IOWA STATE UNIVERSITY
Department of Agronomy

Kenaf Productivity, Morphology, and Anatomy When Grown in Iowa and in Kentucky.

Diana G. and James L. Oblinger Graduate Travel Fund for Agronomy

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1 - BACKGROUND

- There is a growing interest in replacing petroleum-based materials with renewable materials.
- **Kenaf** (*Hibiscus cannabinus* L.) is an annual, dicot herbaceous crop, originally from Africa, that produces bast fiber in its stem (Fig. 1).
- Producing kenaf as a specialty crop in the Midwestern U.S. would provide a local source of this fiber for use in a number of manufactured products.

Figure 1: Kenaf grown in Boone, IA (Oct 3rd 2015; Photo Credit: Pedro Infante) and fiber composition of kenaf stem.

- Kentucky is a southern state generally warmer and wetter than Iowa, allowing Kentucky to have a longer growing season.
- **We investigated kenaf productivity and morphology of two kenaf cultivars under two management practices in Iowa and in Kentucky.**

2 - MATERIAL & METHODS

Experimental Design	
Year	2014, 2015
Location	Boone, IA; Lexington, KY
Variety	'Tainung 2', 'Whitten'
Seeding rate	18.5, 37.1 seed m^{-2}
Exp. Design	RCBD with 3 reps at each year × location
Rep. Measures	7 harvests at each year × location
Measurements and Analysis	
Productivity	Plant density, dry leaf and stem biomass, leaf area index (LAI)
Morphology	Leaf:stem ratio, stem height, diameter, core:bast ratio
Composition	C:N
Statistical analysis	ANOVA, 5% level of significance

Table 1: Description of the experimental design and the measurements of the study.

- 'Tainung 2' and 'Whitten' seeds were planted in 38-cm rows on June 10, 2014 and June 2, 2015 in Boone, IA (42°01'N, 93°46'W); and June 6, 2014 and May 26, 2015 in Lexington, KY (38°10'N, 84°49'W).
- Nitrogen fertilization was applied at a rate of 168 kg ha^{-1} in both locations.

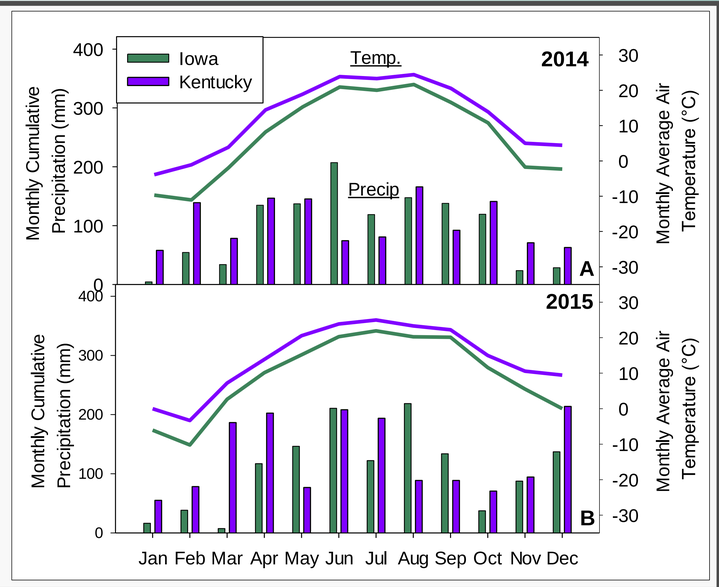

Figure 2: Monthly cumulative precipitation and average air temperature in Iowa and Kentucky, in 2014 (A) and 2015 (B).

3 - RESULTS

Objective 1: 'Tainung 2' and 'Whitten' productivity and morphology

- Kenaf productivity in Kentucky was overall higher than Iowa in 2014. But in 2015, both states reached a similar yield, mostly due to Japanese Beetle presence in KY.
- In 2014, 'Tainung 2' was performed better than 'Whitten' in Kentucky (Fig. 3-A).
- In 2015, 'Tainung 2' was more sensitive to management practices (seeding rate) than 'Whitten' (Fig. 3-B). Also, 'Tainung 2' had a higher core:bast ratio in Kentucky than in Iowa.

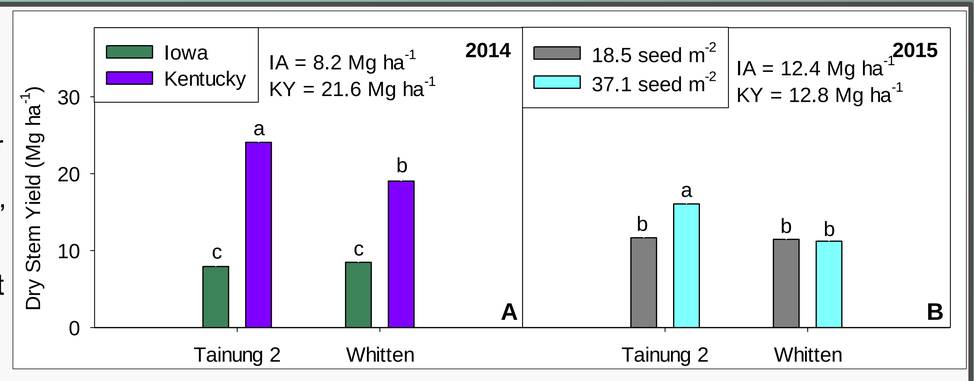

Figure 3: Yield per kenaf variety interacting with locations in 2014 (A) and with seeding rate in 2015 (B).

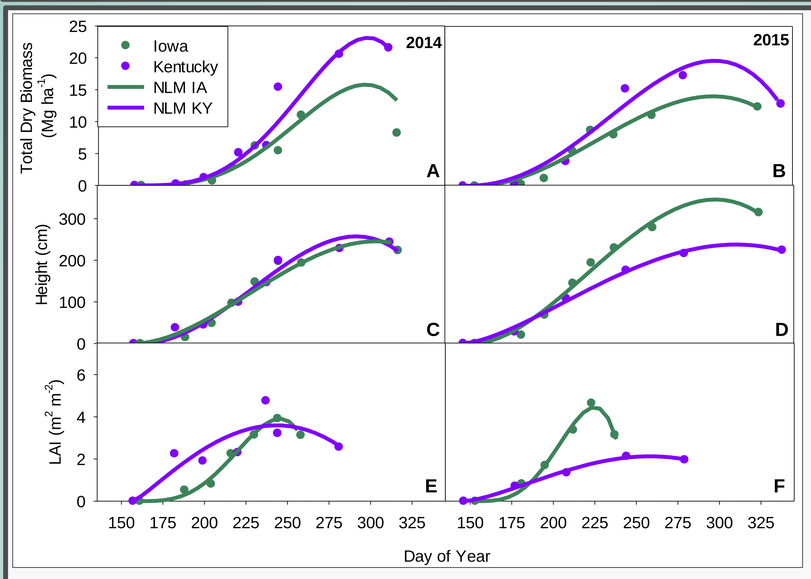

Figure 4: Dry biomass in both states in 2014 (A) and 2015 (B); stem height in both states in 2014 (C) and 2015 (D); and leaf area index (LAI) in both states in 2014 (E) and 2015 (F).

Objective 2: Assess kenaf growth over the growing season

- Kenaf growth, morphology, and physiology varied among states, but also among years (Fig. 4).
- The N dilution curve was drawn based in C:N measurements in both states and years (Fig. 5).

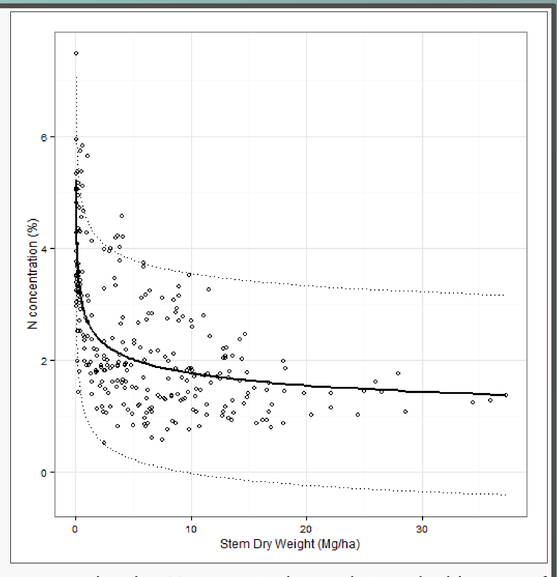

Figure 5: Nitrogen dilution curve, showing N concentration and stem dry biomass of kenaf grown in both states and years. The bold line represents the mean and the dotted line indicated the 95% C.I.

Objective 3: Determine variety and seed density effects on kenaf productivity and morphology.

- In Kentucky: Total dry biomass, core:bast ratio, and N concentration in the whole plant were sensitive to variety and seed density during the growing season.
- 'Tainung 2' planted at 37.1 seed m^{-2} reached the highest total dry biomass. 'Tainung 2' resulted in the tallest stem, during the whole growing season.
- In Iowa: The core:bast ratio was higher for the seeding rate of 37.1 seed m^{-2} and for 'Whitten'.

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4 - CONCLUSIONS

Overall:

- Kenaf productivity and morphology were affected by location, variety, and seeding rate, in different ways.
- Stem yield was higher in Kentucky than in Iowa in 2014, but kenaf productivity in Iowa was less variable over time, varieties, and seeding rates than in Kentucky.
- 'Tainung 2' was more productive than 'Whitten' in Kentucky; however, 'Whitten' was less sensitive to seeding rate.
- Kenaf in Kentucky was more affected by pests than in Iowa.
- Kenaf grown in Iowa remains vegetative compared to that grown in Kentucky, where flowered more than in Iowa. This could represent an advantage for producing kenaf in Iowa.