FORECASTING SUGAR BEET CYST NEMATODE SUPPRESSION IN IMPERIAL VALLEY SOILS

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Introduction:

In California (CA), sugar beets (*Beta vulgaris*) are grown almost exclusively in the Imperial Valley. The per-acre yield is more than twice the US average. The cyst nematode *Heterodera schachtii* is the primary nematode pest but is subject to microbial suppression by species of the Ascomycota *Hyalorbilia oviparasitica* clade. Since the 1960s, the crop has been managed by setting *H. schachtii* population thresholds at harvest, which contractually limits host crop years in rotation. A pre-season DNA soil analysis for *H. oviparasitica* may predict the extent of the nematode population suppression.

Material & Methods

At the 2019 harvest, tare soil samples from 44 different sugar beet fields were collected at the sugar beet processing plant in Brawley, Imperial County, CA (Fig. 1).

Fig. 1 Imperial Valley

After air-drying (Fig. 2) and sieving the samples, *H. oviparasitica* clade members were consistently detected in 13 but not in 5 soils using repeated sequence-selective nested TaqMan qPCR assays.

Fig. 2 Soil air drying

Randomly selected, seven positive and two negative soil samples were each divided into untreated and autoclaved. Four conical tubes were each filled with 200 cm^3 portions of either treatment, seeded with cabbage, and arranged in an RCB design (Fig. 3). Three weeks later, all tubes were infested with 500 second-stage juveniles (J2) of *H. schachtii*. The experiment was conducted twice for 12 weeks (about 1,430-degree days, base temperature 8˚C). White females (Fig. 4) and cysts of *H. schachtii* were washed off the roots with a water jet nozzle, extracted by sieving, and counted.

Fig. 3 Trial set-up

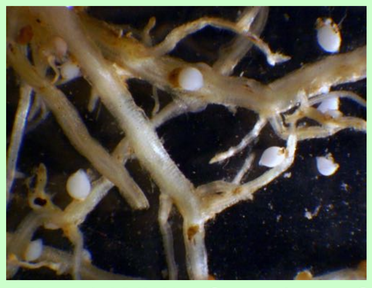

Fig. 4 White females of *Heterodera schachtii*

Results & Discussion

In the combined ANOVA analysis, numbers of white females and cysts in untreated, J2-infested soils with consistent *H. oviparasitica* clade signals were reduced to 1/3 to 1/6 compared to autoclaved, *H. schachtii* infested controls. The two soils with no *H. oviparasitica* qPCR signal showed no suppressive effect compared to the controls (Fig. 5). Only *Hyalorbilia* spp. were isolated from the female nematodes, providing evidence of parasitism in the suppressive soils (Fig. 6).

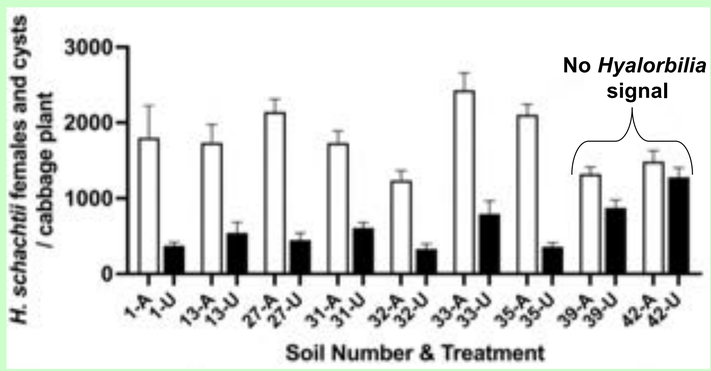

Fig. 5 Numbers of *Heterodera schachtii* females and cysts in autoclaved (A, white bars) and untreated soils (U, black bars), 12 weeks after J2 infestation.

Conclusions

qPCR detection of the *H. oviparasitica* clade in sugar beet tare soil was predictive of its *H. schachtii* population-suppressive activity during the following sugar beet growing season.

Fig. 6 *Heterodera schachtii* female parasitized by *Hyalorbilia* sp.

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