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ORIGINAL PAPER

The effect of mineral N fertilization and seed inoculation with *Bradyrhizobium japonicum* on soybean development and yield in north-eastern Poland

Grzegorz Dzienis[1], Jacek Olszewski[2]*, Adam Okorski[1], Agnieszka Pszczółkowska[1]*

[1] Department of Entomology, Phytopathology and Molecular Diagnostics, University of Warmia and Mazury in Olsztyn, Poland
[2] Experiment and Education Station, University of Warmia and Mazury in Olsztyn, Poland

Abstract

Soybean [*Glycine max* (L.) Merr.] is a strategic crop with a high content of protein and fat that plays an important role in human and animal nutrition. The area under soybean fields continues to increase in Poland. Soybean yields are determined by a number of factors, including nitrogen (N) fertilization and the use of *Rhizobium* bacteria and weather conditions. In the present study, the effect of various N doses and seed inoculation with *Bradyrhizobium japonicum* bacteria on the yield, protein yield of seeds, yield components (number of pods per plant, number of seeds per pod, thousand seed weight) and gas exchange parameters (photosynthetic rate and transpiration rate) was determined in soybean grown in north-eastern Poland. Soybean seed yields increased by 40.3% in response to seed inoculation with the HiStick®Soy preparation, by 43.2% in response to seed inoculation with HiStick®Soy and the application of 30 kg N ha^{-1}, and by 41.9% in response to seed inoculation with HiStick®Soy and the application of 60 kg N ha^{-1} relative to the unfertilized control treatment. The application of 60 kg N ha^{-1} as well as 60 kg N ha^{-1} + HiStick®Soy also positively affected yield components. In both soybean cultivars (Aldana and Annushka), seed yield peaked in 2018, which was characterized by the most beneficial weather conditions for the growth and development of soybean plants. Nitrogen fertilization and seed inoculation exerted varied effects on the examined parameters. The leaf photosynthetic rate was higher at the beginning of flowering than during full flowering.

Keywords: soybean, nitrogen fertilization, *Bradyrhizobium japonicum*, yield, yield components, photosynthesis, transpiration

Agnieszka Pszczółkowska, professor, Department of Entomology, Phytopathology and Molecular Diagnostics, University of Warmia and Mazury in Olsztyn, Pl. Łódzki 5, 10-727 Olsztyn, Poland; e-mail: agnieszka.pszczolkowska@uwm.edu.pl
Jacek Olszewski, associate professor, Experiment and Education Station, University of Warmia and Mazury in Olsztyn, Prawocheńskiego 21, 10-719 Olsztyn, Poland; e-mail: jacek.olszewski@uwm.edu.pl
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