

ABSTRACT

Examining Effectiveness and Competitiveness in *Rhizobium phaseoli*

PAUL DEAN BROWN

The symbiotic effectiveness of 170 local isolates of *Rhizobium phaseoli* on red kidney beans (*Phaseolus vulgaris*, L. cv. Miss Kelly) was evaluated. Eight isolates were selected as being effective. All were found to be host specific (i.e. nodulating only red kidney beans) and capable of growing at low pH (pH 4.5) in the presence of 50 μ M aluminium ions.

Three of the 170 isolates were found to be temperature tolerant up to 43°C. The putative mutants (cured of the symbiotic plasmid) thus obtained did not nodulate their host nor did they produce melanin and exopolysaccharide as did the parent isolates, and were markedly sensitive to antibiotics. However, they caused root hair deformation of their host. Membrane protein profile of a cured strain was significantly different from that of the wild type strain. When growth was examined at various temperatures, it was noted that treatments of 40°C and 43°C had significant effects on

the growth of the wild type strains whereas initial growth of the cured strains at 43°C was better than at 30°C.

The potential benefit to be derived from seed inoculation of *Phaseolus vulgaris* beans with effective strains of *Rhizobium phaseoli*, was investigated in a field experiment. Inoculation improved grain yields ($p=0.05$) over the control.

Toxin production and speed of nodulation were examined as factors affecting competition. While the strains did not produce any toxin, they varied in their nodulating patterns. The relative nodulating success of five strains *Rhizobium phaseoli* was determined under both sterile and non-sterile conditions in all two-strain combinations and alone as controls. All of the *R. phaseoli* strains tested were found to be more competitive than the indigenous soil population. Strain B2 was found to be the most competitive. A combination of strains B17 and CIAT 652 performed better ($p=0.05$) than all other combined inocula and could be useful as a commercial inoculant.