Organic dry bean (Phaseolus vulgaris L.) acreage in Michigan accounted for 38% of the U.S. total organic dry bean acreage in 2008. Historically, navy beans were the leading market class in the state. More recently black beans have overtaken navy beans. Dry beans have the ability to form an association with Rhizobium spp. which provides nitrogen fixed from the atmosphere to the bean plant. Dry beans are generally considered poor nitrogen fixers and nitrogen is applied to achieve good yield. Variability exists, however, in the ability of different genotypes to fix N.

To investigate the ability of 36 elite breeding navy and black bean lines and checks to fix nitrogen the lines were grown in growth pouches to study early nodule formation and development. Lines were also studied in a greenhouse using a no nitrogen system to determine nitrogen fixation ability at flowering. These three methods, growth pouch, greenhouse, and field, allow evaluation of the early, mid, and late stage nitrogen fixation ability of dry bean genotypes, respectively.

Materials and Methods

For the growth pouch study seeds were sterilized and then germinated for 3 d on water agar (9 g agar in 1 L water) in an incubator at 29°C. Seedlings were dipped in a 3 d old liquid broth culture of Rhizobium tropici strain CIAT899 and placed into vermiculite potting mix. Pots were inoculated with Rhizobium vulgaris strain CIAT899 and placed into organic immersion. Plants were watered with B&D solution (Broughton and Dilworth, 1971).

Certified organic ground and transition ground were used to evaluate the 36 genotypes under organic conditions in Tuscola county on a farmer’s field and at the SVREC. Planting occurred in June 2011 and harvest was by the end of September 2011. Weeds were controlled with cultivation and hand hoeing and pulling.

Pots were inoculated with Rhizobium tropici UMR899. Nodules were counted on day 10.

For the greenhouse study seeds were sterilized and then germinated for 3 d on water agar (9 g agar in 1 L water) in an incubator at 29°C. Seedlings were dipped in a 3 d old liquid broth culture of Rhizobium tropici strain CIAT899 and placed into growth pouches. Plants were watered N free Broughton and Dilworth nutrient solution (Broughton and Dilworth, 1971). Growth pouches were then incubated at 29°C between bean plant and Rhizobium.

For the greenhouse study seeds were sterilized and then germinated for 3 d on water agar (9 g agar in 1 L water) in an incubator at 29°C. Seedlings were dipped in a 3 d old liquid broth culture of Rhizobium tropici strain CIAT899 and placed into growth pouches. Plants were watered N free Broughton and Dilworth nutrient solution (Broughton and Dilworth, 1971). Growth pouches were then incubated at 29°C.