Innovative biological products in organic bean growing technology

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Introduction

The world, and the European Union in particular, is currently focusing on an agricultural policy that is orientated towards the green deal. This policy has an important environmental significance, which makes the possibility to create organic, healthy products. One of the most important goals in organic farming is to increase plant productivity so that the cultivated plants are able to compete with weeds, diseases and pests (Ostergard, Jensen, 2004). The selection of intensive cultivation technologies in crop production reduces the biological activity of the soil. The application of various pesticides destroys the elements of diseases and pests, however at the same time damages soil microorganisms and pollutes the environment. When the biological activity of the soil decreases, plant residues contaminate the soil with the pests and pathogens, the microbiological processes of the soil are disrupted, the soil lacks oxygen, and excess moisture can occur. All these soil damages create unfavourable conditions for plant growth and development (Suojala, 2000). About 3,000 different species of microorganisms have been detected to inhabit in the soil, and most of them support soil fertility. The soil contains a variety of bacteria, fungi and other microorganisms that provide plants with nutrients. In addition, microorganisms are involved in humification processes (Dewar et al., 2006). Thus, in order to reduce soil damage, recommendations to consider alternatives to the application of microbiological products become more and more frequent. Microbiological products can improve the soil in which plants are grown. These products have the potential to protect plants from diseases, pests and increase the quantity and quality of the yield. Microbiological products can reduce soil degradation and agricultural production resources. They can be used in combination with mineral fertilizers. There is currently a large selection of microbiological products in the world whose market is constantly growing (Gomaa, 2012).

The aim of the study was to evaluate the effect of the biological product Sporeplus on bean growth and productivity, to evaluate the impact of the product on the prevalence of diseases.

Methodology

The research was conducted in 2020 at Vytautas Magnus University Botanical Garden. A field experiment was performed with a purpose to determine the effect of the microbiological product Sporeplus on plant growth, productivity, and crop disease. Two varieties of beans 'Bobas' and 'Tiffany' were studied during the experiment. Methods of the application of microbiological product Sporeplus: 1. (K) - control variant, where the product was not applied at all, 2. (SA) - seeds were treated with Sporeplus 800 g t^{-1}, 3. (SA + A) - seeds were treated with Sporeplus 800 g t^{-1} and the plants were sprayed with Sporeplus 750 g ha^{-1} in BBCH 40-49 stage.

Soil type - *Calcari-Endohypogleyic Luvisol*. Soil granulometric composition according to Fere: sandy loam. The soil of high economic value dominates which is suitable for growing of main agricultural crops. The average soil productivity score in the area is 46.78. The thickness of the humus layer is 25 cm. The soil is slightly alkaline - pH-7.6.

Sporeplus is a microbiological product consisting of the bacterial species *Bacillus licheniformis*, *Bacillus subtilis* and *Bacillus vallismortis*. The product can be used for pre-sowing treatment of plant seeds and for protection against fungal pathogens. The prevalence of disease (%) was estimated according to the methodology described by Dabkevičius and Gaurilčikienė (2002).

Statistical analysis of the experimental data was performed by analysis of variance (ANOVA) using a SELEKCIJA software package.

Results

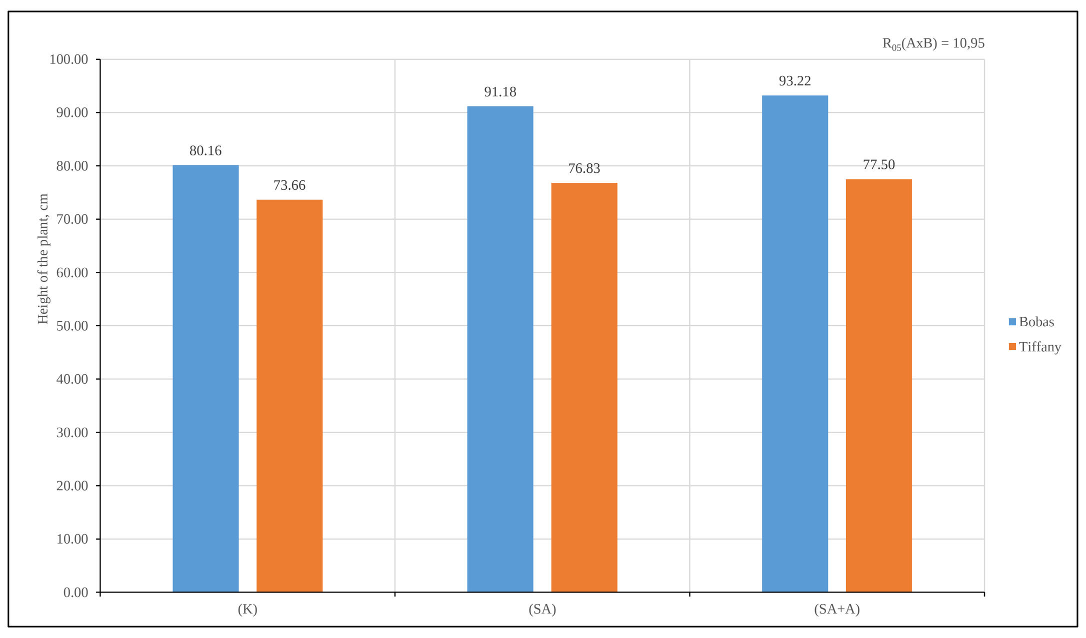

Fig. 1. Influence of biological product on the height of different varieties bean stems, cm *

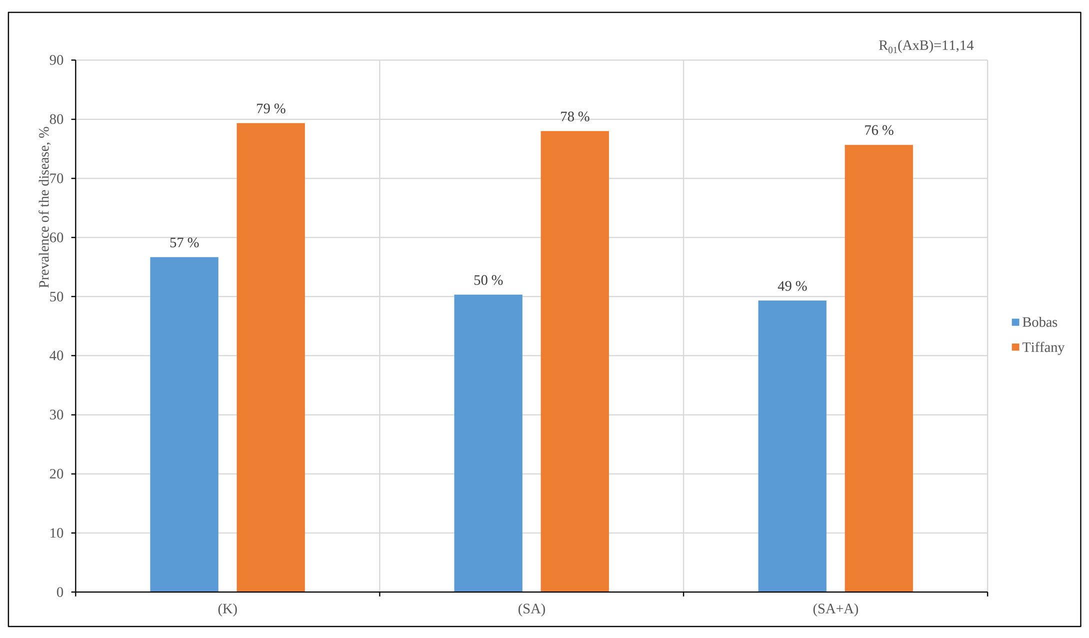

Fig. 3. Influence of the biological product Sporeplus on the prevalence of bean rust, % *

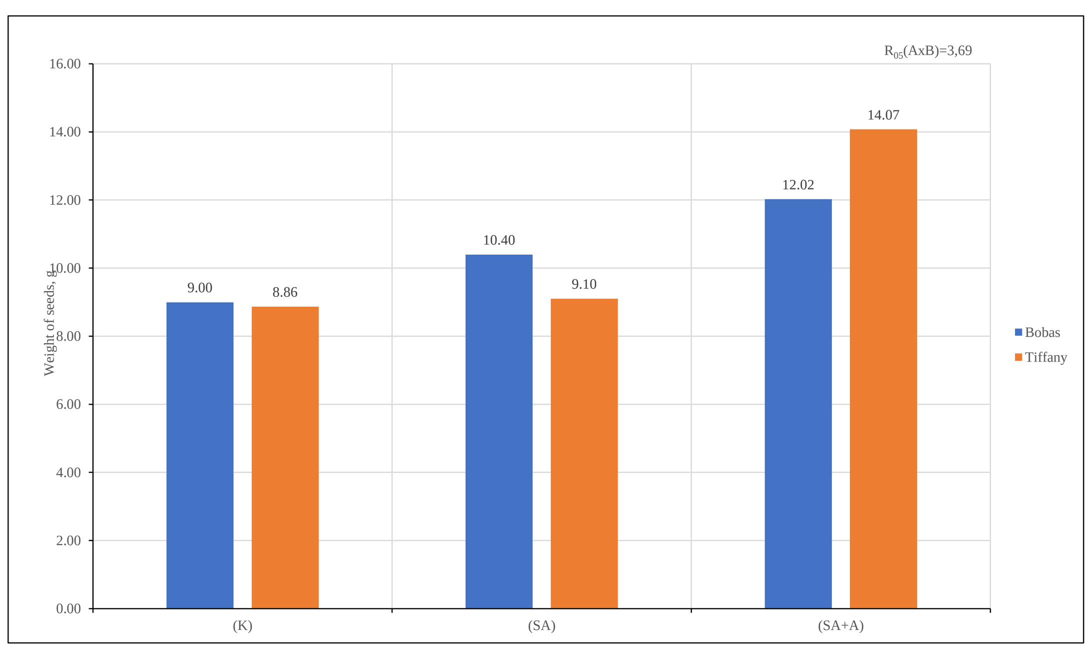

Fig. 2. Influence of the biological product Sporeplus on seed weight of different varieties beans per plant, g *

*Note: (K) – control variant, (SA) – seeds treated with Sporeplus 800 g t^{-1}, (SA+A) – seeds treated with Sporeplus 800 g t^{-1} and plants were sprayed with Sporeplus 750 g ha^{-1}

The highest average bean height was defined in both 'Bobas' (significantly) and 'Tiffany' (insignificantly) varieties sites, where bioproduct Sporeplus was applied for both seed treatment and for later plant spraying during vegetation. Significantly the highest average seed weight per plant was determined in beans of the 'Tiffany' variety, where the seed was treated by bioproduct and also the plants were sprayed with the microbiological product Sporeplus during the vegetation period as well. The average seed weight per plant of the 'Bobas' variety was also the highest (insignificantly) where both the seed and later the plants were treated with the microbiological product Sporeplus. The prevalence of bean rust (Uromyces fabae) was not significantly affected by the application of the microbiological product Sporeplus.