Effects of tillage and maize (*Zea mays* L.) and soybean (*Glycine max* L., Merr) germplasm rotation on the establishment of soybean cyst nematode (*Heterodera glycines* Ichinohe) in virgin land

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ABSTRACT

Increasing distribution of the soybean cyst nematode (SCN, *Heterodera glycines* Ichinohe) in a wide range of soybean (*Glycine max* L., Merr) production landscapes presents major management challenges, including integrating tillage systems. Little is known about how SCN adapts and reproduces when introduced into SCN-virgin land and subjected to tillage, rotation and germplasm. This study introduced SCN race 3 (Hg Type 0) into SCN-virgin Sisson sandy loam (Fine, loamy, mixed, semiactive, mesic Type, Hapludalfs) field in East Lansing, MI, USA, at more than 4,000 eggs/100 cm^3 of soil in 2001 and 2002 under till an no-till, and either maize (*Zea mays* L., C), SCN- resistant soybean (R), or SCN-susceptible soybean (S) monocrop, or RCRC and SCSC rotation cycles. The high inoculum was designed to assess fluctuations from the point of introduction. Few cysts were detected in non-infested plots. Over six years (2003 – 2008), the population density in SCN-infested plots remained less than 1 cyst/100 cm^3 of soil, suggesting a phase of prolonged decline. Overall, SCN population density was lower in no-till than in tilled plots, and highest in S and lowest in C or RC rotations, suggesting the benefits of no-till and cropping system as suppression practices. SCN population density was significantly affected by the interactions of tillage, cropping system, and/or time, showing basis for variable responses. While varying by time, nodulation was lower in SCN-infested and tilled than in non-infested and no-till plots. In 2007 and in 2008 stand count was less in tilled than in no-till plots. Yield of soybean cultivars was similar between nematode treatments until 2006. In 2007, soybean yield in both tillage systems, and in 2008, in no-till plots, of SCN-infested plots was significantly lower than non-infested plots. Normalized difference vegetative index (NDVI, indicator of physiological activities), with soil clay and sand and yield, with sand, had varying degrees of correlations. Moreover, the significant interactions among sand content*tillage*SCN*year on yield and sand*rotation*SCN*year on yield and NDVI show the need to understand variabilities across soils and climates. The results support the hypothesis that the level of SCN establishment SCN-virgin land will depend on tillage, rotation and germplasm, and it takes six years to establish itself to detectable levels. Thus, providing agro-biologically based timeline information that is critical for SCN and tillage management in cropping systems.

Keywords: Correlations, interactions, management strategy, soil conditions