ABSTRACT

Nodulation of soybean (Glycine max (L.) Merr.) cultivar Lambert and genotype PI417566 by Bradyrhizobium japonicum USDA110 in a sterile system is regulated in a population density-dependent manner. Increased nodulation was observed in plants receiving a low density of inoculum, relative to those receiving a high density. The suppression of nodulation was attributed to the presence of a compound(s) produced by B. japonicum USDA110 when grown to high population density, and one of these compounds, bradyoxetin, was previously identified. The compound(s) existing in culture supernatant repressed the expression of nodulation genes. A nodD2′ mutant of B. japonicum USDA110 was insensitive to this quorum-controlled nodulation. The nodD2′ mutant not only had enhanced nodulation, but it is also more competitive for nodulation against USDA123 than is a nolA′ mutant. Additionally, nodW and mwsB genes were also involved in the population density-controlled nodulation, since nodulation by these two mutant strains did not decrease even when a high density of inocula were applied. Quorum-controlled nodulation was alleviated by the addition of either a mixed bed resin or a cation exchange resin into sterile plant growth media prior to soybean planting. Furthermore, enhancement of nodulation was demonstrated by planting soybean at suitable soil conditions of 60% of field capacity and a soil pH of 6.5. With respect to plasmid ecology, studies on geographically and genetically diverse Bradyrhizobium strains using CHEF-PFGE analysis demonstrated that 11
of the 46 strains (24%) investigated harbored at least one plasmid. The plasmid sizes varied from 75 to 285 kb. Plasmids were detected from all geographic regions, and in strains of *B. japonicum* and *B. elkanii*. This suggests that large plasmids are a common feature in *Bradyrhizobium*. However, hybridization studies done using *nod* and *hup* gene probes indicated that none of the strains carry symbiosis-related genes on plasmids.