

Abstract

Effect of seed inoculation and fertilization with titanium on soybean yield

Wacław Jarecki

Department of Crop Production, University of Rzeszow, Zelwerowicza 4, Rzeszow 35-601, Poland

Correspondence: wjarecki@ur.edu.pl

Abstract:

Soybean is grown in many parts of the world due to the high demand for seeds (food and feed) and its advantages and disadvantages are well known. In Poland, efforts have been made to increase soybean production through the use of optimal cultivars and cultivation technology. In soybean agriculture practice, an important treatment is the inoculation of seeds with symbiotic bacteria and optimal fertilization with selected nutrients. Recently, due to the rising dearth of microelements in soils worldwide, the use of several elements such as B, Zn, Cu, Mn, Mo, Fe, Si or Ti has received great attention in crop production. Although Ti application in crops is very rare, but several studies reported its beneficial effects on plant growth and development.

The present study examined the reaction of soybean to seed inoculation with *Bradyrhizobium japonicum* and the synergistic effect of foliar fertilization plants with titanium (Ti). The experiment was carried out in 2021-2022 in a field of the Podkarpackie Agricultural Advisory Centre in Boguchwała (21°57'E, 49°59'N), Podkarpackie Province, Poland. The tested factor was a bacterial inoculant for soybean (PRIMSEED® BIOM Soja) and foliar fertilizer (TYTANIT®, Ti - 8,5 g/l) with applied in the following variants:

A – Control

B – Seeds inoculated

C – Foliar fertilization with Ti (in accordance with the instructions on the product label)

D – B + C.

The experiment was carried out in four replicates in a random block design, using the cultivar Mavka, recommended for cultivation in the study area. Soybean was cultivated in accordance with the best agrotechnical knowledge.

It was demonstrated that the best variant was seed inoculation with *Bradyrhizobium japonicum* in combination with foliar titanium application. As a result of this treatments, a significant increase in nodulation, soil plant analysis development (SPAD) index, leaf area index (LAI) and seed yield (by 0.33 t·ha⁻¹) was obtained compared to the control. In addition, the content of total protein in the seeds increased, while the content of crude fat decreased, which significantly modified the yield of both components. Soybean yielded variably during the study years and the difference obtained between 2021 and 2022 was 0.89 t·ha⁻¹. Inoculation seeds with *B. japonicum*, in combination with foliar fertilization with Ti, could be recommended for agricultural practice, which was confirmed by economic calculations. Future experiments will assess the soybean's response to seed inoculation or coating and fertilization with other micronutrients.

Keywords: *Glycine max* (L.) Merr.; nutrition; nitrogen fixation; foliar application; yield; chemical composition