

# The effect of fermentation by *Bacillus subtilis* on the disappearance kinetics of pesticide residues in legume seeds

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In the conventional agricultural practices, pesticides are used as a part of an integrated plant protection scheme. The aim of this study was to conduct the fermentation process in four plant matrices (lens, chickpea, pea, and soybean) using *B. subtilis* in controlled conditions and then to determine the residue content for two pesticides depending on the fermentation length.

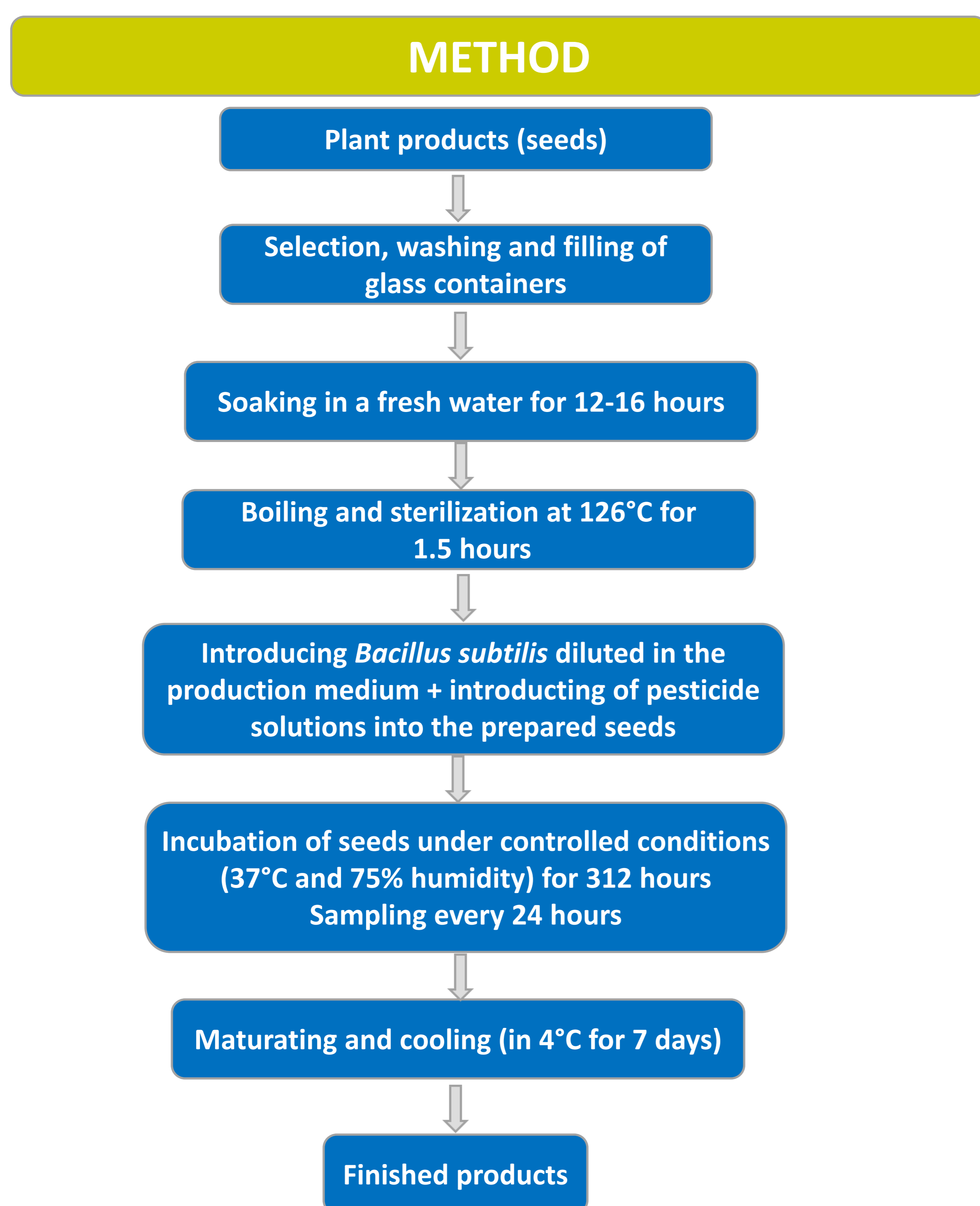


Fig. 1. A diagram presenting preparation and fermentation of plant products by *Bacillus subtilis* [1].

## Pesticide content analysis

The pesticide residue content in fermented seeds was assessed with the QuEChERS multiresidue method, combined with gas chromatography coupled with tandem mass spectrometry (GC-MS/MS) [2].

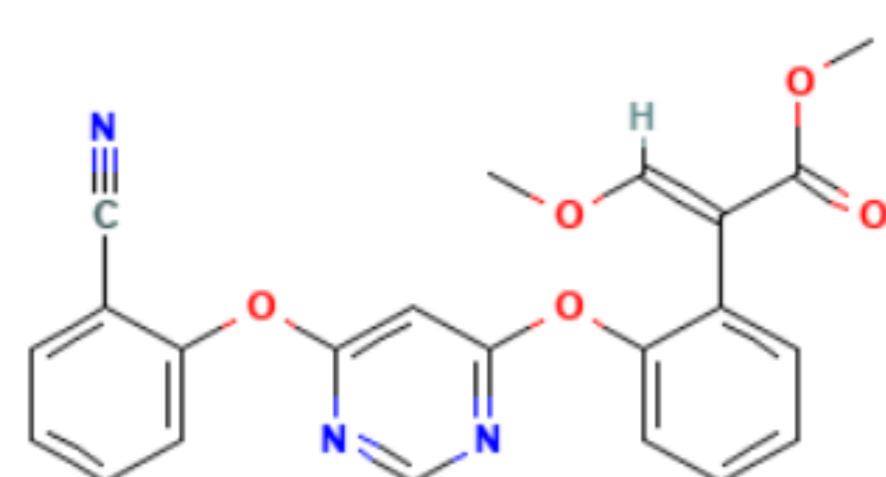


Fig. 2 Azoxystrobin (a post-emergence broad spectrum strobilurin fungicide used mainly for cereals)

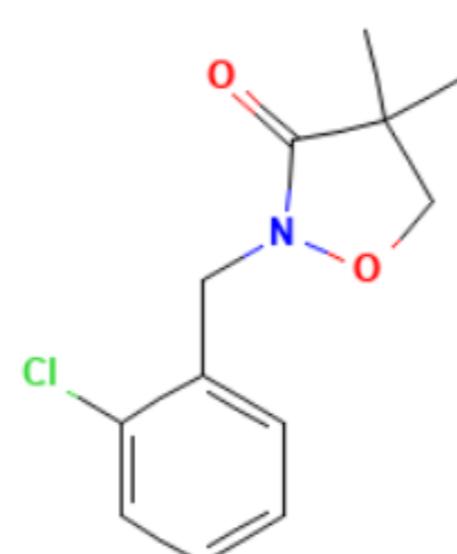


Fig. 3. Clomazone (herbicide used for the control of broad-leaved weeds and grasses in a range of crops)

## RESULTS

### Fermentation products

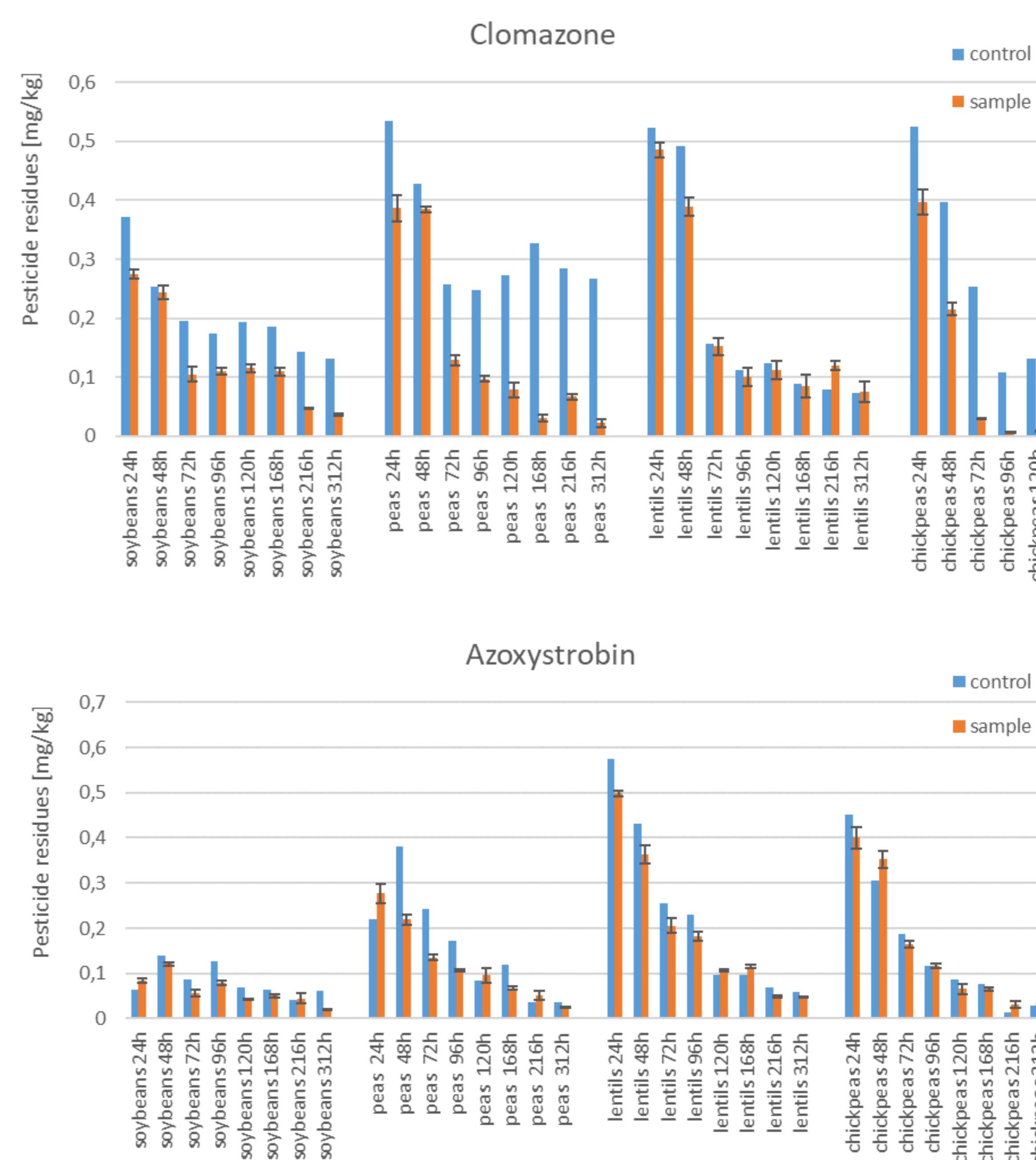


Fig. 4. Degradation of clomazone and azoxystrobin in fermented samples.

## CONCLUSIONS

Fermentation with *Bacillus subtilis* can effectively and significantly reduce pesticides contamination in legumes (soybeans, peas, lens, and chickpea). The conducted experiments demonstrated its ability to achieve a significant reduction in concentration of two pesticides, azoxystrobin and clomazone, with the fermentation progress. The most intense degradation occurred during first hours of the process.

## REFERENCES

- Słowik-Borowiec M., Zdeb G. Kinetics of the dissipation of azoxystrobin, quizalofop-p-ethyl, fluzifop-p-butyl and clomazone in fermented legume seeds, J. Food Compos. Anal., 2024, 127, 105993, <https://doi.org/10.1016/j.jfca.2024.105993>
- Słowik-Borowiec M., Szpyrka, E., Książek-Trela P. Podbielska M. (2022) Simultaneous Determination of Multi-Class Pesticide Residues and PAHs in Plant Material and Soil Samples Using the Optimized QuEChERS Method and Tandem Mass Spectrometry Analysis. Molecules. 27, 2140. <https://doi.org/10.3390/molecules27072140>



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