

Biostimulant–microbial interactions improve nodulation, photosynthetic activity, and yield of pea (*Pisum sativum* L.) under semi-arid conditions of southern Ukraine

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Abstract: Pea crops in the semi-arid conditions of southern Ukraine often fail to reach their yield potential because of unfavorable abiotic factors. This study assessed the individual and combined effects of the biostimulants Stimp (ST) and Regoplant (RP) and the microbial inoculant Azotophyt (AZPH) on rhizobial development, photosynthetic activity, and yield formation. Treatments were applied before sowing and as foliar applications during the budding stage. Combined treatments increased nodule number and weight by up to 1.8 and 2.1 times, respectively, compared with the control. AZPH+ST and AZPH+RP increased the leaf area index by 44–78 % and 44–66 %, respectively, and improved leaf area duration by 52–56 % during generative development. Integrated treatments also enhanced net photosynthetic productivity more effectively than separate applications during BBCH 17–61. Pea yield increased by 9.9 %, 19.8 %, 9.3 %, 41.2 %, and 34.5 % with AZPH, ST, RP, AZPH+ST, and AZPH+RP, respectively. Yield gains were mainly due to more pods per plant and improved seed formation and filling. The results demonstrate that combining biostimulants with microbial inoculants enhances pea productivity under semi-arid conditions.

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