

INTRODUCTION

- The effects of potassium and sodium bicarbonate against plant diseases are well known.
- Various bicarbonate products provide partial control of many powdery mildew diseases.
- Numerous tests carried out in Europe show that potassium bicarbonate has a good effect in the control of other diseases such as black rot, *Phomopsis* and *Botrytis* on grapes and leaf spot (*Phomopsis obscurans*) on strawberries.
- In 2008, the European Commission (EC) authorized the use of potassium bicarbonate in organic farming (EC, 2008).
- The mechanism of action based on osmotic and pH effects on fungal hyphae and spores is nonspecific, therefore, **the development of resistance is very unlikely.**
- The effectiveness of potassium bicarbonate** in reducing the incidence of disease **was comparable to that of sulfur** for most of the crops tested.
- A water-soluble powder containing 85% potassium bicarbonate is currently registered in the US and is being extensively studied in Europe under the brand name Armicarb 85SP®.

The aim of the study was to evaluate aqueous solutions of potassium bicarbonate (KHCO₃) as a contact fungicide to control powdery mildew infections in cucumbers (*Shaerotheca fuliginea* / *Erysiphe cichorasearum* f. *Cucurbitacearum*) in greenhouse conditions.

Methods

- Studies on the assessment of the fungicidal activity of the aqueous solutions of potassium bicarbonate (PB) were carried out in a greenhouse in the period from 2017 to 2019.

Potassium bicarbonate application doses: 0.4, 0.6 and 0.8% solutions.

- The first 2 treatments were preventive, and the next 3-5 (depending on the vegetation season) were curative (the first one - 48 hours after the first signs of the disease appeared).
- All doses of PB solutions were applied as a foliar spray with an interval between treatments of 7-8 days.
- Throughout the testing period, the degree of manifestation and development of the powdery mildew on cucumbers was monitored in terms of prevalence (in%) and intensity of the disease (in%).
- The fungicidal activity of the PB was evaluated in comparison with the untreated control.



Cucumber leaves infected with powdery mildew (experience of 2018)

Results and Discussions

- The first (preventive) treatment with the PB was carried out based on the absence of signs of the disease in the experiment plots and the appearance of the single colonies in the untreated control plots.
- In all variants of the experiments, **the absence of signs of the disease** was noted both **after the first and after the second treatment** with potassium bicarbonate solutions (Figure 1.).

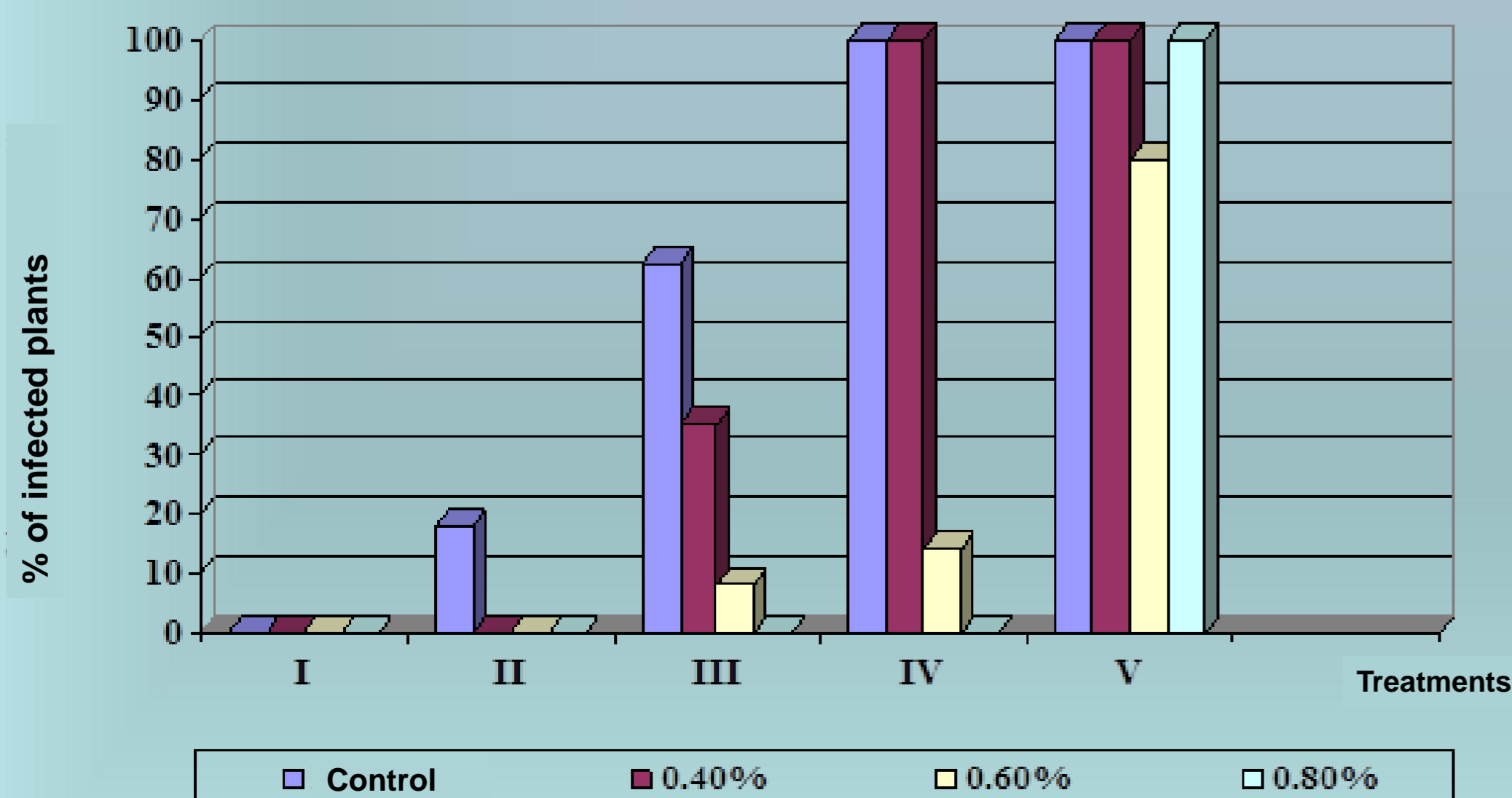


Figure 1. Dynamics of the prevalence of powdery mildew in greenhouse cucumbers based on the treatments with various doses of PB (2018)

Results and Discussions (continued)

- As can be seen from the presented data (Figure 2), the intensity of disease development on the leaf after the first treatment was about 1% in the control, at 0% in the experimental variants.
- At the same time, the prevalence of the disease (the percentage of infected plants from the total number of plants in the group) in the control after the first treatment was 18.7%, and after the second - almost 50%.
- By the third, curative treatment, the presence of colonies of the pathogen was noted both in the control and in the experimental plots at the minimum and medium doses. The latest signs of the disease appeared on leaves treated with a dose of 0.8%, but this was accompanied by pronounced phytotoxicity (multiple burns, leaf drying).
- On average, in all tested groups **based on the use of potassium bicarbonates, the first signs of the disease appeared on the leaves 2-2.5 weeks later than in the control.**
- Note that when using high and medium concentrations (0.6% and 0.8%) of the PB, multiple small burns were observed on the leaves. On the variant with a concentration of 0.4%, there were practically no burns (the appearance of the leaves did not differ from the control).

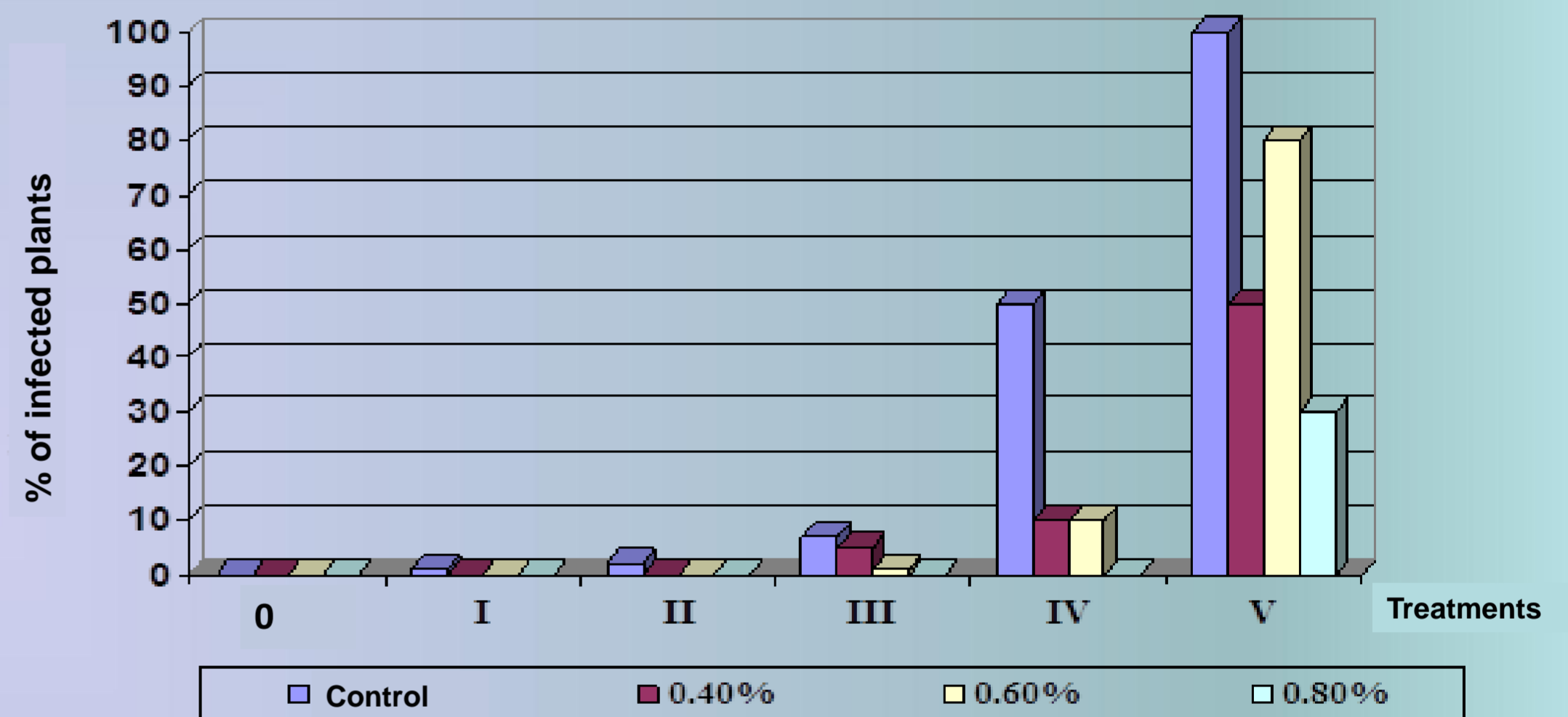


Figure 2. The intensity of the development of powdery mildew on greenhouse cucumbers based on the treatments with different doses of PB (%) (2018).

SUMMARY and CONCLUSIONS

- In a greenhouse, **the use of a product based on potassium bicarbonate** in all tested doses at the initial stages of the development of the disease **showed a good protective effect** - the delay in the development of the disease in the experimental groups was 14-17 days compared to the control.
- All potassium bicarbonate doses above 0.4% show significant phytotoxicity.

Good efficiency in the control of cucumber powdery mildew with less phytotoxicity, under the conditions of the 2017-2019 seasons, **was shown by a dose of 0.4%.**

It is not recommended to carry out preventive treatments in the early stages of culture growth (3-5 true leaves) **due to the high phytotoxicity of PB solutions.**

Potassium bicarbonate is a natural inorganic salt and concentrations that are recommended for agricultural use **are unlikely to have any adverse effects on humans and the environment.**

Experiments to evaluate the effectiveness of cucumber powdery mildew control (*Erysiphe cichorasearum*)



Untreated control

Product on the basis of potassium bicarbonate solution of 0,4 %