The variables evaluated included Yield per Bed (RC), Number of Fruits per Sample (NF), and Fruit Equatorial Diameter (DF).
Statistical analysis of the data was conducted using ANOVA, taking into account yield, fruit diameter, fruit weight, and the number of fruits.
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COMPARING THE EFFECT OF CHEMICAL AND BIOL FERTILIZATION ON THE YIELD AND QUALITY OF GREENHOUSE-GROWN CUCUMBER (*Cucumis sativus* L.)

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INTRODUCTION & AIM

The Green Revolution significantly boosted the use of inorganic fertilizers, leading to substantial growth in agricultural production. However, the excessive use of these inputs has resulted in soil fertility loss and degradation, as well as increased production costs, since the prices of these fertilizers have risen drastically due to global inflation and international conflicts in producing countries. In response to this issue, biofertilizers have been developed over the past decade. These can be produced by farmers using local inputs, thereby reducing dependence on other countries while simultaneously improving soil conditions by allowing nutrients to be retained and more readily assimilated by crops. Among these products are mycorrhizal fungi, nitrifying bacteria, composts, and biols (Álvarez, 2010).

The aim of this work was to evaluate the feasibility of biol as an alternative to inorganic fertilization, an experiment was conducted on cucumber crops (*Cucumis sativus* L.) at the Faculty of Higher Studies Cuautitlán, part of the National Autonomous University of Mexico.

METHOD

Four different fertilization plans were evaluated: Biol30 (100L of 3% biol applied every 30 days), Biol70 (100L of 7% biol applied every 30 days), Nitro (1.9kg urea in 3 applications), and Comp [complete fertilization: 2kg $Ca(NO_3)_2$, 1.6kg $MgSO_4$, 0.8kg $(NH_4)_2HPO_4$, 1.6kg KNO_3, and 1.6kg urea]. Comp treatment was designed following a Cucumber production manual for mesh-house systems by Alvarado Carrillo et al. (2017). Phosphorus and potassium were applied 14 days after planting (dap), and the rest were split into three applications: 14, 42, and 63dap. Biol treatments used liquid biofertilizer (biol) produced at the La Laguna field school, established under the “Producción para el Bienestar” program in the community of La Laguna, Apan, Hidalgo. Meanwhile, Treatment Nitro was designed considering nutrient soil contributions, obtained from an analysis conducted prior to the experiment, as shown on Table 1. Each treatment repetition was allocated to a greenhouse cultivation bed of 25 m^2 in a completely randomized design where 120 cucumber seedlings were planted. Fifteen plants per bed were sampled to evaluate size (length and diameter), yield, and fruit weight by harvesting their fruits starting at 50dap. Statistical analysis of the data was conducted using ANOVA and Tukey tests with α=95%. The variables evaluated included Yield per Bed (Y), Number of Fruits per Sample (NF), and Fruit Equatorial Diameter (DF).

Table 1. Fertilization treatments applied in the experiment.

Treatment	Dose (N-P-K)
Comp	425-125-310
Biol 30	0.125-1.57-52.32
Biol 70	0.292-3.5-122.08
Nitro	155-00-00

RESULTS & DISCUSSION

The results showed no significant differences between the organic and chemical treatments regarding yield (p=0.094), as shown in Table 2. This contrasts with the findings of Gámez et al. (2013), where lower yields were obtained even with higher doses of biol. This discrepancy could be associated with the quality of the biofertilizer, as the aforementioned study does not report the nutrient content percentages. In general, the experiment showed that Biol70 produced 1.44x higher yields than Nitro, 1.18x higher than Comp, and only 1.09x higher than Biol30.

Table 2. Total production and yields of the different fertilization treatments.

Treatment	Total harvested fruits (kg)	Average yield (kg/bed)
Biol 30	235.08	29.38 a
Comp	269.35	33.67 a
Biol 70	272.59	34.07 a
Nitro	247.55	30.94 a

As shown in Table 3, the application of 7% biol improved the number of fruits per plant, while the least favorable results were observed in the treatment with nitrogen-adjusted fertilization (p=0.046). This may be due to the high availability of the applied nitrogen, which likely promoted vegetative growth over fruit development.

Table 3. Number of fruits and equatorial diameter of the different treatments.

Grupos	Total number of harvested fruits	Average fruits per bed	Equatorial diameter (cm)
Dosis completa	134	16 a	5.04 a
3L Biol	133	14.375 ab	5.19 a
7L Biol	149	16.625 a	5.17 a
Dosis ajustada	89	11.125 b	5.64 a

For the variable Equatorial Diameter, the Nitro treatment produced the widest, but also heaviest (p≤0.029) fruits. In general, it was seen that the shape of the fruits was not affected by organic fertilization. This contrasts with the findings of Callizaya Huanca (2015), who reported that fruit diameter is related to the amount of biol applied.

The improvement in yield observed in the organic treatments was likely caused by the number of harvested fruits in the Biol and Comp treatments, given that Nitro consistently produced the biggest fruits but also the lowest number of fruits.

CONCLUSION

Although Biol fertilization showed no significant differences for most of the variables, it can be said they performed favorably, producing fruits of similar quality and greater yield when compared to recommended chemical fertilization treatments. Therefore, biol can be considered a sustainable and accessible alternative for the fertilization of cucumber by producers.

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