

Abstract

Green pea (*Pisum sativum* L.) is a key crop for food security in communities of the Peruvian Andes; however, its productivity is constrained by low soil fertility and the high cost of nitrogen fertilisers. In this context, the effects of co-inoculation with *Rhizobium leguminosarum* bv. *viciae* (strain Ar-014) and *Azospirillum brasilense* (strain Az-007) on crop yield, crude protein content, and economic profitability were evaluated in comparison with conventional nitrogen fertilisation. The study was conducted at the Canaan Agrarian Experimental Station (Ayacucho, Peru; 2,750 m.a.s.l.) using a randomised complete block design with five treatments and four replicates: T01 (*Rhizobium leguminosarum* bv. *viciae* inoculation), T02 (*Azospirillum brasilense* inoculation), T03 (co-inoculation), T04 (mineral-N comparator, 82.5 kg N ha⁻¹), and T05 (uninoculated and unfertilised control). The results showed that T03 (co-inoculation) significantly outperformed nitrogen fertilisation (T04) ($p < 0.01$), achieving higher green pod yield (6.73 vs 5.63 t ha⁻¹), crude protein content (24.28 vs 23.67%), and economic profitability (262.75 vs 176.78%). Furthermore, T03 recorded the highest values for root length (21.73 cm), number of nodules per plant (20.27), and number of seeds per pod (6.07). Individual inoculation treatments (T01 and T02) also improved specific agronomic traits, such as aboveground biomass and number of pods per plant, respectively, although neither surpassed the performance of the co-inoculation treatment (T03). The Relative Yield Index (RYI_N) in the inoculated treatments was 16.85–19.49% higher than that observed under nitrogen fertilization. Overall, these results indicate that co-inoculation with *R. leguminosarum* b. *viciae* and *A. brasilense* (T03) represents a promising alternative to conventional nitrogen fertilization for green pea production under the evaluated high-Andean conditions, improving agronomic performance and economic profitability.