**Supporting information**

**Text S1**. Rice cultivation on nitrogen-deficient agar plates with *Azoarcus* sp. KH32C

*Azoarcus* sp. strain KH32C was cultivated on DNB-NS agar plates at 26°C in anaerobic conditions for 1 week. *Escherichia coli* K-12 strain MG1655 was cultivated on LB agar plates at 30°C for 1 week. Strains KH32C and MG1655 were suspended in 0.5 mM calcium chloride (OD660 = 0.8). Hulled rice seeds (*Oriza sativa* L. cv. Nipponbare) were immersed in a mixture of sodium hypochlorite, sodium hydroxide, and surfactant for surface sterilization. After washing with sterilized distilled water, the surface-sterilized seeds were immersed in the cell suspensions of strain KH32C or strain MG1655 for 1.5 min. The rice seeds were germinated on nitrogen-deficient agar plates (0.5 mM calcium chloride and 7.5 g Agar Type A plant cell culture tested [Sigma-Aldrich, MO, USA] per a liter), and cultivated at 30°C with a 14 h/10 h light/dark photoperiod. After 12 days, the fresh weight of seed-removed rice seedlings was measured. To assess the effect of strain KH32C on rice plant growth, heteroscedastic *t*-test was carried out between KH32C inoculation and MG1655 inoculation conditions.

PCR amplification was performed to detect strain KH32C from rice root. DNA was extracted from rice roots at 4 days after KH32C or MG1655 inoculation. Specific primer sets for the *nos Z* gene in strain KH32C, del-NosZ-F/del-NosZ-R, was used for PCR amplification (Gao *et al*. 2017).

**Table S1**. Sampling date of rice plants and rice root-associated soil. Eg, early growth stage; Pf, panicle formation stage; Fh, full heading stage; Hv, harvesting stage. The numbers in parenthesis show the number of days after transplantation.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Nipponbare | | Takanari | | IR64 | |
| KH32C | Control | KH32C | Control | KH32C | Control |
| PF4 in 2015 | | | | | | |
| Eg | June 23rd (25) | | June 23rd (25) | | June 23rd (25) | |
| Pf | July 14th (46) | | July 14th (46) | | July 14th (46) | |
| Hv | Oct. 10th (134) | | Oct. 5th (129) | | Oct. 5th (129) | |
| PF2 in 2017 | | | | | | |
| Eg | June 20th (24) | | June 20th (24) | | June 20th (24) | |
| Pf | July 11th (45) | | July 11th | | July 11th | |
| Fh | Aug. 25th (90) | | Aug. 18th (83) | Aug. 21st (86) | Aug. 25th (90) | Aug. 21st (86) |
| Hv | Oct. 12th (139) | | Oct. 9th (135) | | Oct. 12th (139) | |

**Table S2**. Yield of rice.

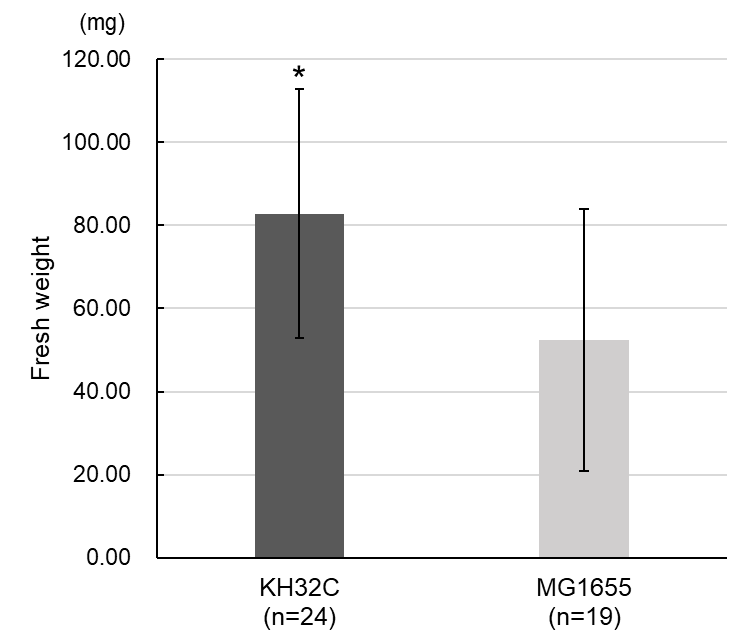
|  |  |  |
| --- | --- | --- |
| (g/m2) | KH32C | Control |
| PF4 |  |  |
| Nipponbare | 773.0±57.2 | 724.4±6.0 |
| Takanari | 787.9±17.1 | 714.4±125.3 |
| IR64 | 683.4±1.9 | 747.0±42.8 |
| PF2 |  |  |
| Nipponbare | 409.1±23.0 | 471.1±52.3 |
| Takanari | 786.6±89.0 | 840.5±23.7 |
| IR64 | 572.7±60.3 | 523.9±36.4 |
| Mean±SE |  |  |

**Table S3**. The number of high-quality sequences and OTUs obtained by meta-amplicon sequencing analysis of Nipponbare root-associated soil. Eg, early growth stage; Pf, panicle formation stage; Hv, harvesting stage.

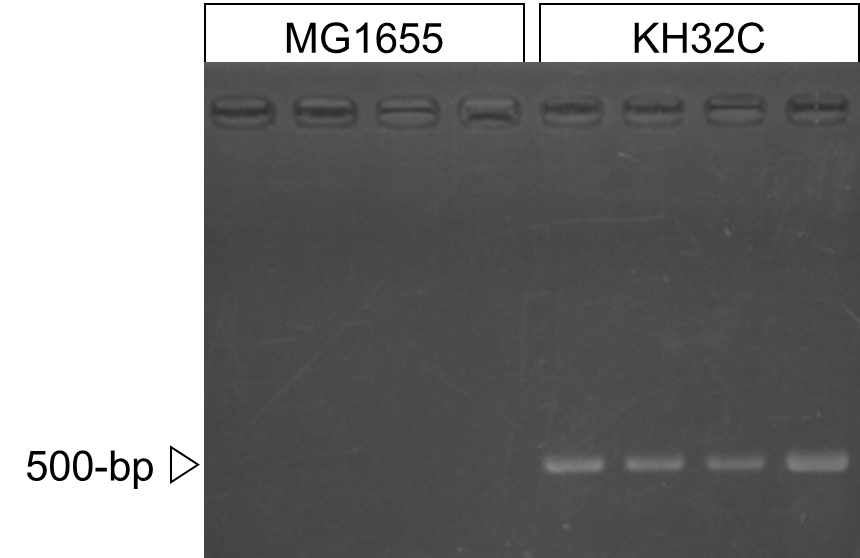
|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | KH32C | | | Control | | | Total |
|  | Eg | Pf | Hv | Eg | Pf | Hv |
| High-quality sequence | 11,930 | 9,428 | 31,368 | 15,583 | 8,960 | 14,242 | 91,511 |
| OTU | 4,002 | 3,146 | 7,696 | 4,784 | 3,048 | 5,016 | 14,064 |

**Table S4**. The diversity of bacterial community in root-associated soil of Nipponbare in PF4. Eg, early growth stage; Pf, panicle formation stage; Hv, harvesting stage.

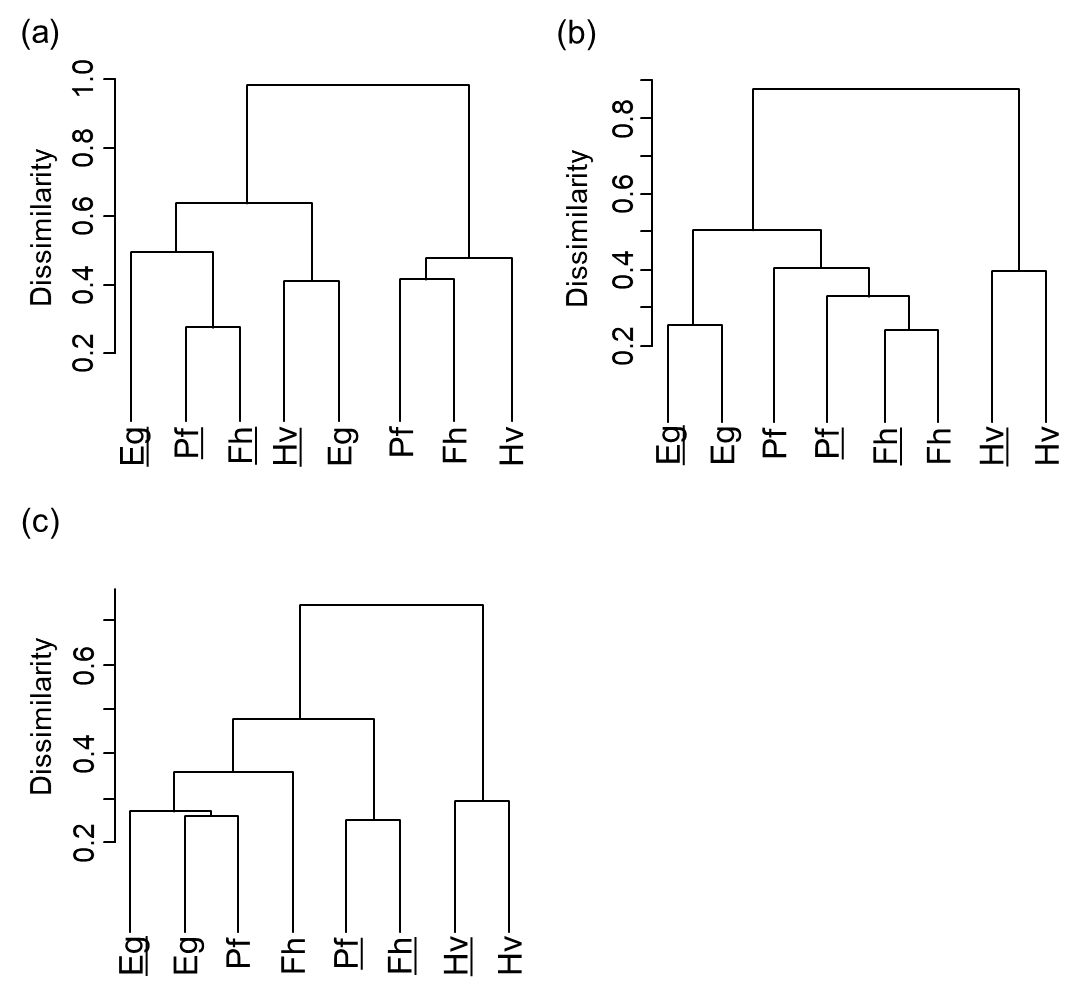
|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | KH32C | | | Control | | |
| Eg | Pf | Hv | Eg | Pf | Hv |
| Shannon index | 7.42 | 7.36 | 7.62 | 7.48 | 7.32 | 7.67 |
| ACE | 11503 | 7879 | 13020 | 11752 | 8354 | 13407 |
| Evenness | 0.91 | 0.92 | 0.93 | 0.92 | 0.91 | 0.93 |



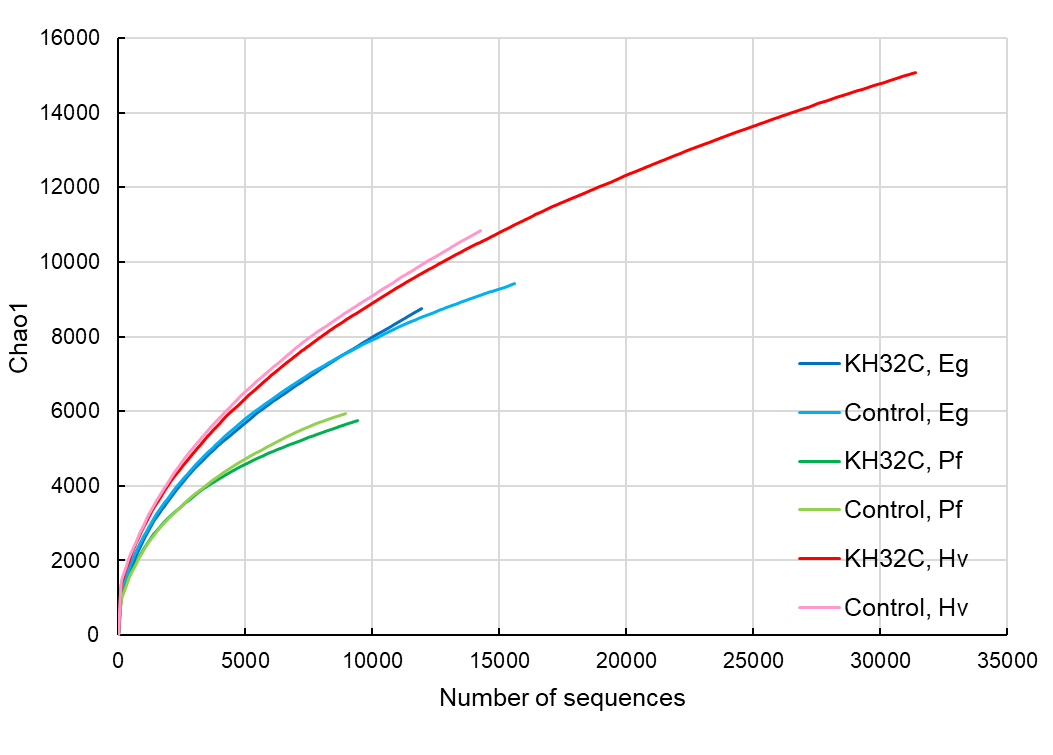
**Figure S1**. Fresh weight of seed-removed rice seedlings grown on nitrogen-deficient agar plates. Error bars mean SD. \*, Significant high at *p*-value <0.01 by heteroscedastic *t*-test.



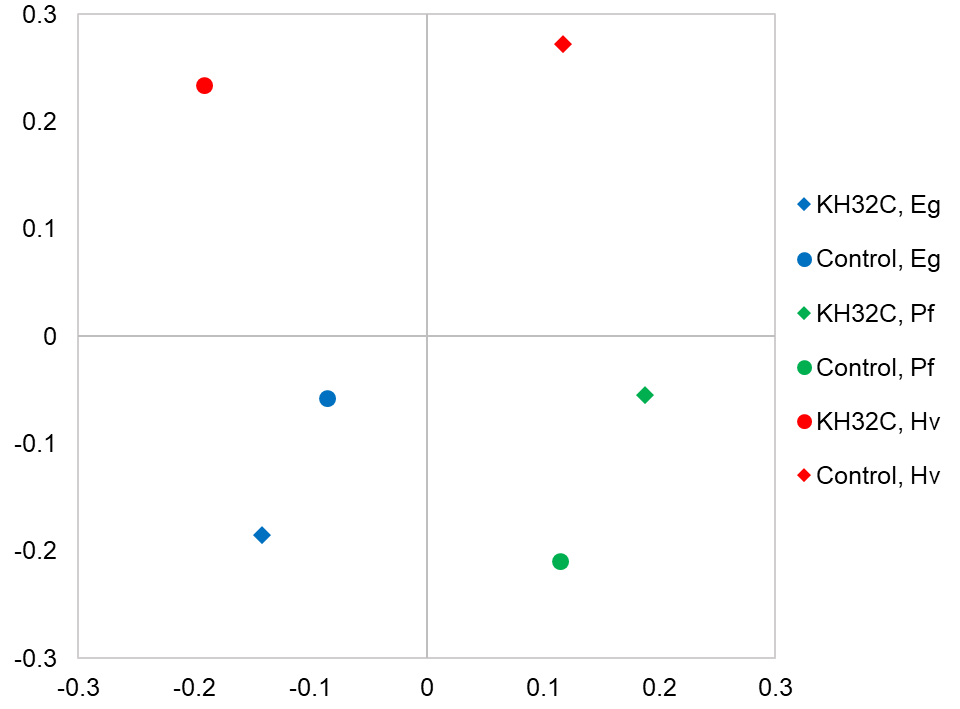
**Figure S2**. Agarose gel electrophoretic patterns of PCR amplification of rice root grown on nitrogen-deficient agar plates.



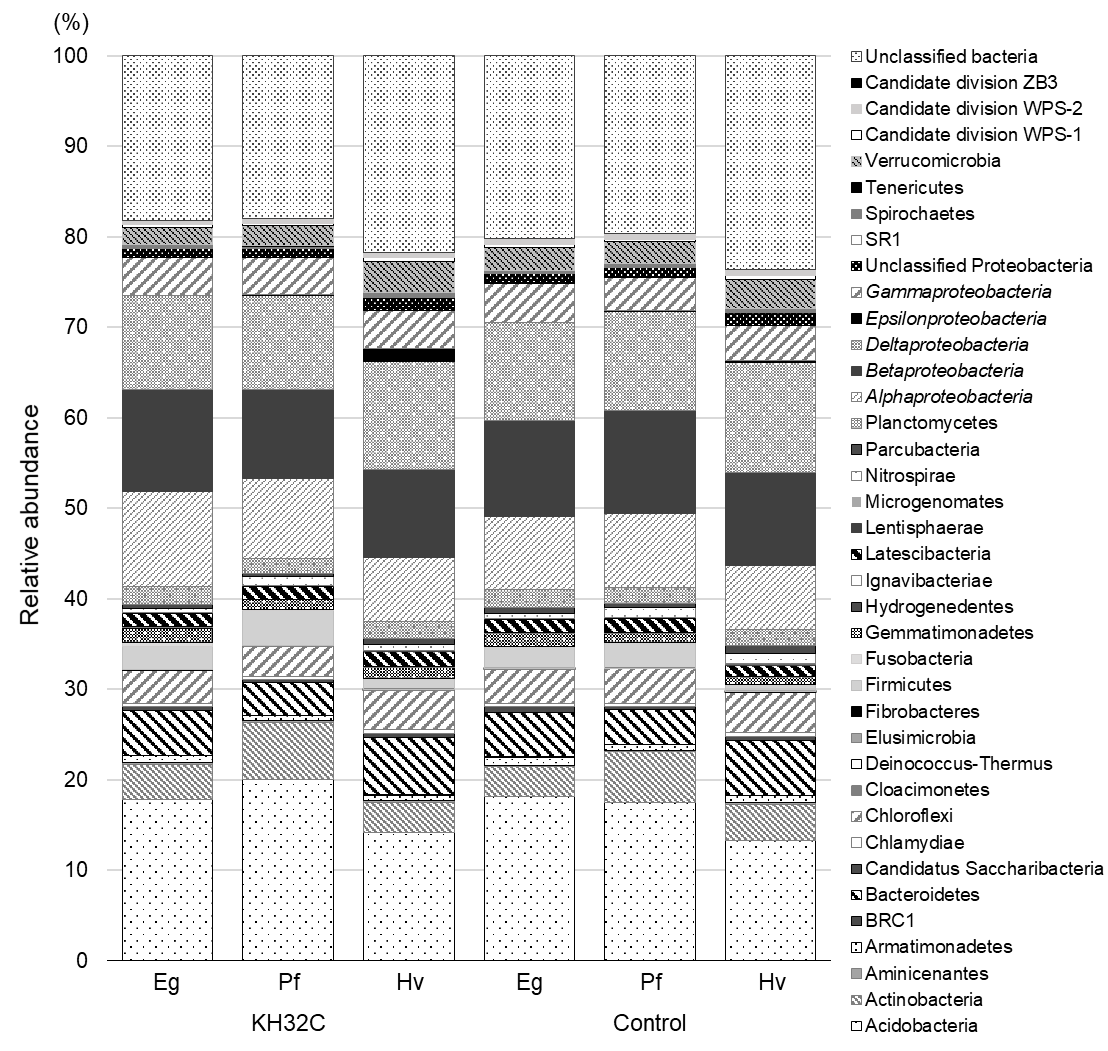
**Figure S3**. Cluster analysis of the bacterial community in rice root-associated soil in each cultivar based on terminal restriction fragments profile in PF2. (a) Nipponbare, (b) Takanari, (c) IR64. Eg, early growth stage; Pf, panicle formation stage; Fh, full heading stage; Hv, harvesting stage. Underlines indicate KH32C inoculation.



**Figure S4**. Rarefaction curve calculated using the chao1 estimator of the Nipponbare root-associated soil bacterial community. Eg, early growth stage; Pf, panicle formation stage; Hv, harvesting stage.



**Figure S5**. Non-metric multidimensional scaling plot of the Nipponbare root-associated soil bacterial community. Eg, early growth stage; Pf, panicle formation stage; Hv, harvesting stage.



**Figure S6**. Bacterial community structure at the phylum level in root-associated soil of Nipponbare in PF4. Proteobacteria are shown at a class level. Eg, early growth stage; Pf, panicle formation stage; Hv, harvesting stage.

**Reference**

Gao N, Shen W, Camargo E, Shiratori Y, Nishizawa T, Isobe K, He X, Senoo K 2017: Nitrous oxide (N2O)-reducing denitrifier-inoculated organic fertilizer mitigates N2O emissions from agricultural soils. *Biol. Fertil. Soils*, **53**,885-898. 10.1007/s00374-017-1231-z