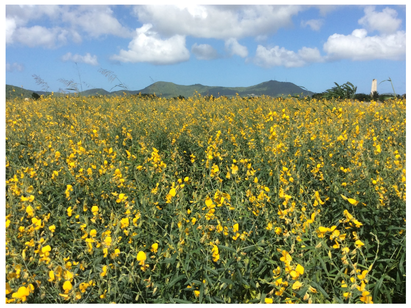

Utilizing the Cover Crop Sunn Hemp (*Crotalaria juncea* L.) to Improve Vegetable Cropping Systems

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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.

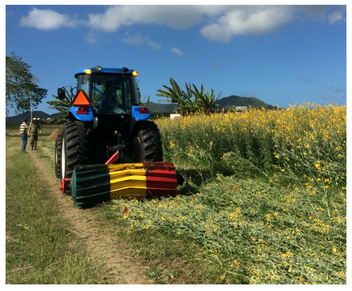
The alternative termination method of rolling/crimping CCs to create surface mulch has gained attention because of the additional agroecosystem benefits it provides.

GOAL

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

OBJECTIVES

1. Evaluate the cover crop sunn hemp [*Crotalaria juncea* cv. IAC-1 (SH)] and identify its suitability for termination with a roller-crimper
2. Compare in situ cover crop surface mulch to plastic mulch, hay mulch, and conventional no mulch vegetable systems for weed suppression
3. Determine subsequent quality and yield of the pepper crop



METHODS

Studies were conducted on the island of St. Croix, US Virgin Islands and at the UF/IFAS Suwannee Valley Agricultural Extension Center near Live Oak, FL.

Four treatments were arranged in a RCBD, then split to two levels of weeding intensity (high and low) six weeks after planting to evaluate the effectiveness of weed management among treatments.

Cropping System

Sunn hemp was planted as a cover crop and allowed to reach full bloom prior to termination. Following termination either jalapeno (Florida) or cubanelle (USVI) peppers were transplanted into treatment plots.

	2013 FL	2014 FL	2015 USVI
Cover Crop		kg ha^{-1}	
Sunn Hemp	9,026	6,704	7,208
Weeds			
Broadleaf	0	62B	67A
Grass	0	346A	39B
Sedge	0	0B	25B

Vegetable Crop Treatments

Surface mulch treatments:

1. **ROLLER-CRIMPER:** Sunn hemp terminated by crimper, residue remains on soil surface
2. **NO MULCH:** Sunn hemp mowed and soil incorporated
3. **PLASTIC:** Sunn hemp mowed and soil incorporated, Plastic mulch applied.
4. **CUT-N-CARRY:** Sunn hemp residue mowed and soil incorporated, straw applied to surface.

Two Weed Removal Frequencies:

Each plot was divided in half perpendicular to tractor direction, and weeding treatments were randomly assigned to each plot six weeks after planting (WAP).

1. **LOW INTENSITY** weeding (every 3rd week)
2. **HIGH INTENSITY** weeding (every week)

1.

2.

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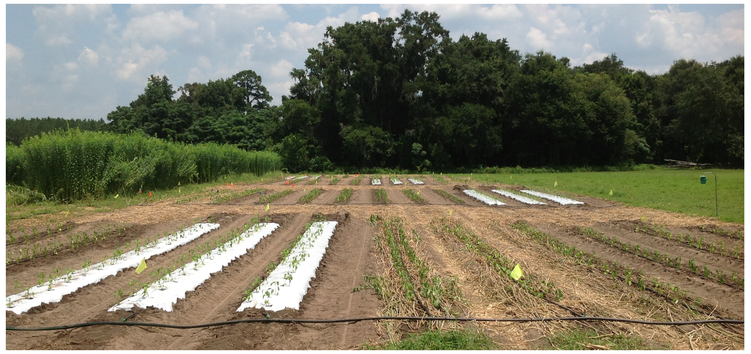
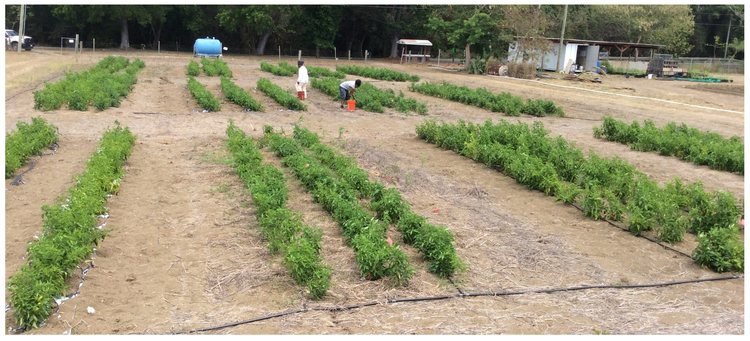


Experimental plots near Live Oak, Florida at the Suwannee Valley Agricultural Extension Center.

Total Weed Biomass at 3 and 6 Weeks Post Termination kg ha^{-1}

	MULCH SYSTEM (kg ha^{-1})			
Florida 2013	Sunn Hemp Mulch	Straw Mulch	Plastic Mulch	No Mulch
3 Week	17c	46b	3c	82a
6 Week	17ab	1b	5ab	40a
Florida 2014				
3 Week	66b	263a	264a	134ab
6 Week	88a	175a	335a	41a
USVI 2015				
3 Week	468a	136bc	64c	218b
6 Week	1,130a	156bc	46c	295b

Experimental plots on St. Croix, US Virgin Islands at GLG Farm.



Total Weed Biomass 9 ks Post Termination kg ha^{-1}

US Virgin Islands 2015 MULCH SYSTEM	Weeding Weekly	Weeding Every 3rd Week	
Roller-Crimped Sunn Hemp	14	404	A
Cut and Carry Straw	3	64	B
Plastic Mulch	0	26	B
No Mulch	19	96	B
P	0.0895	<0.0001	<0.05

Total Weed Biomass 12 ks Post Termination kg ha^{-1}

US Virgin Islands 2015 MULCH SYSTEM	Weeding Weekly		Weeding Every 3rd Week	
Roller-Crimped Sunn Hemp	10	A	181	A
Cut and Carry Straw	1	C	24	C
Plastic Mulch	2	BC	3	C
No Mulch	6	AB	91	B
P	0.0023	<0.05	<0.0001	<0.05

Marketable Pepper Yield in Florida kg ha^{-1}

Florida 2013 MULCH SYSTEM	Marketable Yield kg ha^{-1}	
Roller-Crimped Sunn Hemp	16,061	B
Cut and Carry Straw	22,706	A
Plastic Mulch	15,008	B
No Mulch	16,974	B
P	0.0001	p<0.05

Florida 2014 MULCH SYSTEM	Marketable Yield kg ha^{-1}	
Roller-Crimped Sunn Hemp	9,071	B
Cut and Carry Straw	9,856	AB
Plastic Mulch	10,834	A
No Mulch	7,074	C
P	0.0001	p<0.05

Marketable Pepper Yield in the USVI kg ha^{-1}

US Virgin Islands 2015 MULCH SYSTEM	Marketable Yield kg ha^{-1}			
	Weeding Weekly		Weeding Every 3rd Week	
Roller-Crimped Sunn Hemp	11,327	B	8,099	C
Cut and Carry Straw	19,837	A	20,418	A
Plastic Mulch	17,217	A	15,462	B
No Mulch	11,352	B	15,595	B
P	0.0009	<0.05	0.0028	<0.05

RESULTS & DISCUSSION

In Florida and the USVI, sunn hemp provided substantial quantities of biomass at 2.5% nitrogen containing an estimated range of potentially available nitrogen of 168 to 226 kg ha^{-1}.

Treatment effects from Cropping System experiments conducted in Florida contrasted from results observed in similar cropping systems evaluated in the U.S. Virgin Islands. In Florida, roller-crimped SH mulch either reduced weeds or had similar weed biomass compared to the other mulch treatments. In the USVI, SH mulch had greater total weed biomass than all other treatments at 3 and 6 weeks and at 9 and 12 weeks after termination for the low intensity weeding frequency. In Florida, pepper yields were unaffected by weeding frequency. This indicates that regardless of the weed management system, fewer weeding events will be economically beneficial. In the USVI, there was a marketable yield x weeding frequency interaction and marketable yield is presented independently for low and high intensity weed removal frequencies.

In both FL and the USVI, pepper yields were greatest in the cut and carry straw treatment. In FL in 2013, the roller-crimped SH treatment pepper yields were similar to the plastic mulch and no mulch treatments and in 2014 were similar to the cut and carry straw but greater than the no mulch treatments. This indicates that under Florida conditions, when SH residue is utilized as mulch for subsequent pepper production, pepper yields can be similar to or greater than yields obtained by conventional mulching methods that rely upon full tillage for weed suppression. However, roller-crimped SH treatments in the USVI had the lowest marketable pepper yields. When SH is tilled into the soil and additional cut and carry straw mulch is utilized, then yields are similar or exceed those from all other weed management practices evaluated.

Cropping System Management

Cover crop management and the proper timing of cover crop termination followed by pepper transplanting is critical to system performance. Delayed termination and an extended interval between roller-crimping and pepper transplant resulted in a decrease in weed control for the roller-crimped SH treatment. Precise cropping system management is needed to fully achieve the benefits of integrated vegetable cropping systems. Reduced tillage from the adoption of roller-crimped SH can provide additional ecosystem service benefits.

Acknowledgements

UF IFAS UNIVERSITY of FLORIDA

SOUTHERN SARE Sustainable Agriculture Research & Education

Project # LS12-252