N Uptake Ability under Interrupted N Supply in Day/Night in Response to Transpiration Demand in rice

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イネの窒素吸収能力の昼夜の断続窒素施用への応答の蒸散要求の影響

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N uptake and transpiration rate during the day and night are different because of environmental variation. Mechanism for regulating of N uptake in relation with transpiration is not clear. Here, we tested whether N uptake ability in rice can be changed by transpiration demand during day and night.

Materials and Methods

Rice cultivar Hitomebore (*Oryza sativa.* L) was grown hydroponically in growth chamber under a 12-h light period (282 μmol m^{-2} s^{-1}) and 12-h darkness with 26°C and 68% relative humidity (RH). NH_4Cl was used as N source. The 3-week-old plants were exposed to 3 treatments as Control (CT), with a 24-h N supply at the full-strength nutrient solution (1.0mM day/1.0mM night) ; Day-feeding (DF), only in the 12-h day N supply (1.0mM day/0mM night) ; and Night-feeding (NF), only in the 12-h night N supply (0mM day/1mM night) for 2 weeks. Remaining other half-day of DF and NF, N was not provided. Transpiration rate (*TR*) was modified by changing RH. Three RH levels normal (68%), low (41%) and high (73%) were applied at 7 and 14 days after treatment. Each RH modification applied for 24h (12h day/12h night). So, we performed 3 different RH levels continuously for 4 days by following this pattern “Normal-High-Normal-Low”. *NUR* and *TR* were measured from the change of N concentration and weight of medium, respectively. N concentration was determined by photometer (Photometer-HI83325, HANNA, USA).

Results and Discussion

N uptake ability was acclimated in both day and

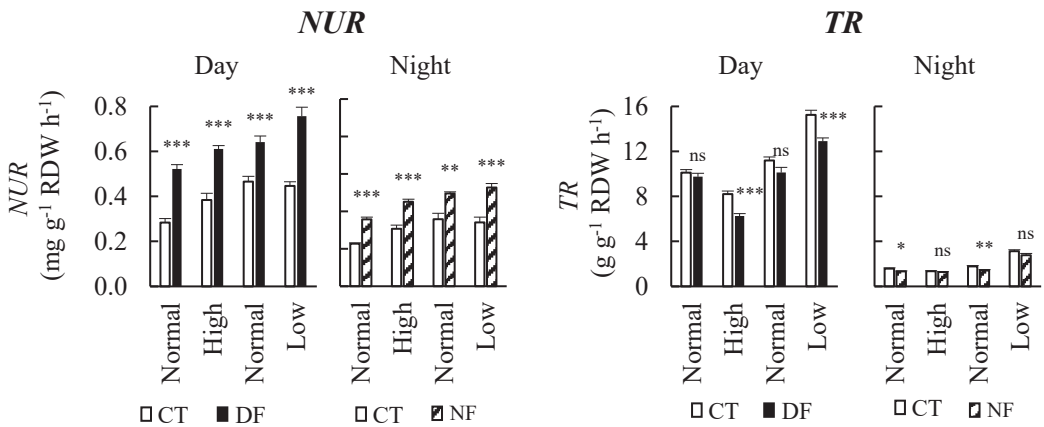

Figure 1. Nitrogen uptake rate (*NUR*) and transpiration rate (*TR*) in control (CT) , day-feeding (DF) and night-feeding (NF) plants under normal, high and low humidity at 14 days after treatment. Root dry weight (RDW) . Significance: ***P < 0.001; **P < 0.01; *P < 0.05; and ns, not significant.

night because *NUR* of DF and NF plants significantly promoted respectively 25-46% and 28-36% than CT plants under normal *TR* or RH where *TR* was slightly reduced or unchanged for both treatments. *NUR* showed positive relationship with *TR* for all treatments during daytime but not for nighttime. To evaluate the effect of *TR* on the acclimatization of *NUR*, we monitored the *NUR* during the day and night under high and low *TR*. During daytime, *TR* of CT and DF plants was increased under low RH by 34-51% and 24-32%, respectively and decreased under high RH by 19-43% and 34-38%, respectively. At night, *TR* of CT and NF plants was promoted under low RH by 62-98% and 64-107%, respectively and reduced under high RH by 15-20% and 5-22%, respectively. Up regulation of *NUR* in DF and NF plant than CT were respectively 21-41% and 6-35% for high; 9-37% and 30-32% for low *TR*. Acclimatization of *NUR* was slightly negatively correlated with RH, indicating minor positive effect of *TR* on *NUR*.

Conclusions

N uptake ability of rice during the day and night under interrupted N supply is acclimated and slightly positively influenced by transpiration.