Investigation note

Use of plant growth promoting bacteria to increase the production of *Lactuca sativa* L. in the field

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Abstract

The extensive use of agrochemicals to increase food production today has led to loss of soil fertility, poor crop yield, loss of profits for farmers among many other negative factors, plant growth promoting bacteria they have used to increase the production of crops of agricultural interest, reducing the use of chemicals and creating sustainable agriculture. The objective of this work was to evaluate two consortia of bacteria characterized as BPCV, in lettuce crops. Lettuce orejona cultivation was carried out directly on a demonstration plot, throughout the process it was accompanied by the farmer, the seeds were previously disinfected, embedded by the consortiums used and germinated in pachol directly in the soil, then the seedlings they were placed in grooves to follow up. Obtaining larger lettuce and biomass with consortium B consisting of *B. licheniformis*, *P. putida*, *Pseudomonas* sp., *E. cloacae* and *A. vinelandii* with a value of $p< 0.05$. For what is proposed as a strategy to increase the production of *Lactuca sativa* L., in the communities dedicated to this crop, improving production yield, greater economic and environmentally sustainable gains.

Keywords: BPCV, consortia, lettuce cultivation, plot, production.

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The increase in the need for food by the world population has resulted in an abuse of chemical fertilizers, which leads to the loss of soil fertility, contamination of water resources, cost increases and diseases due to the consumption of traces in food (FAO, 1996; Patel *et al.*, 2012). The producers are currently concerned about the yield of the crops and the pollution that is generated, which is why it is sought to evaluate some other strategies compatible with the environment that are less aggressive with the soil and increase their crops in the same period of time or reducing it.

That is why the use of plant growth promoting bacteria (BPCV) (Vejan *et al.*, 2016) in various crops with favorable results has aroused the interest of local producers to use them in the production of their crops, considering them as biofertilizer, therefore, the strains of de *B. licheniformis*, *P. putida*, *Pseudomonas* sp., *E. cloacae* and *A. vinelandii* previously selected *in vitro* were evaluated on a lettuce plot to promote plant growth.

All strains were obtained from a biobank of -20 °C and inoculated separately in 20 ml nutrient broth until obtaining an $OD_{600\ nm}$ of 1.3 to 1.5, after activating the strains they were transported to the plot destined by the producer that was previously ready to germinate the seeds (collected by the same producer) of *Lactuca sativa* L., orejona variety. Subsequently, the strains were mixed to form equal 1:1 volume consortia and the seeds were embedded in each consortium for 10 min, sown in pachol with the participation of the producer, after germinated the seeds (approximately 18-20 days) were replanted the seedlings and placed at a distance between groove and groove suitable for not mixing, only water was used throughout the crop cycle in each furrow (consortium A; *B. licheniformis*, *P. putida*, *Pseudomonas* sp., *E. cloacae*; consortium B, the strains of consortium A, plus *A. vinelandii*), a groove with fertilizer (Sulfamin 45) and a control was used.

At the end of the production cycle (3 months), healthy and heavier plants were obtained for both consortia, than the fertilizer and control, only consortium B promoted the total growth of the plant and root weight unlike the other treatments, an Anova and comparison of means were performed using the Tukey test (a= 0.05); (Figure 1, 2A and 2B).

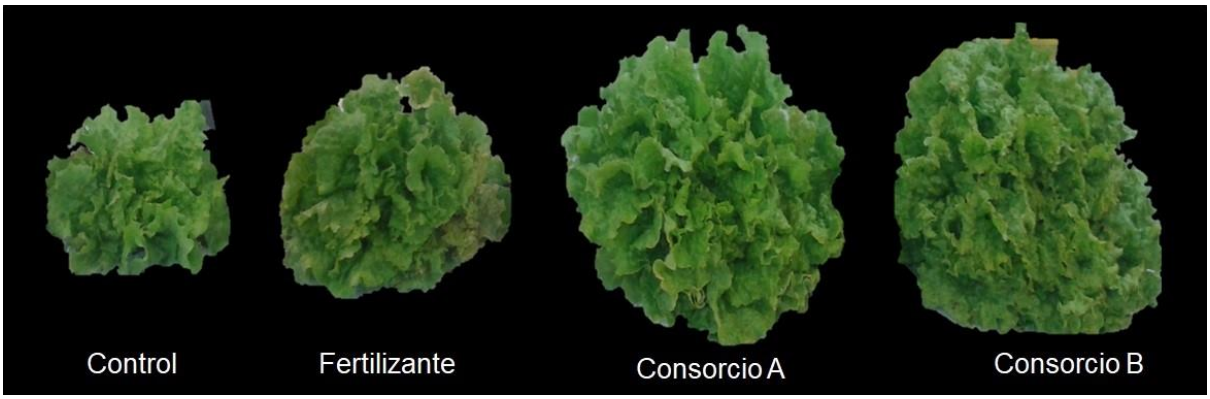

Figure 1. *Lactuca sativa* L. var Orejona (lettuce). From left to right: fertilizer, control, consortium A and consortium B.

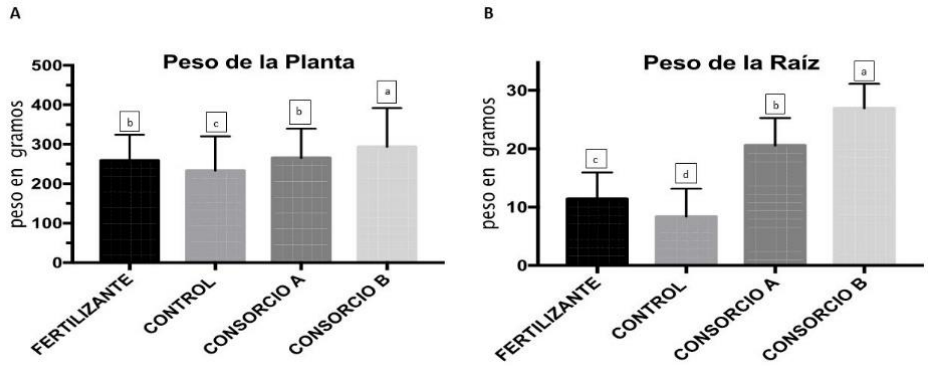

Figure 2. Plant weight (A), root weight (B) of *L. sativa* L., the means with the same letter are statistically equal (a= 0.05)

The growth of the plant was successfully promoted by all the inoculated strains, highlighting consortium B, with the presence of *A. vinelandii*, bacteria capable of increasing N_2 fixation and fertilizer treatment was the least successful. The results suggest that the BPCV of this work have the potential to be used in the production of seedlings of horticultural interest and therefore reduce the use of fertilizers (Martínez-Blanco *et al.*, 2018).

Colonization, impregnation and establishment of BPCV in seeds is a viable strategy, low cost and have a significant effect on plant growth, since they promote germination, root growth, stems, increase in biomass, protection against pathogens , so its application favors a large number of crops of agricultural and horticultural interest, which include: corn, rice, wheat, sorghum, sugar cane, rice, lettuce, wheat, soybeans, radish, rapeseed, alder, among many others (Guerra, Betancourth and Salazar, 2011; Noumavo *et al*., 2016; Parray *et al*., 2016).

Conclusions

BPCV are a viable strategy for producers as they help mitigate the abuse of agrochemicals and obtain higher quality horticultural products for local markets.

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