

S1 Table. Strains used in this study

Strain	Relevant characteristic	Source
<i>A. vinelandii</i>		
DJ	ATCC BAA-1303. High frequency transforming variant of <i>A. vinelandii</i> UW generated in 1984 by Dennis Dean	[1]
DJA	DJ derived. 1401 bp deletion of <i>nifA</i> gene. Mo-Nif ⁻ , Rif ^R	R.D. lab
DJH	DJ derived. <i>nifH::tetA</i> . Mo-Nif ⁻ , Tc ^R	This study
DJHZ	DJ derived. <i>nifH::lacZ</i> inserted into the <i>algU</i> locus. Tp ^R	This study
EK	DJA derived. <i>nifA</i> deletion rescued by insertion of <i>nifA-E356K</i>	This study
EKH	EK derived. $\Delta nifH::tetA$ insertion into the native locus. Tc ^R	This study
EKHZ	EK derived. <i>nifH::lacZ</i> fusion inserted into the <i>algU</i> locus. Tp ^R	This study
EK Δ E	EK derived. $\Delta glnE::tmp$ insertion into the native locus. Tp ^R	This study
AZBB163	<i>nifL::Km^R</i> . Spontaneous mutant from AZBB150 resulting in the Nif ⁺ phenotype	[2]
163HZ	AZBB163 derived. <i>nifH::lacZ</i> inserted into the <i>algU</i> locus	This study
<i>P. stutzeri</i>		
A1501	CGMCC 0351, wild-type, isolated from rice roots inoculated with strain A15	[3,4]
Ps_ <i>nifLA</i> ^C	A1501 derived. <i>rnf-nifLA</i> intergenic region swapped by the reciprocal <i>A. vinelandii</i> region.	This study
Ps_EK ^C -tetA	Ps_ <i>nifLA</i> ^C derived, but Ps_ <i>nifAE356K</i> + <i>tetA</i> (Tc ^R)	This study
Ps_EK ^C	Ps_EK ^C -tetA derived, but <i>tetA</i> cured with pMB2006	This study
Ps_EK	A1501 derived, Ps_ <i>nifAE356K</i>	This study
<i>E. coli</i>		
ET8000	<i>rbs lacZ::IS1 gyrA hutC</i> . Used for β -galactosidase assays	[5]
NEB 5-alpha	Derivative of DH5 α . T1 phage resistant and <i>endA</i> deficient. Used for cloning and plasmid maintenance	NEB
ST18	<i>E. coli</i> S17 λ pir $\Delta hemA$. Used for conjugations	[6]

Abbreviations: Mo-Nif⁻: no molybdenum-dependent nitrogenase activity; Rif: rifampicin, Km: kanamycin, Tc: tetracycline, Tp: trimethiorim, ^R: resistance

S1 Table References

1. Setubal JC, dos Santos P, Goldman BS, Ertesvåg H, Espin G, Rubio LM, et al. Genome Sequence of *Azotobacter vinelandii*, an Obligate Aerobe Specialized To Support Diverse Anaerobic Metabolic Processes. *J Bacteriol.* 2009;191: 4534–4545. doi:10.1128/JB.00504-09
2. Barney BM, Eberhart LJ, Ohlert JM, Knutson CM, Plunkett MH. Gene Deletions Resulting in Increased Nitrogen Release by *Azotobacter vinelandii*: Application of a Novel Nitrogen Biosensor. *Appl Environ Microbiol.* 2015;81: 4316–4328. doi:10.1128/AEM.00554-15
3. You C, Zhou F. Non-nodular endorhizospheric nitrogen fixation in wetland rice. *Can J Microbiol.* 1989;35: 403–408. doi:10.1139/m89-062
4. Vermeiren H, Willems A, Schoofs G, de Mot R, Keijers V, Hai W, et al. The rice inoculant strain *Alcaligenes faecalis* A15 is a nitrogen-fixing *Pseudomonas stutzeri*. *Syst Appl Microbiol.* 1999;22: 215–24. doi:10.1016/S0723-2020(99)80068-X
5. MacNeil T, Roberts GP, MacNeil D, Tyler B. The products of *glnL* and *glnG* are bifunctional regulatory proteins. *Mol Gen Genet MGG.* 1982;188: 325–333. doi:10.1007/BF00332696
6. Thoma S, Schobert M. An improved *Escherichia coli* donor strain for diparental mating. *FEMS Microbiol Lett.* 2009;294: 127–132. doi:10.1111/j.1574-6968.2009.01556.x