



Warm Season Cover Crop Adaptation Study Trials Using *Crotalaria* Entries for Southern Louisiana

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ABSTRACT

There is an increased interest in *Crotalaria* entries as a cover crop for sugarcane (*Saccharum officinarum* L.) production in southern Louisiana. Information is limited on the adaptation and production of sunn hemp (*Crotalaria juncea* L.) and red hemp (*Crotalaria ochroleuca* G Don) in southern Louisiana. Objective of this study was to evaluate the productivity and adaptation of commercially available sunn hemp cultivars of 'Tropic Sun', 'AU Golden', and a common sunn hemp source (Hancock), and a common red hemp source in southern Louisiana. *Crotalaria* entries were evaluated for field emergence, plant height, days after planting to 50% bloom and yield in 2015-2017 at the Galliano, LA Plant Materials Center. All *Crotalaria* entries and seed sources quickly emerged after planting except red hemp, which did not reach 100% emergence until 5 weeks after planting. 'AU Golden' reached 50% bloom approximately 2 months earlier than the other entries. All *Crotalaria* entries lacked water logged soil conditions except red hemp. Red hemp produced 1.4 tons/acre more biomass than 'Tropic Sun' or Hancock under water logged conditions. Future trials will be conducted on elevated rows of soil, which is more typical for sugarcane production in southern Louisiana.

INTRODUCTION

There are 450,000 to 500,000 acres of sugarcane grown in southern Louisiana (USDA, NASS, 2017). A typical production practice is to plant sugarcane in late August through mid-October, allowed to grow for one year then harvested the following year in October-December. After approximately 4 years of production, the sugarcane is destroyed, leaving the soil bare or fallowed for up to a year. Incorporating sunn hemp into a sugarcane cropping system can control soil erosion, improve soil quality by increasing soil organic matter and providing partial N for crop growth, and suppressing weeds on fallowed sugarcane fields (Clark, 2007). While *Crotalaria* entries may provide numerous agronomic and environmental benefits, these benefits are not fully achieved unless the best adapted cultivar/seed source is recommended that meets the objective of the producer. Therefore, the purpose of this study was to evaluate the growth characteristics and production attributes of commercially available *Crotalaria* entries for southern Louisiana sugarcane cropping systems.

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MATERIALS AND METHODS

Sunn hemp cultivars consisted of ‘Tropic Sun’, ‘AU Golden’ and a common sunn hemp source (referred to as Hancock) obtained from Hancock Seed (Dade City, FL). Also included was a red hemp source (referred to as red hemp) from Petcher Seed (Fruitdale, AL). The study was conducted from 2015-2017 at the USDA-NRCS Plant Materials Center near Galliano, LA on a Rita Muck soil (Fig. 1). A clean, firm seedbed was prepared prior to planting by disking and conditioning the soil prior to planting. Plots were planted with a Hege 1000 precision single cone plot planter (Hege Equipment Inc. Colwich, Kansas). Plots consisted of 5 rows, 40-foot in length with 12-inch spacings between rows. Cultivars/seed sources were seeded at 40 lb/acre on 12 May 2015, 9 June 2016, 11 May 2017 and 11 May 2018. Plots received no fertilizer amendments and were hand weeded as needed to prevent vegetative competition.

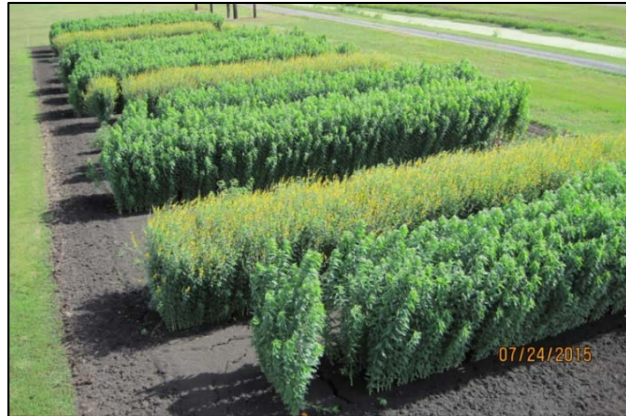


Fig. 1. *Crotalaria* entries and seed sources at the USDA-NRCS PMC, Galliano, LA.

Percent emergence (percent stand coverage) was recorded 7, 14, 21 and 28 days after planting (DAP). Plant heights were taken 30, 60 and 90 days after planting by measuring from ground level to the absolute height of the plant. Days after planting to 50% bloom were recorded for each cultivar. When plants reached 50% bloom, aboveground biomass was clipped at ground level using a 50-cm x 50-cm sampling frame from the center of the plot, except for 2017. Biomass samples were dried at 55 degrees C for yield determination. Data was analyzed using the analysis of variance procedure in Statistix 10 (Analytical Software, Tallahassee, FL) and means were separated with Tukey’s HSD at $P < 0.05$.

RESULTS AND DISCUSSION

Monthly rainfall for April-October and 26-year average was recorded from a Davis Vantage Pro2 weather station (Davis Instruments – Hayward, California) near the study (Fig. 2). Rainfall amounts were well below normal from May-Aug in 2015 with April’s rainfall providing adequate moisture for May planting. Rainfall amounts were well above normal in April-September in 2016 averaging about 3 inches above the normal in most months. In 2017, nearly 12 inches above the normal rainfall was received in May, approximately 4 inches above normal in June and nearly 8 inches above normal in August. In 2018, rainfall was near normal from April-August with September’s rainfall over 6 inches (data not shown).

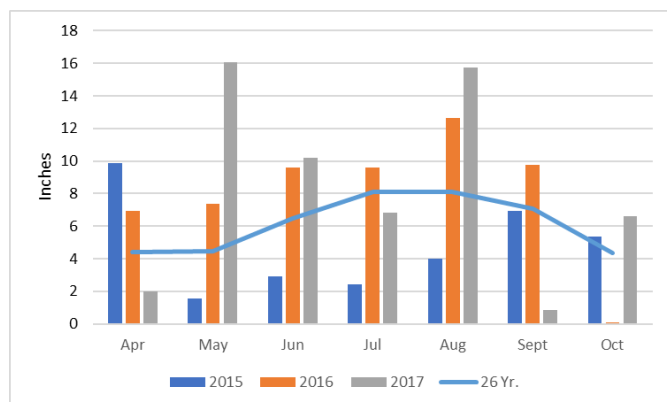


Fig. 2. Monthly rainfall totals for April-October in 2015-2017 and 26 year normal, Galliano, LA.

Quick canopy cover is important for protecting the soil from erosion and suppressing weeds (Clark, 2007). All *Crotalaria* entries, except red hemp emerged to quick cover, reaching 100% emergence within 7 DAP in 2015-2017 (data not shown). Red hemp did not reach 100% emergence until 5 weeks after planting in 2015-2017 (data not shown), which is not acceptable where a quick cover is needed for soil protection and weed suppression. Plant height varied among *Crotalaria* entries and years (Table 1). ‘Tropic Sun’, ‘AU Golden’ and Hancock made the greatest growth in 2015 compared to 2016 and 2017. The difference in growth between 2015 and 2016-2017 is attributed to excessive amounts of rainfall received during the growing season in 2016-2017 (Fig.2), resulting in less growth and stunting of plants (Table 1). ‘Tropic Sun’ and Hancock were approximately 3.5-ft shorter at 90 days in 2016-2017 compared to 2015. This lack of growth and productivity suggest ‘Tropic Sun’, ‘AU Golden’ and Hancock will not tolerate water logged soil conditions (Fig. 4). Rotar and Joy (1983) recommend planting ‘Tropic Sun’ in a well-drained soil with a pH of 5 to 7.5 for best growth and production. The poorly drained Rita Muck soil remained too wet for these *Crotalaria* entries to survive, except red hemp (Fig 5). Red hemp showed good tolerance to these wet soil conditions in 2016-2017.

Table 1. Plant height of *Crotalaria* entries at 30, 60 and 90 days after planting in 2015-2017. USDA-NRCS Galliano, LA.

<i>Crotalaria</i> entry	2015			2016			2017		
	Days after planting								
	30	60	90	30	60	90	30	60	90
Tropic Sun	13	76	120	26	73	73	9	48	71
Hancock	17	74	113	27	81	81	9	45	78
Red Hemp	1.5	21	46	7	43	58	5	31	66
AU Golden	17	70	78	26	69	71	9	41	56



Fig. 3. 60 DAP in 2015; L-R ‘Tropic Sun’, Red Hemp, ‘AU Golden’ and Hancock USDA-NRCS Galliano, LA.



Fig. 4. Growth of *Crotalaria* entries in water logged soil conditions in 2016; L-R ‘Tropic Sun’, Red Hemp and ‘AU Golden’ USDA-NRCS Galliano, LA.



Fig 5. Red hemp growth under water logged soil conditions. USDA-NRCS Galliano, LA.

Days after planting to 50% bloom varied among cultivars with ‘AU Golden’ blooming approximately 8 weeks after planting and maturing quicker than the other *Crotalaria* entries (Table 2). ‘AU Golden’ was the only entry to reach 50% in 2016 and was 75 days earlier than Hancock and red hemp in 2017.

Table 2. Days after planting to 50% bloom for *Crotalaria* entries, 2015-2017. USDA-NRCS, Galliano, LA.

<i>Crotalaria</i> entry	Year		
	2015	2016	2017
Tropic Sun	150	*1/	*
AU Golden	59	57	67
Hancock	143	*	142
Red Hemp	173	*	142

*- plants died before 50% bloom due to excessive rainfall/ponding water

Plant height and yield were taken when the *Crotalaria* entries reached 50% bloom (Table 3). ‘Tropic Sun’ was the tallest entry and yielded significantly more biomass than red hemp and ‘AU Golden’ in 2015. The 17.8 tons/acre reported for ‘Tropic Sun’ at 5 months after planting was 4 times greater than those reported by Balkcom and Reeves (2005) when ‘Tropic Sun’ was harvested at 3.5 months in Alabama. Terminating ‘Tropic Sun’ or Hancock at 50% bloom is not advisable because of the excessive amount of residue and the added costs of preparing the field for planting (i.e. shredding and tillage). Rotar and Joy (1983) suggest terminating ‘Tropic Sun’ 60 days after planting to maximize N production and minimize plant size in the Pacific Island Area. ‘AU Golden’ was the first *Crotalaria* entry to reach 50% bloom, which occurred approximately 2 months after planting compared to 5 months for the other *Crotalaria* entries and explains the lower yields in 2015-2016. The drastic yield decline in all *Crotalaria* entries from 2015 to 2016 was due to excessive rainfall in 2016 (Fig. 3 and 4). Red hemp, which showed better tolerance to water logged soil conditions than the other *Crotalaria* entries, had the shortest stature early in the growing season, but produced the highest yield in

2016. Red hemp increased yield approximately 1.4 tons/acre more than ‘Tropic Sun’ and Hancock but the yield increase was not significant.

Table 3. Plant height and yield of *Crotalaria* entries at 50% bloom in 2015-2017. USDA-NRCS Galliano, LA.

<i>Crotalaria</i> entry	2015		2016		2017	
	Plant height	Yield	Plant height	Yield	Plant height	Yield
	---in---	tons/acre	---in---	-tons/acre-	---in---	-tons/acre-
Tropic Sun	138 a ^{1/}	17.8 a	73 a	3.8 ab	63 bc	* ^{2/}
Hancock	129 b	14.8 ab	81 a	3.7 ab	86 a	NH ^{3/}
Red Hemp	78 c	13.3 b	58 b	5.2 a	75 ab	NH
AU Golden	74 c	4.2 c	71 a	2.3 b	54 c	NH
Mean	106	12.5	70	3.8	70	

^{1/} Means in columns followed by the same letters are not significantly different according to Tukey HSD at $P < 0.05$.

^{2/} Plants died due to water logged conditions. ^{3/} Not harvested.

CONCLUSION

Crotalaria entries consisting of ‘AU Golden’, ‘Tropic Sun’, a seed source from Hancock Seed (Hancock) and Petcher Seed (red hemp) were evaluated for adaptation in southern Louisiana as cover crop for sugarcane fields. All entries emerged quickly after planting except for red hemp, which generally took 5 weeks longer to achieve 100% emergence. ‘AU Golden’ reached 50% bloom 2 months after planting. ‘Tropic Sun’ and Hancock produced yields in excess 14 tons/acres when harvested at 50% bloom. ‘AU Golden’ produced an average yield of 3.25 tons/acre in 2015-2016. Excessive rainfall in 2016-2017 produced water logged soil conditions resulting in poor performance and productivity of all *Crotalaria* entries except red hemp, which remained surprisingly productive. Future trials should be conducted on elevated rows of soil which are more conducive to sugarcane production in southern Louisiana.

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