

Economic Analysis of Anaerobic Soil Disinfestation on Tomato Production in Southwest and North Florida



Introduction

- With the phase-out of methyl bromide, research has focused on developing alternative biological fumigation methods.
- Anaerobic soil disinfestation (ASD) is a biological method developed to suppress plant parasitic nematodes, weeds and soil borne pathogens.
- This study conducted trails to collect data on tomato costs of pre-planting, production, harvesting and marketing, market tomato prices and tomato yields.

Hypothesis

- Anaerobic soil disinfestation had no negative effects on tomato fruit qualities, such as firmness, pH, or macronutrient and micronutrient content.
- Although ASD can be a high cost production method, the high tomato yield generated significant gross returns to offset the additional cost.

Objective

- To check the economic viability of using ASD in tomato production drawing on data produced by two field experiment stations.

Materials and Methods

- Southwest Florida Research and Education Center in Immokalee, FL.
- Plant Science Research and Education Unit in Citra, FL.
- Three harvests in Immokalee from 01/04/2016-01/26/2016.
- Five harvests in Citra from 11/10/2015-12/08/2015.
- Six field trails.
- Each location had one chemical soil fumigation (CSF) and two ASD treatments in a randomized complete block design.
- Chemical soil fumigation treatments were conducted in fumigated raised beds with polyethylene mulch and drip irrigation. Anaerobic soil disinfestation used labile organic carbon sources like molasses or composed poultry litter(CPL), to stimulate soil microbial respiration and oxygen consumption.
- Pic-Clor 60 (1,3-dichloropropene + chloropicrin) was used as the CSF and applied at 224 kg ha⁻¹. Molasses was applied by 6.93 m³ ha⁻¹ for treatment ASD0.5 and 13.86 m³ ha⁻¹ for ASD1.0. Composed poultry litter was applied at a rate of 11 Mg ha⁻¹ for ASD0.5 and 22 Mg ha⁻¹ for ASD1.0.



Results

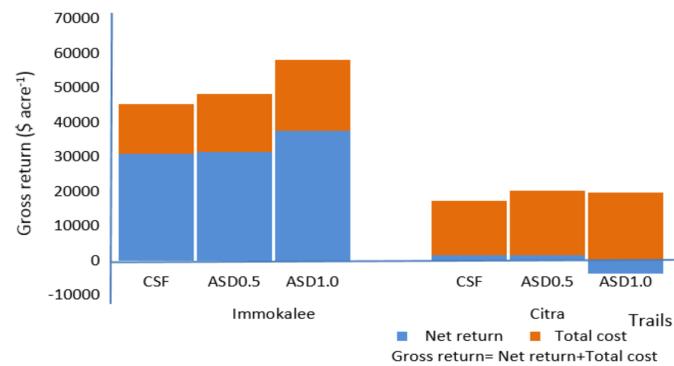


Figure1 Estimated gross returns, net returns and total cost of tomato production between CSF and ASD at Immokalee and Citra

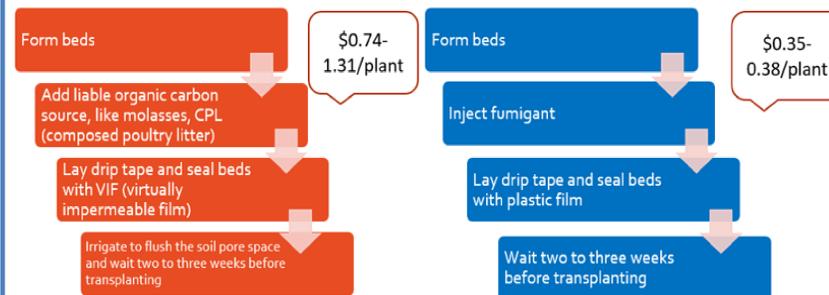


Figure2 Pre-planting differences between ASD and CSF

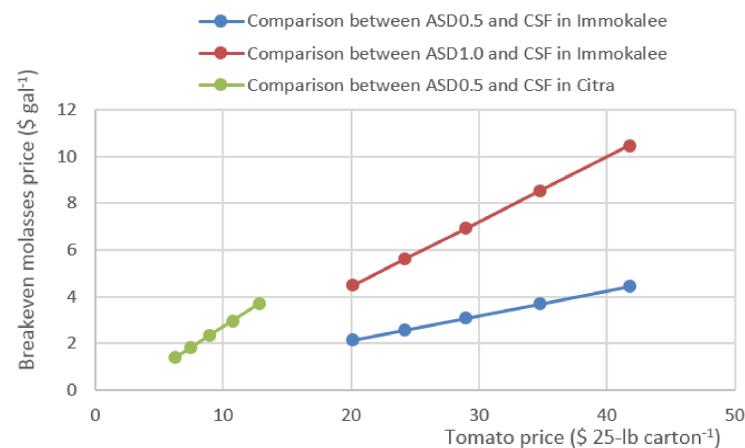


Figure3 Breakeven molasses price with varying tomato price

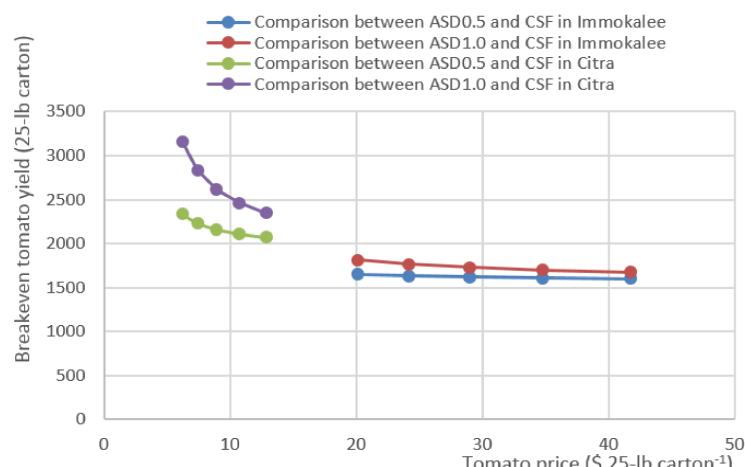


Figure4 Breakeven tomato yield with varying tomato price

Main Points in Figures

- Figure 1
 - These two ASD treatments in Immokalee generated higher net return than the CSF treatment.
 - Although the commercial viability on ASD in Citra was not obvious, we can still get profit if we sell the Citra's tomato at Immokalee's price. The planting date was not the most concerned factor. However the market tomato price changed a lot as time changing.
- Figure 2
 - The cost of growing ASD tomatoes was higher than CSF because of the costs associated with carbon sources and enhanced yields.
 - The cost per plant in ASD land preparation was more than two times higher than CSF.
- Figure 3 and Figure 4
 - With increased tomato price, ASD is more affordable as ASD can obtain the same net return as CSF at higher molasses price.
 - Higher tomato price led to higher gross returns, higher price of molasses and lower tomato yields could be accepted.
 - Because more carbon sources were applied at ASD1.0 trails, the cost was higher. At the same tomato price, Breakeven tomato yield were higher in ASD1.0 compared to ASD 0.5 (Figure 4). Higher yield generated in ASD1.0 led to higher breakeven molasses price (Figure 3).
 - Breakeven molasses prices in comparing net return between ASD1.0 and CSF in Citra were negative, which implies that ASD1.0 is not economically feasible at all with the yields from the trials at Citra (Line was removed from Figure 3).

Conclusions

- In most cases, ASD can be an effective and economically viable tomato field production method in Florida.
- For the next step, the cost of ASD need to be controlled and the most appropriate carbon source application rate based on different production environment need to be confirmed to make the profit maximization.

References

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- Di Gioia, Francesco, et al. 2016. The Effects of Anaerobic Soil Disinfestation on Weed and Nematode Control, Fruit Yield, and Quality of Florida Fresh-market Tomato. HortScience 51(6): 703-711.

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