

2017 University of Kentucky Industrial Hemp Variety Trials for Fiber-Only Production

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Introduction

Variety trials for fiber-only industrial hemp production were conducted at both the University of Kentucky's Spindletop Farm in Lexington, Fayette County, KY and the Robinson Center for Appalachian Resource Sustainability (UK-RCARS) in Quicksand, Breathitt County, KY. Experimental designs were randomized complete blocks (RCB) planted independently on 3 May, 2 June, and 28 June 2017 at both locations. Each respective planting date was analyzed as an individual trial. These trials included one variety of kenaf (*Hibiscus cannabinus*). Varieties evaluated are provided in Table 1.

Table 1. Varieties evaluated in 2017 and their owners.

Variety Name	Owner
Asso	Schiavi Seeds
Beniko	Schiavi Seeds
Carmagnola	Schiavi Seeds
Carmaleonte	Schiavi Seeds
Codimone	Schiavi Seeds
Elleta Campana	Schiavi Seeds
Fibranova	Schiavi Seeds
Fibrol	Schiavi Seeds
Futura 75	Terres Inovia, Thiverval-Grignon, France (standard entry)
CHG	Ecofibre Industries Operations, Sydney, Australia
MS77	Ecofibre Industries Operations, Sydney, Australia
Whitten Kenaf	Sunstrand, LLC
SS Alpha	Sunstrand, LLC

The soil types were Maury silt loam at Spindletop and silt loams in the Nolin-Grigsby complex at Quicksand. Fields were prepared using conventional tillage practices. Urea (46-0-0) was applied by broadcast on the day of seeding at a rate of 50 lbs. of N/A. Fertilizer was incorporated into the soil at a depth of 3-4 inches by cultivation. Hemp seed was planted using the Mundell Modified Soybean Plot Planter at a rate of 60 lbs/A. Seeding depth was calibrated to 0.25 inch. No additional pesticides or irrigation were used for the duration of the studies.

Stalks were harvested at or after ~20% flowering from two, randomly selected 1m² sub-plots from within each main plot, careful to avoid plot edges using a handheld sickle mower and air dried. Plot ends were trimmed before sub-plot definition. Data collected from stalks were plant populations, straw yields measured as dry weight (DW), stalk heights, and stalk diameters at the base. All data were analyzed using the ANOVA procedure of SAS 9.4 (SAS Institute, Cary,

NC). Means were separated by a Fisher's Protected LSD ($\alpha=0.05$) where the main effect of variety was significant.

Results

The 2 June planting was destroyed at Quicksand due to extreme precipitation very soon after seeding. Additional crop failures resulted in either variety deletions and/or incomplete data collection among planting dates and at both locations. ANOVA statistics for each successful planting date at each location are provided in Table 2. Weather and photoperiod data are presented for both locations in Appendix 1. Data are presented in Figures 1-3 for the May, June and July plantings, respectively. Data are separated by variety and location where location is abbreviated either ST = Spindletop (blue bars, letters) or QS = Quicksand (orange bars, letters). NS= not significant ($P>0.05$).

Table 2; A-D. ANOVA statistics for the May and July planting dates at Quicksand (A and B, respectively) and the May (C), June (D) and July (E) planting dates at Spindletop; 2017 fiber-only variety trials.

A. May planting-Quicksand

ANOVA Statistic	Plant Height	Stem Diameter	Straw Yield	Plant Density
P-Value Model	<0.0001	0.0044	0.0007	<0.0001
P-Value Replication	0.0053	0.5197	0.0529	0.7797
P-Value Variety	<0.0001	0.0014	0.0004	<0.0001
CV	10.92	10.01	19.68	16.16

B. July planting-Quicksand

ANOVA Statistic	Plant Height	Stem Diameter	Straw Yield	Plant Density
P-Value Model	0.0012	0.0013	0.0004	0.0026
P-Value Replication	0.4499	0.9882	0.5319	0.0693
P-Value Variety	0.0003	0.0002	<0.0001	0.0013
CV	9.13	11.03	19.73	21.65

C. May planting-Spindletop

ANOVA Statistic	Plant Height	Stem Diameter	Straw Yield	Plant Density
P-Value Model	0.0116	0.3885	0.1195	0.3585
P-Value Replication	0.0302	0.4519	0.1081	0.6391
P-Value Variety	0.0071	0.2953	0.1255	0.2306
CV	0.1874	11.21	2.60	13.20

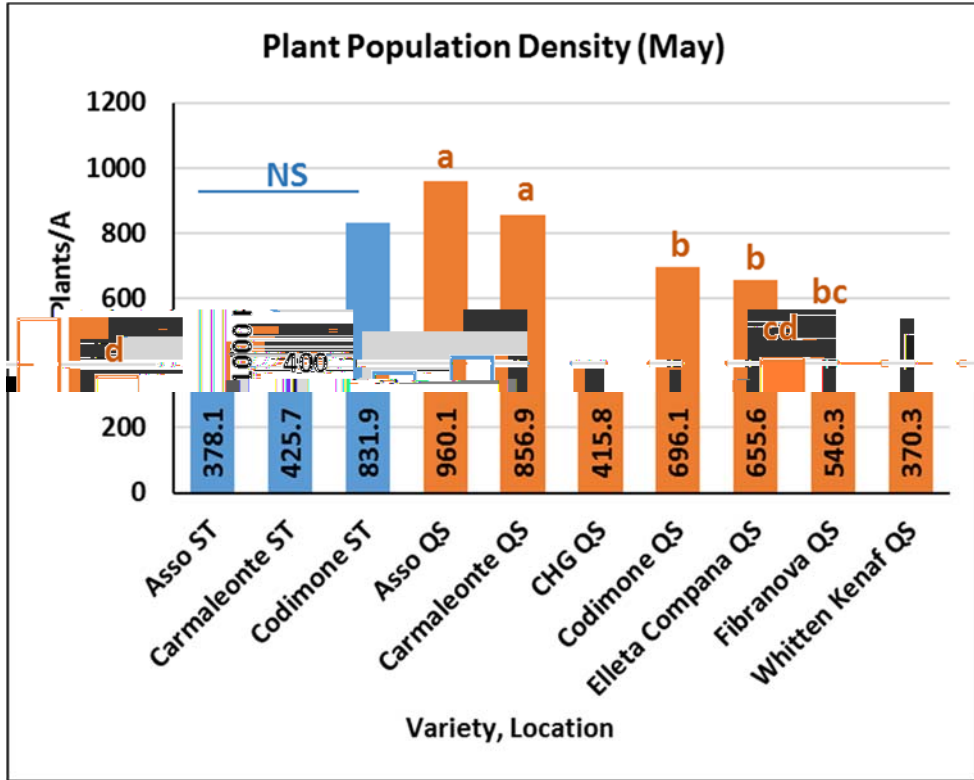
D. June planting-Spindletop

ANOVA Statistic	Plant Height	Stem Diameter	Straw Yield	Plant Density
P-Value Model	0.0002	<0.0001	0.0006	<0.0001
P-Value Replication	0.4291	0.7964	0.5100	0.56877
P-Value Variety	0.0001	<0.0001	0.0003	<0.0001
CV	13.18	11.18	22.59	24.82

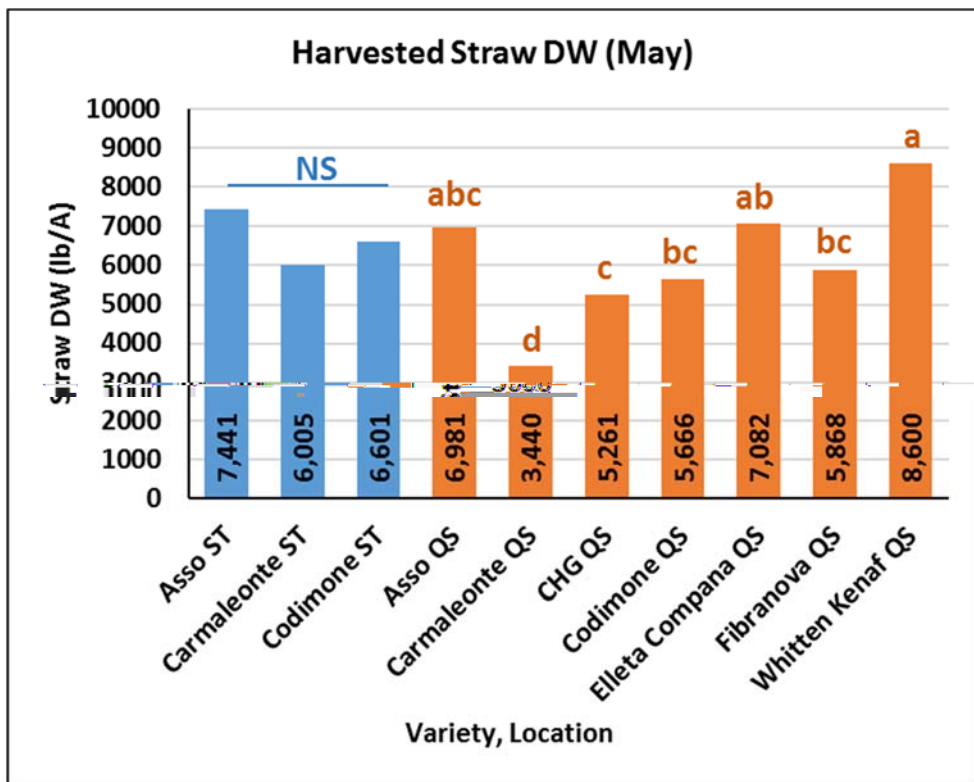
E. July planting-Spindletop

ANOVA Statistic	Plant Height	Stem Diameter	Straw Yield	Plant Density
P-Value Model	<0.0001	<0.0001	<0.0001	0.0005
P-Value Replication	0.0595	0.2921	0.1354	0.0963
P-Value Variety	<0.0001	<0.0001	<0.0001	0.0003
CV	12.09	11.75	29.09	23.15

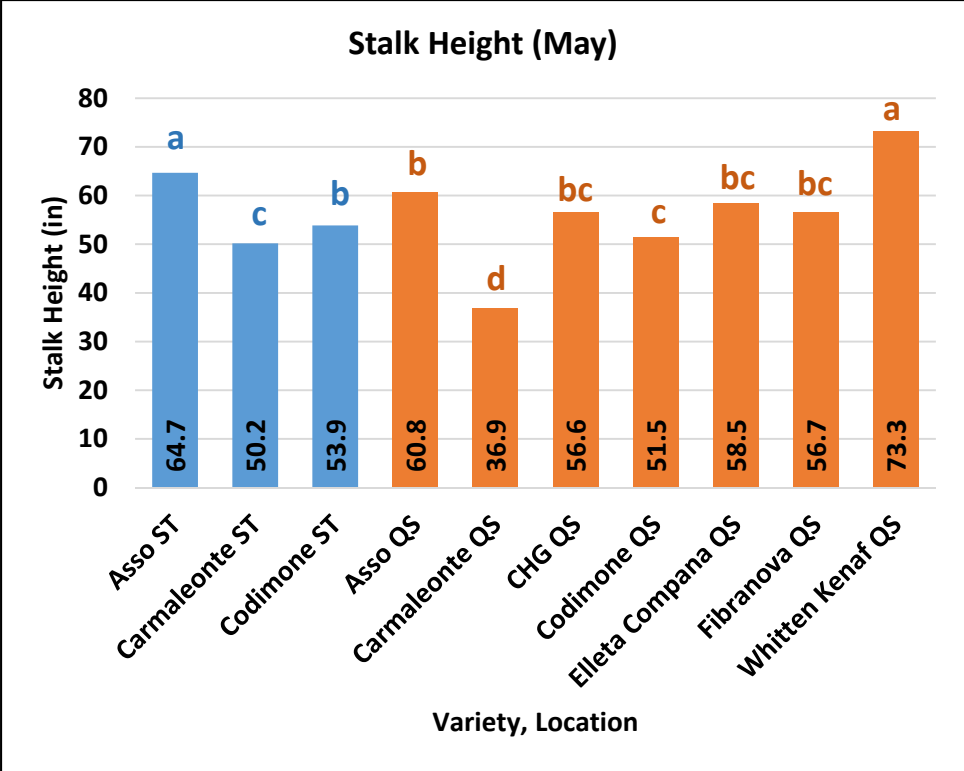
Figure 1. Fiber-only trial May planting date. A. Mean population density (1000 plants/A). B. Mean harvested straw DW (lbs./A). C. Mean stalk height (cm). D. Mean stalk diameters (mm).



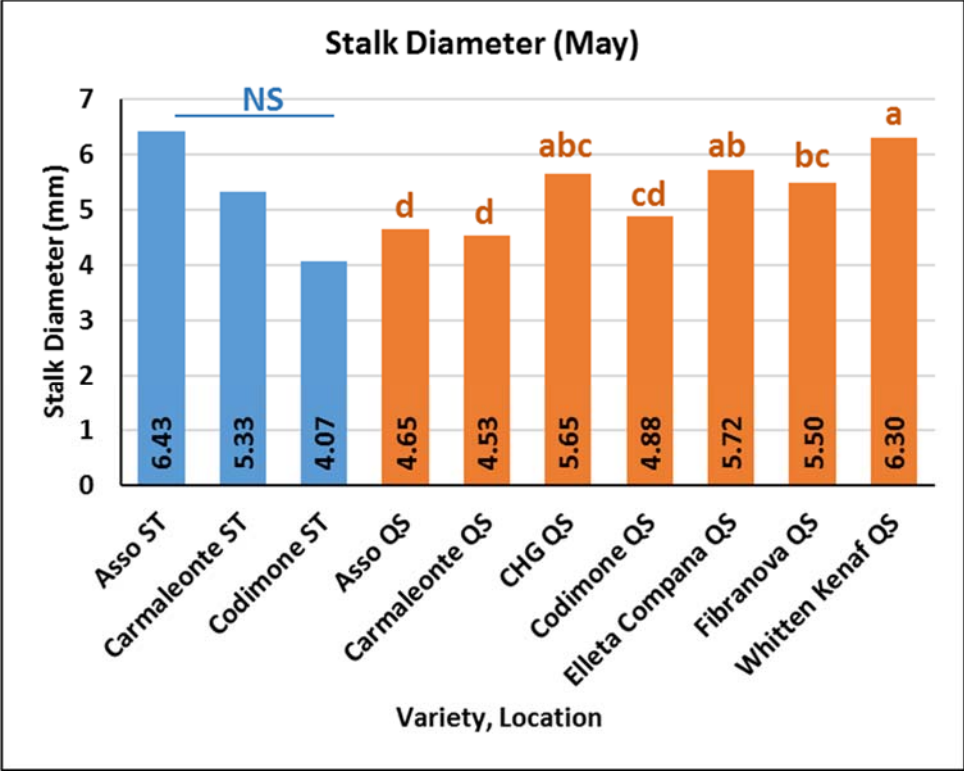
A



B

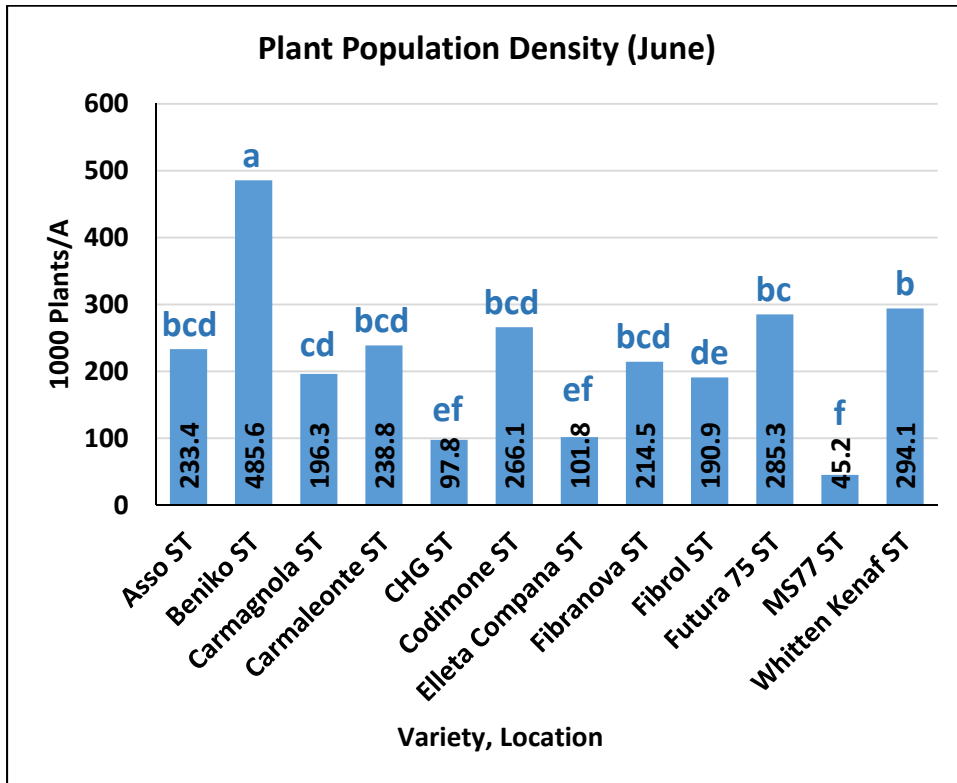


C

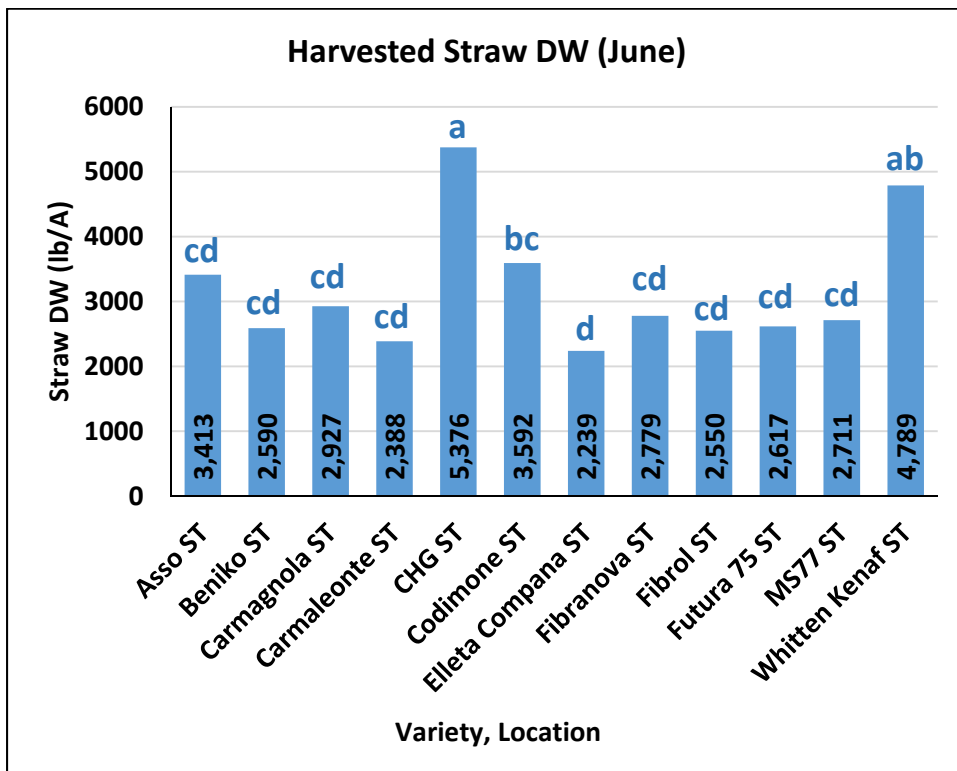


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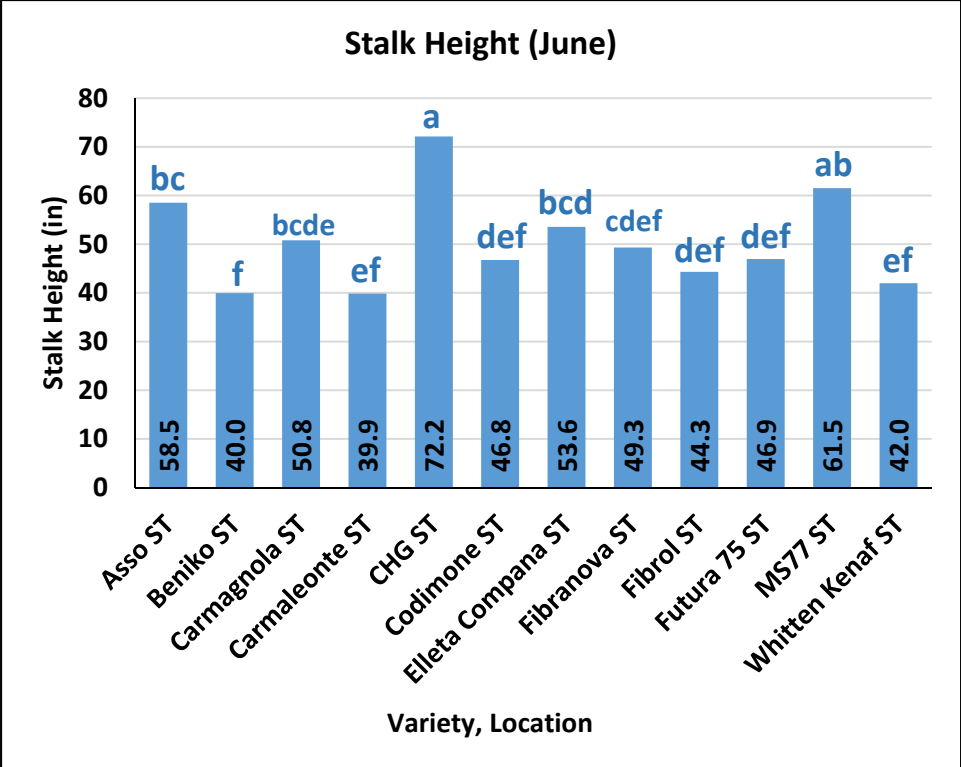
Figure 2. Fiber-only trial June planting date. A. Mean population density (1000 plants/A). B. Mean harvested straw DW (lbs./A). C. Mean stalk height (in). D. Mean stalk diameters (mm).



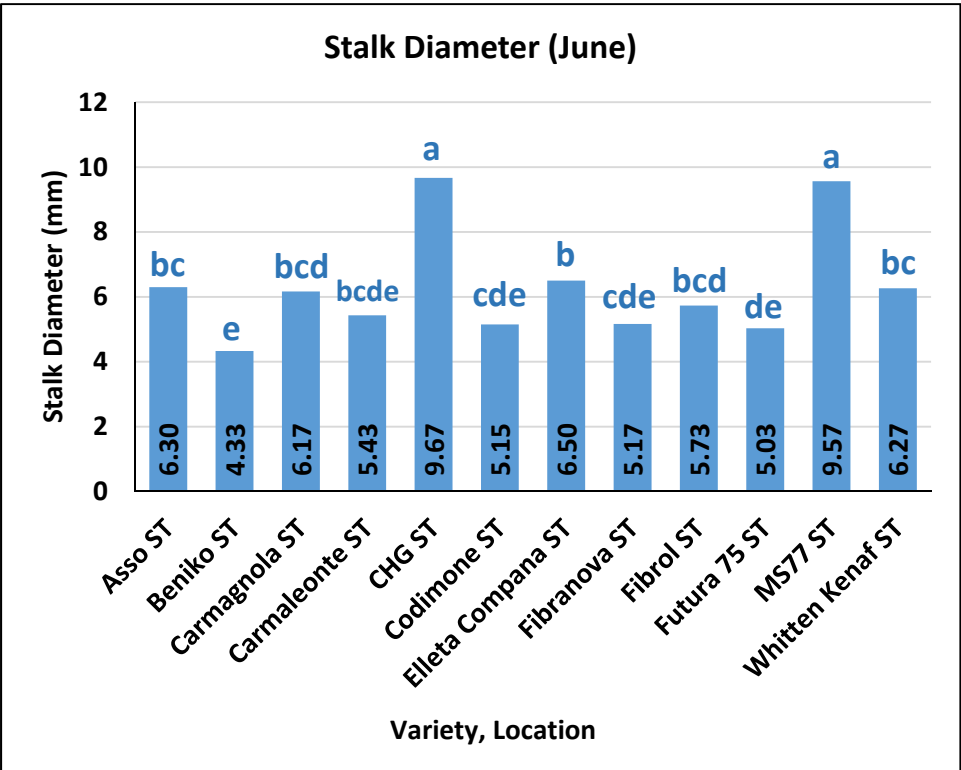
A



B

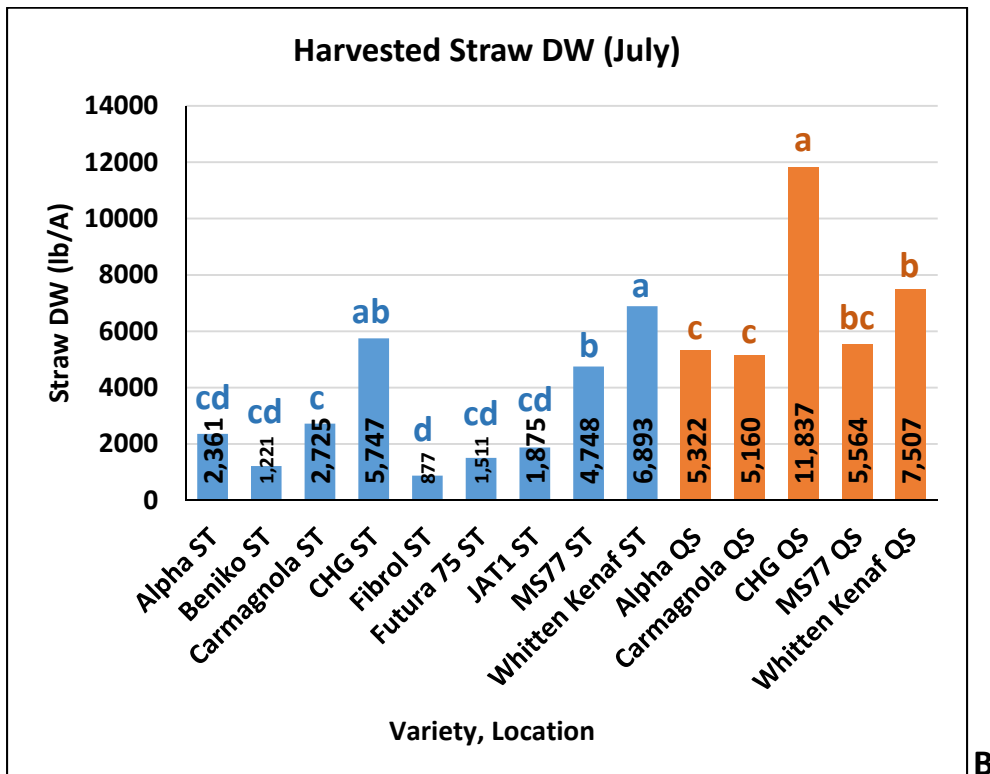
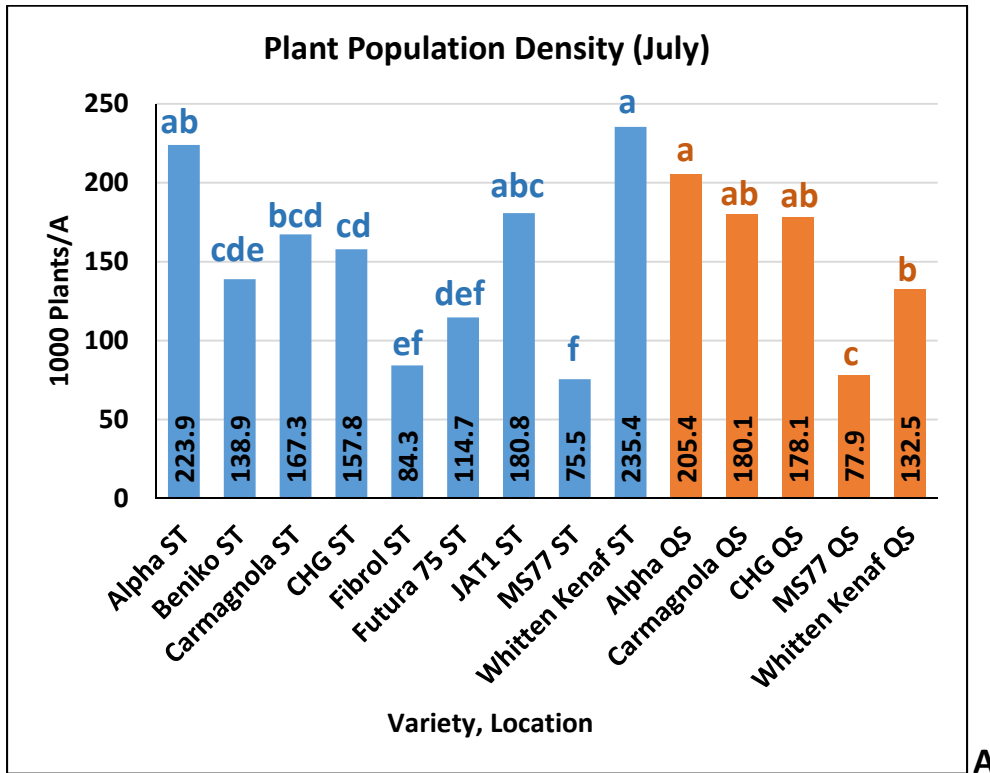


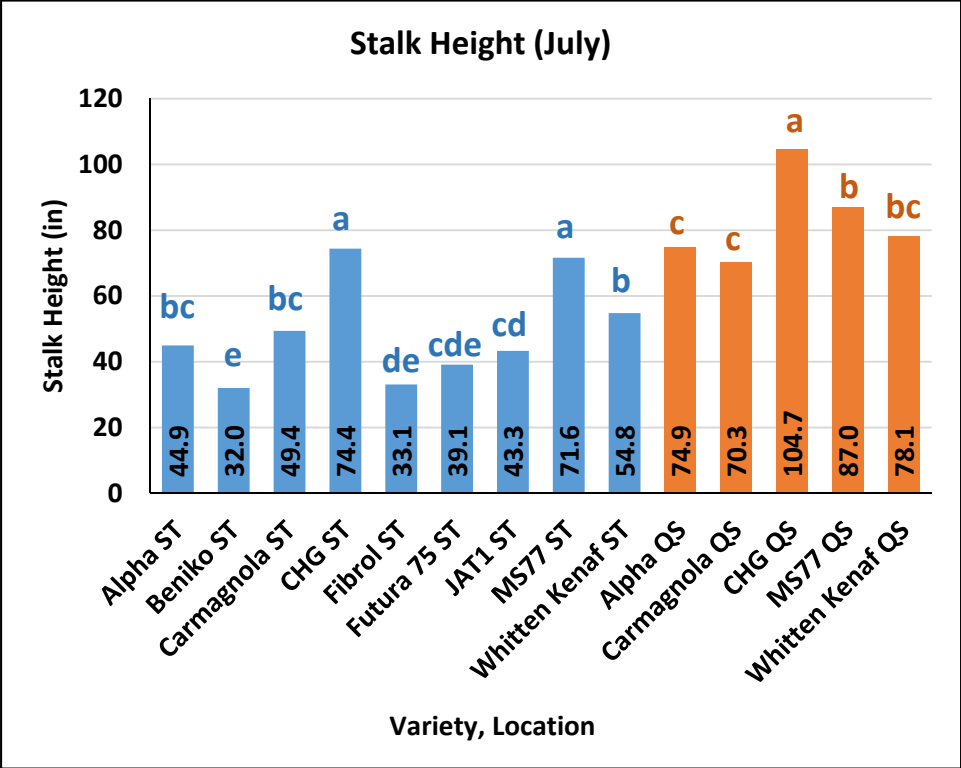
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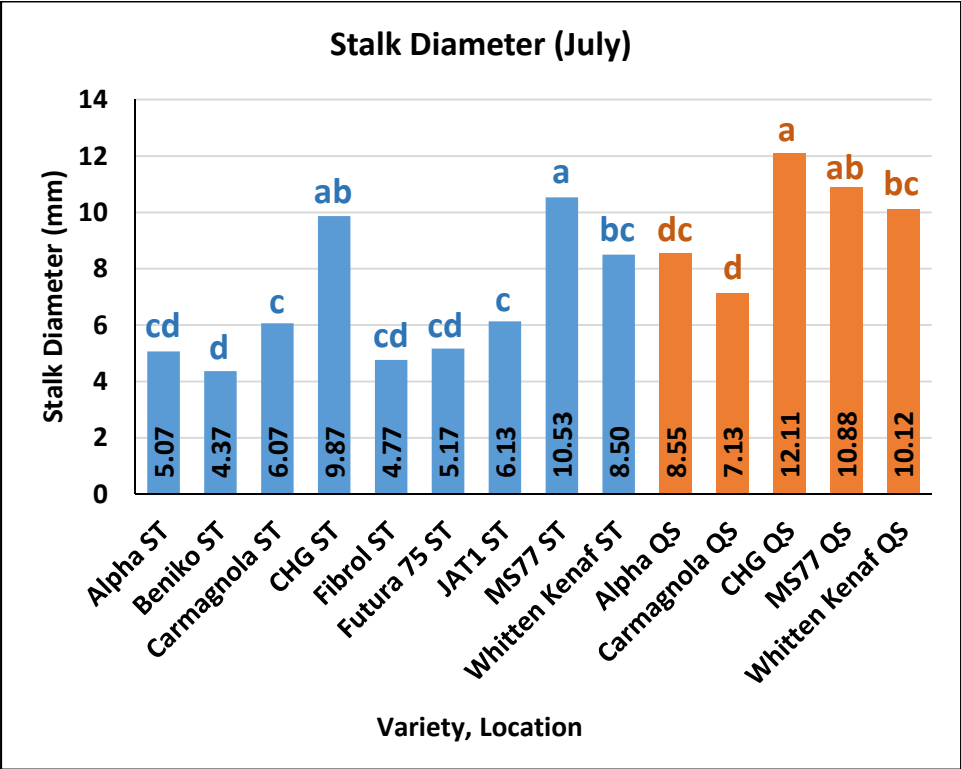
D

Figure 3. Fiber-only trial July planting date .A. Mean population density (1000 plants/A). B. Mean harvested straw DW (lbs./A). C. Mean stalk height (in). D. Mean stalk diameters (mm).





C



D

Conclusions

In general, DM yields were lower in these trials than would be desired. In some cases at both locations and in 2 of the 3 planting dates, varieties failed due to weed pressure which resulted in un-harvestable crops. Data from this trial and the 2017 UK dual-purpose variety trials (http://hemp.ca.uky.edu/sites/hemp.ca.uky.edu/files/2017_dual_purpose_report.pdf) indicate the severe need for labeled herbicides in Kentucky and the U.S.

At the Spindletop location May planting date, which was limited in data recovery due to a planting failure, there were no significant relationships between variety and population density (Fig. 1A), harvested straw DW (Fig. 1B), or in stem diameter (Fig. 1D). There was a significant relationship between variety and plant height (Fig. 1C). At the Quicksand location, all response variables demonstrated a significant relationship with variety (Figure 1A-D). Kenaf ranked among the top performers compared to hemp varieties in terms of straw DW, stalk height, and stem diameter. Hemp varieties producing the highest straw DW yields were Asso (which was among the highest plant densities, and lowest stem diameters) and Elleta Compana (moderate in population density, among the highest stem diameters).

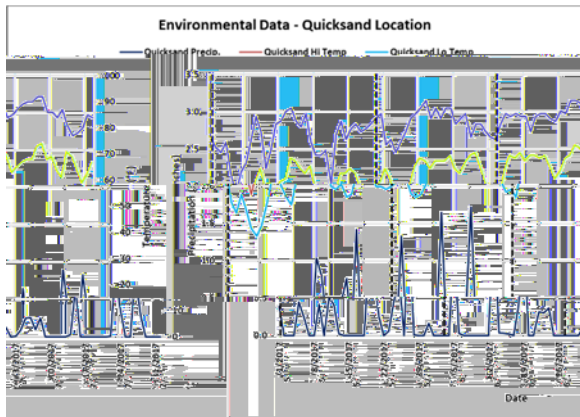
The June planting was destroyed at the Quicksand location due to heavy rain immediately following seeding. Data was collected from all twelve entries at the Spindletop location (Fig. 2), but yields were relatively low; more like what would be expected from a dual-purpose crop. CHG consistently ranked among the highest performers in terms of straw DW yields, height, and stem diameter (Fig. 2B-D). Other varieties ranking in the upper tier in terms of straw DW were the Italian varieties Asso, Carmagnola, and Codimone. Kenaf also ranked one of the highest straw yielding while maintaining lower population density and stem diameter (Figure 2B,D) which are likely favorable combinations in terms of commercial processing ability.

The July planting date was also limited in data from Quicksand due to excess weed pressure leaving five recovered varieties while Spindletop collected data from nine varieties (Figure 3). Kenaf performed among the highest in population density and straw DW and moderately with stalk height and stalk diameter at Spindletop; this trend was not necessarily observed at the Quicksand location, with Kenaf performing moderately among hemp varieties (Figure 3B,D). CHG significantly out-yielded all other varieties in harvested straw DW at Quicksand, while maintaining large stem diameters (≈ 12 mm).

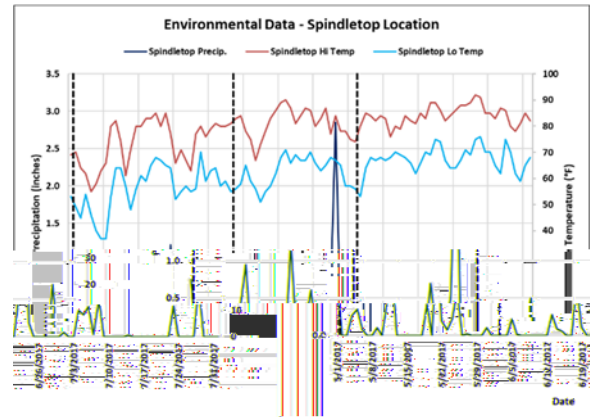
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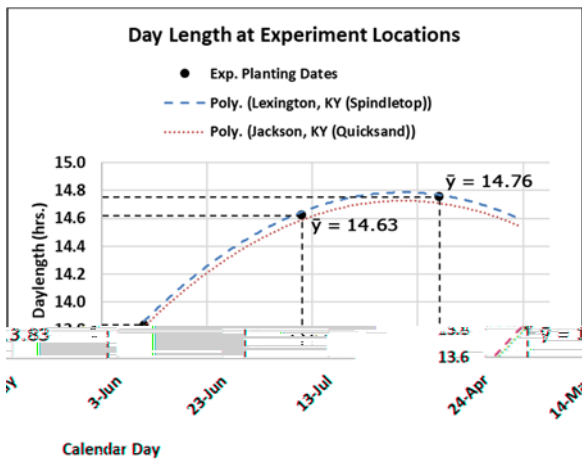
Appendix 1: Environmental and day length data from both locations. Vertical dashed lines represent each respective planting date. **A.** Daily precipitation (in), daily high and low temperatures at the Quicksand location. **B.** Daily precipitation (in), daily high and low temperatures at the Spindletop location. **C.** Day length at each location. Actual day length at Spindletop location denoted by blue dashed line. Actual day length at Quicksand denoted by red dotted line. Mean day length (average length between locations in hours) of each planting date denoted by black marker and dashed lines.



A



B



C