Would micro-ecology be damaged by a plastic film that kills a harmful soil insect?

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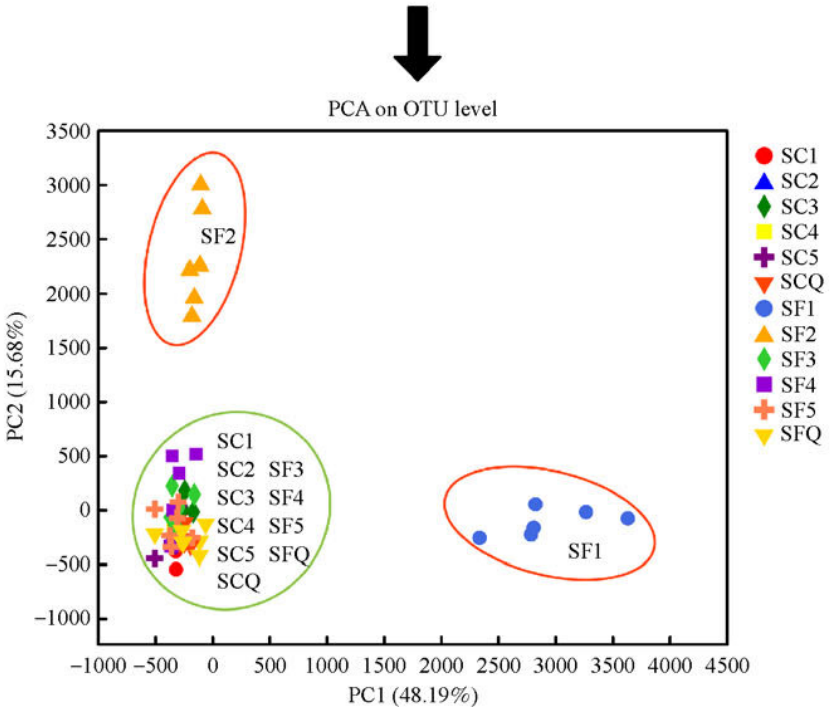
PCA on OTU level
PC2 (15.68%)
PC1 (48.19%)
3500
3000
2500
2000
1500
1000
500
0
−500
−1000
−1000 −500 0 500 1000 1500 2000 2500 3000 3500 4000 4500
SF2
SC1
SC2 SF3
SC3 SF4
SC4 SF5
SC5 SFQ
SCQ
SF1
SC1
SC2
SC3
SC4
SC5
SCQ
SF1
SF2
SF3
SF4
SF5
SFQ

Credit: Youjun Zhang

Chinese chive (Allium tuberosum) is a perennial herbaceous vegetable with medicinal qualities. Unfortunately, Chinese chive crops are severely damaged by the soil insect Bradysia cellarum. B. cellarum are mainly found in the surface soil to a depth of 5 cm. Department of Plant Protection, Institute of Vegetables and Flowers, Chinese Academy of Agricultural Sciences Investigator Youjun Zhang and his team showed that thermal treatment of B. cellarum adults, eggs, larvae, and pupae at 40 °C for 3 hours produced mortalities of 100%, 100%, 100% and 81%, respectively, and the fecundity of B. cellarum significantly decreased with increasing temperature and exposure time, completely inhibiting egg-laying at 37°C for 2 hours. These data suggested that B. cellarum is quite sensitive to elevated temperatures. As long as soil temperature to a depth of 5 cm is increased and remains over 40°C for 4 hours, the mortality rate of B. cellarum will be 100%. Therefore, the team has been studying how to improve soil temperature without destroying the ecological environment.

Youjun Zhang and his team had believed that applying a light blue anti-dropping film of 0.10 or 0.12 mm thickness would be enough to kill B. cellarum under a sufficient intensity of sunlight (e.g., between late April and mid-September in Beijing, China). The method was called soil solarization. However, it was not known whether soil solarization affects soil microbial diversity. If soil solarization can kill B. cellarum and also avoid affecting Chinese chive growth and the soil microbial ecological balance, it will be an environmentally friendly control technology.

In this study, Youjun Zhang and his team show that on the first day after

soil solarization, 100% control of B. cellarum was achieved. Growth of Chinese chive was lower in solarized plots than in control plots over the first 10 days after treatment, but 20 days after treatment, plants in the solarized plot had recovered and leaf height and yields were equivalent among the treatments. Moreover, the soil microbial community diversity in the treatment group decreased initially before gradually recovering. In addition, the abundance of beneficial microorganisms in the genus Bacillus and in the phyla Proteobacteria, Chloroflexi and Firmicutes increased significantly.

Soil solarization is a promising strategy to control B. cellarum. It is simple to implement, pesticide-free and non-destructive to soil microbial diversity, and it may also promote the abundance of beneficial microorganisms. Soil solarization is practical and worth promoting as a new method of control of B. cellarum infestations in Chinese chive-growing regions.

More information: Effect of Solarization to Kill Bradysia Cellarum on Chinese Chive Growth and Soil Microbial Diversity, *Frontiers of Agricultural Science and Engineering* (2021). DOI: 10.15302/J-FASE-2021402

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