdiction under 35 U.S.C. § 6(b).

We AFFIRM–IN–PART.

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<sup>1</sup> Appellants identify the real party in interest as Centro de Investigación y de Estudios Avanzados del Instituto Politécnico Nacional (CINVESTAV). App. Br. 4.

### STATEMENT OF THE CASE

Claims 1–9 and 11–18 are on appeal and can be found in the Claims Appendix of the Appeal Brief. App. Br. 43–45. Claim 1 is the only independent claim. It reads as follows:

1. A method of controlling weeds, comprising:  
growing a plant that has been transgenically modified to express a phosphite dehydrogenase enzyme capable of catalyzing oxidation of phosphite to phosphate,  
wherein the plant is grown in the presence of sufficient phosphite to selectively promote growth of the plant relative to weeds near the plant.

App. Br. 43 (Claims Appendix). Claim 11 depends from claim 1 and additionally specifies that “phosphite dehydrogenase enzyme is PtxD of *Pseudomonas stutzeri*, an analog or derivative of PtxD, or a PtxD-like homolog.”<sup>2</sup> Claims 12–14 similarly limit the “phosphite dehydrogenase enzyme” of claim 1 and require that it have 80 or 90 percent identity to particular SEQ ID NOs (claims 12 and 14) or particular sequences recited in the claim itself (claim 13).

Examiner rejected claims 1–9 and 15–18 under 35 U.S.C. § 112(a) for failing to comply with the written description requirement (“the Written Description Rejection”) and claims 1–9 and 11–18 under 35 U.S.C. § 103 as

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<sup>2</sup> The Specification states that PtxD is a phosphate dehydrogenase enzyme with the sequence in SEQ ID NO: 1. Spec. 15, l. 28.

unpatentable over Abad,<sup>3</sup> in view of Metcalf,<sup>4</sup> Lovatt,<sup>5</sup> McDonald,<sup>6</sup> and Metcalf 98 (“the Obviousness Rejection”).<sup>7</sup> Non-Final Act. 2–12.

Appellants seek review of the Obviousness Rejection, but “do not request review” of the Written Description Rejection. App. Br. 9. Accordingly, we summarily affirm the Written Description Rejection. See MPEP § 1205.02 (“If a ground of rejection stated by the examiner is not addressed in the appellant's brief, appellant has waived any challenge to that ground of rejection and the Board may summarily sustain it, unless the examiner subsequently withdrew the rejection in the examiner's answer.”).

With respect to the Obviousness Rejection, the issue is: Has Examiner established a prima facie case of obviousness, and if so have Appellants provided evidence of secondary considerations that, upon reweighing the entire merits of the case, demonstrates Examiner's determination of obviousness is not supported by the preponderance of the evidence of record?

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<sup>3</sup> Mark Scott Abad et al., US 2007/0124833 A1; published May 31, 2007 (“Abad”).

<sup>4</sup> William W. Metcalf et al., US 2004/0091985 A1; published May 13, 2004 (“Metcalf”).

<sup>5</sup> C.J. Lovatt et al., *Phosphite Fertilizers: What Are They? Can You Use Them? What Can They Do?*, Better Crops, Vol. 90 (2006) (“Lovatt”).

<sup>6</sup> Allison E. McDonald et al., *Phosphite (Phosphorous Acid): Its Relevance in the Environment and Agriculture and Influence on Plant Phosphate Starvation Response*, J. Plant Nutrition, Vol. 24, 1505–1519 (2001) (“McDonald”).

<sup>7</sup> William W. Metcalf et al., *Molecular Genetic Analysis of Phosphite and Hypophosphite Oxidation by Pseudomonas Stutzeri WM88*, J. Bacteriology, Vol. 180, 5547–5558 (1998) (“Metcalf 98”).

## ANALYSIS

Examiner determines that Abad teaches the transformation of plants with a construct comprising “a sequence (SEQ ID NO: 20228) that shares **100% identity** with” SEQ ID NO: 1, i.e., PtxD of *Pseudomonas stutzeri*. See Non-Final Act. 7; Ans. 9. Examiner acknowledges that Abad did not actually “reduce SEQ ID NO: 20228 to practice in a plant” and “fail[s] to teach growing the plant in the presence of phosphite,” but points to Metcalf’s teaching that PtxD “catalyzes the oxidation of phosphite to phosphate” as evidence that PtxD’s function was known in the art. Non-Final Act. 8–9. Examiner finds that Lovatt and McDonald teach that phosphite has benefits to plants, but that it can also be toxic in high concentrations. *Id.* at 9–10. In particular, Examiner notes McDonald’s teaching that “when phosphite is administered to plant roots or soil, the oxidation of phosphite to phosphate takes place; however, this process is very slow” and, as such, phosphite is a “very poor source of nutritional phosphorous.” *Id.* (quoting McDonald 1506). Examiner further finds that Metcalf 98 teaches that “phosphite can be used as a selectable marker for organisms who can oxidize phosphite into phosphate.” *Id.* at 10. Based on these collective teachings, Examiner determines that a skilled artisan would be “motivated to select SEQ ID NO: 20228 because it was known that this specific phosphate dehydrogenase enzyme when overexpressed confers to the organism the property of phosphite oxidation, thereby conferring . . . the ability to grow in phosphite-containing environments” and “would reasonably expect that plants overexpressing PtxD would be capable of using phosphite . . . whereas other non-transgenic organisms” such as weeds “would be inhibited by” such. Ans. 10.

Appellants contend that Examiner’s prima facie showing fails for several reasons. First, while conceding that Abad’s SEQ ID NO: 20228 is the sequence for PtxD, Appellants urge that “Abad does not assign a name or function to the sequence” and merely refers to it as a “homolog” of “another sequence . . . which improves cold germination tolerance, heat stress tolerance, high salinity stress tolerance, and osmotic stress tolerance in transformed Arabidopsis.” App. Br. 19 (citing Abad ¶¶ 92, 94–96, Table 3). Thus, argue Appellants, “there is nothing in Abad that would motivate the skilled person to single out SEQ ID NO:20228 from Abad’s 30,000 homologs . . . to create a plant expressing that sequence and then to grow it in the presences of sufficient phosphite to selectively promote growth of the plant relative to weeds near the plant,” as claimed. *Id.* Second, Appellants contend that the rejection is improper because the proposed modification of Abad (i.e., to transform a plant to express PtxD and then grow it in the presence of phosphite sufficient to selectively promote its growth) changes Abad’s “principle of operation,” which is enhancing an “existing plant trait”—not conferring a “new trait” such as phosphite oxidation/metabolism. *Id.* at 20. Third, Appellants argue there is no prima facie case “because none of the cited references recognizes the benefits of changing phosphorus metabolism of plants.” *Id.* at 21. Fourth, Appellants urge that Lovatt teaches away from modifying a plant to express a phosphite dehydrogenase. *Id.* at 23–24.

In addition to contesting Examiner’s prima facie showing, Appellants contend that there is “[c]ompelling evidence for secondary considerations of non-obviousness presented in the Herrera Declaration.” *Id.* (citing Declaration of Luis Rafael Herrera-Estrella dated July 25, 2017 (“Herrera-

Estrella Decl.’’)). In particular, Appellants urge that the claimed invention unexpectedly provides a “two-pronged solution to the twin problems of poor soil fertility and aggressive weeds” by producing crops that use phosphite to grow and “easily out compete the weeds, reducing or eliminating the need for herbicides to achieve maximum yield.” *Id.* at 33 (quoting Herrera-Estrella Decl. ¶ 17). According to Appellants, “[t]his is a totally new concept: instead of killing the weeds, we produce crops that can outcompete weeds without the need for herbicides” and achieve “maximum crop yield . . . with 30 to 50% less phosphorous when applied as phosphite instead of phosphate.” *Id.* Moreover, because the claimed method controls, “rather than simply killing the weeds” it promotes “biodiversity” and “provides ground cover that can decrease soil erosion.” *Id.* at 37–39 (quoting Herrera-Estrella Decl. ¶¶ 20–22). Moreover, Appellants contend the claimed invention has garnered significant praise by others in the field as well as commercial interest. *Id.* at 41–42.

Upon considering Appellants’ arguments and the record as a whole, we determine that the preponderance of the evidence does not support the Examiner’s conclusion of obviousness. As discussed below, while Examiner has met the burden to provide a prima facie showing of obviousness, Appellants’ evidence of unexpected results and other secondary considerations outweighs the evidence of obviousness.

We agree with Examiner that the cited references support a prima facie case of obviousness. It is undisputed that Abad teaches the transformation of plants to express proteins corresponding to specific sequences—one of which (SEQ ID NO: 20228) is the sequence for PtxD. It is true that Abad does not teach that PtxD catalyzes the oxidation of

phosphite to phosphate, but Metcalf does. *See, e.g.,* Metcalf Abst., ¶ 42. And we agree with Examiner’s determination that Metcalf, particularly when viewed in light of the McDonald’s teaching that phosphite must be converted to phosphate before it can serve as a nutritional source of phosphorus for plants,<sup>8</sup> provides a sufficient rationale for a skilled artisan to transform a plant to express PtxD. Thus, even if one accepts Appellants’ argument that Abad’s SEQ ID NO: 20228 is “buried in a listing of over 30,000 homologs,” (App. Br. 18) the other references support Examiner’s finding that it would be obvious to select that sequence.

Contrary to Appellants’ arguments, such a modification does not change Abad’s “principle of operation.” App. Br. 20. Abad describes “genes and uses for plant improvement.” Abad (title). According to Abad, such “improvement” in some “aspects of the invention” involves transforming a plant to “express[] a protein that provides tolerance from exposure to an herbicide applied at levels that are lethal to a wild type of said plant.” *Id.* ¶ 9. Such a modification is similar to the modification proposed in the obviousness rejection here. It is immaterial whether one describes this as conferring a “new trait” or merely enhancing an “existing” one. *See* App. Br. 20. Put differently, the distinction Appellants attempt to draw regarding Abad’s “principle of operation” is one of semantics. *Id.* It does not reflect a change to scientific or technical principles underlying

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<sup>8</sup> *See* McDonald 1510 (explaining that phosphate slowly converts to phosphite in soil and that studies dating back to the 1930s “determined [phosphite] to be a very poor source of nutritional [phosphorus], as the conversion of [phosphite] to [phosphate] in the soil was too slow to be agriculturally relevant”).

Abad’s teaching that plants can be improved by transforming them to express the sequences taught therein.

We also agree with Examiner that a skilled artisan would reasonably expect that transforming a plant to express PtxD would allow the transformed plant to more effectively metabolize phosphite. *See* Ans. 10. “The reasonable expectation of success requirement for obviousness does not necessitate an absolute certainty for success.” *Par Pharm., Inc. v. TWI Pharms., Inc.*, 773 F.3d 1186, 1198 (Fed. Cir. 2014) (citation omitted). Metcalf demonstrates that *E. coli* transformed to express PtxD can be successfully grown on media containing phosphite as the sole source of phosphorus, whereas untransformed *E. coli* cannot. This does not guarantee that a similar effect would be seen in a plant, but it does support a reasonable expectation of such. At the same time, we agree with Appellants that “none of the cited references recognizes the benefits of changing the phosphorus metabolism of plants.” App. Br. 21–22. However, that argument primarily goes to the strength of Appellants’ unexpected benefits evidence, which we address below.<sup>9</sup> As for Examiner’s initial burden, we determine a prima facie case of obviousness has been shown—albeit not a particularly strong one.

Turning to Appellants’ objective indicia evidence, we are persuaded that the record demonstrates that the claimed invention provides significant

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<sup>9</sup> We are not persuaded by Appellants’ argument that Lovatt teaches away from modifying a plant to express a phosphite dehydrogenase. App. Br. 23–24. Lovatt does not contemplate any such modification, much less “criticize, discredit, or otherwise discourage” one of skill in the art from doing so. *See In re Fulton*, 391 F.3d at 1201. Therefore, it cannot be said to teach away from the “claimed solution.” *Id.*

and unexpected benefits over prior art methods of controlling weeds. There is a clear nexus between the results evidenced by the Herrera-Estrella Declaration and the method in claims 1–9 and 11–18.<sup>10</sup> *See* Herrera-Estrella Decl. ¶¶ 17–21 (describing results and benefits of claimed method). Examiner, however, was not persuaded, finding that Appellants’ results were “neither surprising, nor unexpected” in light of the prior art. *See* Non-Final Act. 12–22. We disagree. While it may be that a skilled artisan would expect a plant expressing PtxD to more effectively utilize phosphite as a source of phosphorus, there is no evidence that a skilled artisan would expect many of the other benefits Appellants identify. For example, nothing in the record supports that one of ordinary skill in the art would expect that by modifying crops to express PtxD one can: (a) achieve maximum crop yield with 30 to 50% less phosphorus, (b) reduce or eliminate the need for herbicides, and (c) decrease soil erosion because weeds are controlled, rather than killed off. *See id.* ¶¶ 17 and 20. Moreover, the testimony concerning these benefits is supported by data from both laboratory and “real world” experiments demonstrating with dramatic effect the extent to which the claimed methods achieve these results. *Id.* ¶¶ 18–19, 25. Indeed, Appellants identify a number of articles from others in the field recognizing their work and highlighting, in particular, the use of the claimed method to control weeds. *See, e.g.*, Herrera-Estrella Decl. Ex. C, 1 (referring to Appellants’ work as “a novel plant fertilization and weed control system”); Ex. E (reporting on Appellants’ data and reproducing photographs showing the

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<sup>10</sup> The nexus between the Appellants’ present claims and the evidence in the Herrera-Estrella Declaration distinguishes the facts here from those in Appeal No. 2019-002835.

“effectiveness” of transformed plants to outcompete surrounding weeds); Ex. G (same). The fact that these articles focus on Appellants’ data, further supports Appellants’ argument that such results were indeed significant and unexpected from the prior art. Thus, Examiner has not shown that one of ordinary skill would expect to achieve results of both the type and extent evidenced by the Herrera-Estrella Declaration.

Having considered the entirety of the record, and reweighing “the entire merits of the matter” in light of Appellants’ objective indicia evidence, we determine that Appellants’ evidence is sufficient to overcome Examiner’s comparatively weaker prima facie showing. *See In re Hedges*, 783 F.2d 1038, 1039 (Fed. Cir. 1986). Because it is not supported by the preponderance of the evidence, we reverse the Obviousness Rejection.

#### SUMMARY

We affirm the rejection of claims 1–9 and 15–18 under 35 U.S.C. § 112(a) for failing to comply with the written description requirement.

We reverse the rejection of claims 1–9 and 11–18 under 35 U.S.C. § 103 as obvious over Abad, in view of Metcalf, Lovatt, McDonald, and Metcalf 98.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a).

AFFIRMED-IN-PART