Lessons Learned in Conservation Tillage Vegetable Systems in the Sub-Tropics and Tropics

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INTRODUCTION

Conventional cover crop (CC) management strategies developed and adopted in temperate climates utilize seasonal transitions, plant senescence, and mechanical operations with or without additional chemical termination strategies to ensure effective CC termination. In tropical and subtropical climates, temperate strategies are not practical (due to the cost of inputs), not possible (due to the absence of a killing frost to coincide with crop rotation transitions) and not beneficial to soil quality in the long term. Farmers with low-external-input systems rely heavily on farm-derived resources such as CCs for soil and pest management. Tropical agroecosystems require unique CC management strategies that meet environmental and cultural conditions. The use of reduced tillage practices have been promoted to increase soil conservation and reduce on-farm expenses.

The alternative termination method of rolling/crimping CCs to create surface mulch has gained attention because of the additional agroecosystem benefits it provides. Due to the persistent high temperatures in these climates, assessment of different mechanical CC termination methods is needed to avoid CC regrowth during production of income-producing crops. Cover crop cultural practices including species selection, seeding date and termination strategies, and the manner in which they influence weed diversity and density as well as vegetable crop yield and quality are the primary issues to define.

GOAL

Our overall goal is to develop cover crop technologies in minimum-till vegetable systems that minimize labor and external inputs and ensure competitive vegetable yields.

OBJECTIVES

A series of studies funded by SR-SARE were conducted on St. Croix USVI, Mayaguez PR, and Live Oak FL. Each location utilized RCBD with at least three replications and multiple years. Treatments were specific to study locations. Objectives shared among study locations included:

- Evaluate tropical CC species and identify their suitability for termination with a roller-crimper.
- Assess mechanical roller-crimper CC termination on CC regrowth and weed populations in the following crop rotation.
- Compare in situ CC surface mulch to plastic mulch, hay mulch, and conventional no mulch vegetable systems.
- Determine subsequent cash crop quality and yield.

METHODS

We evaluated tropical CCs for their ease of termination and ability to suppress weeds:

Sunn hemp [(*Crotalaria juncea* cv. IAC-1, Tropic Sun, and an unnamed accession) SH], **Lablab** [(*Lalab purpureus* cv. Rongai) LL], **Velvet bean** [(*Mucuna pruriens* L. DC. cv. Vine 90 and Dwarf) VB], **Jack bean** [(*Canavalia ensiformis*) JB], **Pigeon pea** (Cajanus cajan L. cv. BRS Mandarim) **Sesame** [(*Sesamum indicum* Linn.) SE], and **Sun flower** [(*Helianthus annus* L.) SF].

CC, soil, and weed management treatments included:

Experiment 1: Comparison of standard mechanical termination methods (mow/incorporate and disc/incorporate) to roller crimper termination of erect vs. vining CCs.

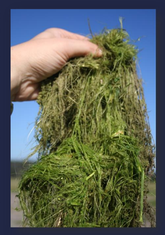
Experiment 2: Evaluation of tropical CCs pre and post termination with a roller crimper.

Experiment 3: Evaluation of selected tropical CCs, their response to roller-crimper termination, and the resulting surface mulch's ability to provide ecosystem services in vegetable rotations (pepper, corn, plantain, and banana).

Experiment 4: Comparison of 4 vegetable crop production systems (plastic mulch, cut and carry hay mulch, in situ surface mulch, and conventional no mulch) following SH as a CC.

Data collected included:

1. Cover crop and weed biomass, weed species, and weed density
2. Physical and chemical decomposition of SH and LL residue (litter bag analysis)
3. Post termination CC regrowth and weed biomass, weed species, and weed density.
4. Crop quality and yield of jalapeño pepper (*Capsicum annuum* cv.Tormenta) in Florida and USVI or plantain (*Plantago major*) and corn (*Zea mays*) in PR.



LESSONS LEARNED

Successful systems are associated with:

1. Cover crop species selection that do not exhibit post-termination regrowth traits;
2. Significant cover crop surface mulch that is retained throughout the vegetable crop season; and
3. A reduction in weed establishment leading to reduced weeding frequency.
4. Integrated systems with legume living mulches reduced weeds between plantain rows compared with conventional systems, and resulted in increased plantain height and stalk diameter, and reduced the number of herbicide applications.
5. Fruit and vegetable yields in treatments receiving sunn hemp or sun flower surface sheet mulch are comparable to or greater than yields in conventional systems.

Limitations to the system include:

1. A limited number of cover crop species that respond to roller-crimper termination and
2. The overall additional management effort required relative to traditional vegetable systems.

Future work should include a critical examination of CC germplasm and suitability for meeting specific system objectives.

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SOUTHERN SARE Sustainable Agriculture Research & Education

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