

## Effect of seed inoculation and fertilization with titanium on soybean yield



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### INTRODUCTION

Soybean is the most important protein and oil plant in the world, and its advantages and disadvantages are well known. The largest soybean producers are Brazil, the United States, Argentina and China [1]. In Europe, soybean meal and seeds are in high demand, but the region relies mainly on imports due to the small area of legume cultivation, only 1.5% of agricultural land [2]. 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 some studies [3] reported its beneficial effects on plant growth and development.

### MATERIALS AND METHODS

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.

### RESULTS

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<sup>-1</sup>) was obtained compared to the control (Fig. 1). 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<sup>-1</sup>. 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.

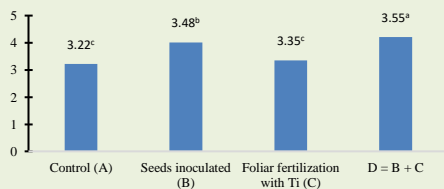


Figure 1. Grain yield (t·ha<sup>-1</sup>)

### CONCLUSIONS

The present study examined the reaction of soybean to seed inoculation with *Bradyrhizobium japonicum* and the synergistic effect of foliar fertilization with titanium. It was demonstrated that seed inoculation combined with foliar titanium application significantly increased: nodulation on roots, SPAD index, LAI index, seed protein content, as well as seed yields compared to control.

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