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論文の内容の要約

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学位論文名	Application of Biofertilizer Containing Spores of *Bacillus pumilus* TUAT1 to Agricultural Rice Cultivation and Exploration for Substances Inducing Plant Growth Promoting Effect

【論文の内容の要約】

Bacteria belonging to *Bacillus* genus form spores that are tolerant to chemicals, ultraviolet lights, and heat stresses. Due to the property, *Bacillus* can be characterized as one of the most suitable bacteria for biofertilizers among manufacturing, transportation, and storage for sustainable agriculture. A biofertilizer named "Kikuichi / Yume-bio" has been developed, containing 10^7 CFU g^{-1} of spores of strain *B. pumilus* TUAT isolated from farming fields of Tokyo University of Agriculture and Technology. The biofertilizer and the strain were reported that they promoted the growth and yield of rice plants. Also, this strain has been reported that the plant response of rice differed between spore inoculation or vegetative cell inoculation; the former promoted the biomass higher than the latter. Similar spore-specific plant growth promotion was reported, such as autoclaved dead spores of several *Bacillus* spp. showed the improvement of rice root development. At first of this study, the experiments were conducted on *Setaria viridis*, a C4 model plant to find the spore-specific plant growth promoting mechanism if it can apply to other plants in chapter 2. This chapter indicated the spore-specific plant growth promotion could be applied to other C4 plants. For further application of this strain as a biofertilizer, the evaluation of the effects on the growth, yield, and lodging resistance of forage rice in transplanting cultivation was conducted in chapter 3. Biofertilizer improved the feeding yields of 'Fukuhibiki' and LTAT-29 that it was ascribed to increases of those total panicle numbers while the biofertilizer application was correlated with total spikelets number of LTAT-29 only. In the yield of TAT-26 as a whole crop silage (WCS), only the shoot dry weight was promoted by biofertilization, especially in sparse transplanting with 4 N. Biofertilization decreased the lodging indexes provided by the improvement of pushing resistance per culm in three genotypes. In addition, the seed coating system for direct sowing using this biofertilizer on forage rice, LTAT-29 was also developed in chapter 4. Three chemical materials for seed coating (e.g., CALPER®, Iron, Benmoly) were fused with the biofertilizer as a double coated. Only the Benmoly was promoted the effect of biofertilizer on the seedlings. Lastly, the analyses of siderophores coded in the genome as a spore-specific substance were conducted using dead spores in chapter 5. The supernatants and residues of autoclaved dead spores at 10^9 CFU ml^{-1} (ADS9) were collected separately to apply on *Setaria*. Surprisingly, both promoted the plant growth. Siderophores were detected from supernatants of ADS but were not from autoclaved dead vegetative cells. The gene expressions of the siderophore biosynthesis were higher in vegetative cells of *B. pumilus* TUAT1 than those in spores, suggesting the siderophores accumulated by spores could be exuded during the germination.