

Understanding Farmer Motivations for Adopting Soil Health Management Techniques

Introduction/Need for Research:

Organic high-tunnel vegetable production is increasingly important across Pennsylvania and the surrounding region, extending growing seasons and improving farm profitability (Ford et al., 2023; Lamont, 2019). Yet intensive use places sustained pressure on soil systems: restricted crop rotation and repeated planting cycles accelerate the buildup of soilborne pests, pathogens, and weeds, limiting yields (Carey et al., 2009; Pierre et al., 2024). Organic growers face particular difficulty managing these pressures, as many conventional chemical fumigants are prohibited under certification standards (Broderick et al., 2023). Following the phase-out of methyl bromide, non-chemical alternatives such as Anaerobic Soil Disinfestation (ASD) and Soil Steaming Disinfection (SSD) have emerged as promising solutions; however, despite demonstrated effectiveness, adoption among organic high-tunnel growers in this region remains limited (Panth et al., 2020). Existing research has emphasized agronomic outcomes while paying less attention to how farmers experience these technologies and make adoption decisions in practice. This study explores farmers' motivations for adopting ASD and SSD, offering insights into the decision-making processes underlying adoption and informing the design of Extension education programs.

Conceptual or Theoretical Framework:

This study draws on the Theory of Planned Behavior (TPB; Ajzen, 1991) and the Diffusion of Innovations (DOI; Rogers, 2003) to understand the motivations of organic high-tunnel growers to adopt Anaerobic Soil Disinfestation (ASD) and Soil Steaming Disinfection (SSD). TPB identifies three belief-based influences on adoption: behavioral beliefs (perceived outcomes, such as pathogen control or yield), normative beliefs (perceived social pressure from peers, Extension agents, or certifiers), and control beliefs (perceived ease of adoption based on resource access). DOI contributes to technology characteristics, relative advantage, complexity, compatibility, trialability, and observability (Rogers, 2003), while perceived barriers (e.g., cost, labor, equipment access, training, environmental factors) and demographic characteristics (age, farming experience, farm revenue) round out the model as additional influences on adoption behavior. Together, these frameworks provide a lens for exploring why farmers selectively and situationally adopt ASD and SSD, and for identifying the motivational factors that strongly encourage adoption among organic high-tunnel growers.

Method:

This study employed a qualitative research design to explore organic high-tunnel growers' motivations to adopt ASD and SSD. A purposive, criterion-based sampling strategy, supplemented by snowball sampling, was used to recruit organically aligned high-Tunnel growers (18+) in Pennsylvania and the surrounding region through the Pennsylvania Association for Sustainable Agriculture Conference 2025 and 2026, Mid-Atlantic Fruit and Vegetable Convention 2026, farm visits, professional networks, and interested survey respondents. Based on the study's conceptual framework, a semi-structured interview instrument was developed comprising seven major questions, each with probing follow-ups, addressing behavioral beliefs, normative beliefs, control beliefs, technology characteristics, motivations, barriers, and adoption intention, concluding with a demographic component; separate adopter and non-adopter guides shared identical core domains. A pilot interview was conducted in Fall 2025 to assess protocol clarity (Turner, 2010). Fourteen semi-structured interviews (11 via Zoom, 2 by phone, 1 in person) were audio- and video-recorded with consent, transcribed, and verified against the recordings (Creswell & Poth, 2018). A hybrid inductive-deductive thematic analysis followed Fereday and Muir-Cochrane (2006): codes were

developed inductively from the initial three transcripts, applied across all 14, and refined until saturation (Guest et al., 2006), then deductively classified as motivations or barriers. Trustworthiness followed Lincoln and Guba's (1985) criteria, including member checking, an audit trail, and intercoder reliability on two transcripts

Results/findings:

Analysis of the interviews identified five motivation themes influencing farmers' decisions to adopt ASD and SSD: pathogens, pests, and weeds concerns (10 of 14 participants; 8 adopters, 2 non-adopters); perceived effectiveness (14 of 14; 8 adopters, 6 non-adopters); organic compatibility (10 of 14; 5 adopters, 5 non-adopters); economic and access factors (11 of 14; 7 adopters, 4 non-adopters); and knowledge and social factors (14 of 14; 8 adopters, 6 non-adopters). Adopters consistently described adoption as a response to chronic or escalating soilborne problems. One farmer explained, *"We were at a point where we were like; this is kind of a last-ditch effort"* (F4). Adopters also emphasized visible and rapid outcomes, particularly for soil steaming: *"The first result was like, wow, look how green and lush this is... and the second thing was, there are no weeds"* (F7); experiences with ASD were more variable, suggesting less consistency in perceived performance outcomes. Non-adopters acknowledged disease pressure and recognized the appeal of chemical-free approaches, but motivation remained conditional, with hesitation primarily linked to uncertainty about outcomes and concerns for soil health; interest under certain conditions did not consistently translate into adoption.

Implications/Conclusion:

This study is exploratory and findings from this study suggest that Extension programming might need to move beyond traditional outreach by incorporating on-farm demonstrations, field trials, farm tours, and peer-to-peer learning opportunities that allow growers to observe the effectiveness of ASD and SSD firsthand. Educational efforts might also address concerns regarding organic compatibility, reliability, and consistency of outcomes. The results indicate that adoption decisions are driven primarily by practical experience and observable evidence rather than attitudes alone. While adopters were motivated by demonstrated effectiveness and production needs, non-adopters expressed willingness to adopt these practices if provided with stronger evidence of their effectiveness and alignment with organic production systems.

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