2021 HEMP GRAIN & FIBER CULTIVAR TRIAL

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Introduction & Methods

Research at Purdue University was conducted to evaluate grain and fiber cultivars in 2021 at one location in West-Central Indiana. Seven cultivars of fiber hemp and nine cultivars of grain hemp were included in the trials. Weed pressure was high in the grain plots, resulting in low hemp populations. Bird damage was also extensive in the later maturing grain cultivars. Hemp cultivars were sourced from the United States, Canada, and Europe, with selection of several cultivars based on similar day length to West Central Indiana.

Hemp plots were managed conventionally at Meigs Farm in Lafayette, Indiana (40.288821, -86.882260). A pre-plant application of 400 pounds of 12-31-20 fertilizer blend and an additional 100 pounds of 46-0-0 urea was made. Seeds were planted into a tilled, firm seedbed using a no-till drill (Great Plains, Salina, KS). Sowing occurred on June 4th, at 25 plants/ft^2 for grain cultivars and 50 plants/ft^2 for fiber cultivars. Seeding rate was adjusted for each cultivar based on germination and seed size. The trial was established as a randomized complete block design with four replications. Plots were 5 feet wide by 19 feet long, with 7.5-inch row spacing. The trial was planted on Toronto-Millbrook complex soil type. One application of Poast herbicide was made on June 29th at 1.5 pt/ac and one application of Broclean herbicide was made on July 7th at 1.5 pt/ac. Herbicide injury was recorded, but most plots showed little to no injury due to the hemp growth stage when the Broclean was applied. Seed size was determined using one-thousand kernel weight. Observations of stand establishment, flowering date, height, stem diameter, and yield were made (Table 1-4). Aggregate flower samples (unreplicated) were collected at harvest, dried, and analyzed for THC and CBD using HPLC at Purdue University.

Fiber plots were harvested on August 19th once all cultivars were flowering. Whole plots were cut using a walk behind mower (BSC America, Oregon City, OR) and weighed green. Grab samples were taken and dried in a greenhouse to get moisture content at harvest. Stem diameter and height were taken on 10 stems per plot. Fiber dry matter yields are reported at 0% moisture content.

Purpose

Compare performance of grain and fiber hemp cultivars at one location in West Central Indiana.

Trial Location

Meigs Farm, Throckmorton Purdue Agricultural Center - Lafayette, IN

Experimental Design

Randomized complete block design with four replications.

Trial Management

Planted June 4th

Plots measure 5' x 19' with 7.5" rows

400 lbs 12-31-20 and 100 lbs 46-0-0 fertilizer applied

1.5 pt/ac Poast June 29th

1.5 pt/ac Broclean July 7th

Fiber harvest August 19th

Grain harvest August 31st

Outcomes

All cultivars were THC compliant

Bird damage caused considerable loss of grain

'Fibror 79' had the highest stalk yields

'Grandi' had the highest grain yields. 'NWG 2730' had the highest stalk yields in the grain trial.

The majority of grain plots were harvested on August 31st based on seed maturity. Final stand was very low for most grain cultivars, so stalks were not collected for most of the plots. There was severe bird damage in four grain cultivars, which resulted in no grain data, stalk data was collected in these cultivars due to their height. Whole plot grain yield was collected by hand harvesting the upper portion of the plant and processing through a stationary thresher (John Deere, Moline, IL). Grain was cleaned using a grain aspirator (Carter Day, Minneapolis, MN). Grain yields are reported at 9% moisture content.

Temperature and precipitation were slightly above normal from planting through harvest. Several large, late summer storms caused extensive damage to the trial, with excessive rain and wind speeds reaching 30-40 mph at times. This caused lodging to the later maturing grain cultivars in the trial and likely increased seed shattering. Weed pressure was excessive in some plots. Replicates two and three for 'Hlesiia', replicates one and four for 'Hliana', and replicate four for 'Henola' were removed due to weed pressure. Data were analyzed using ANOVA and Tukey's HSD test (alpha = 0.05) in JMP 16 (SAS Institute Inc., Cary, NC, USA) Varieties were compared based on a single year. Table values with the different letters are significantly different from each other.

Results & Discussion

Significant differences were observed in fiber hemp height, stem diameter, and yield (Tables 1 & 2). The average dry matter yield was 3,308 lb/ac, with the lowest yielding cultivar, 'Hlesiia', producing 1,643 lb/ac. However, two plots for both 'Hlesiia' and 'Hliana' were not harvested due to weed pressure. 'Fibror 79' was the highest yielding cultivar producing 5,352 lb/ac. All cultivars were THC compliant.

Significant differences were observed in grain hemp time to flower and height (Tables 3 & 4). The average grain yield was 185 lbs/ac, with the lowest yielding cultivar, 'CFX-2', producing 146 lb/ac. The highest yielding cultivar, 'Grandi', produced 247 lb/ac. Yields were likely affected by heavy bird damage, with several cultivars losing the majority of their seeds. The four NWG cultivars sustained the worst of the bird damage and yield was not collected. However, due to the considerable height of the plants, dry matter yield was collected. The average stalk yield for the four NWG cultivars was 3,698 lb/ac. 'NWG 2370' had the highest yield, producing 5,528 lb/ac. 'NWG 4000' had the lowest yield, producing 2,595 lb/ac. All cultivars were THC compliant.

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Table 1. Fiber Hemp Observations

Cultivar	Seeds/lb	Plant Date	Stand (1 ft^2)	Flower Date	Herbicide Injury (0-5)	Height (in)
Bialobrzeskie	34,092	6/4/2021	13a	7/3/2021	1	65.5c
Fibror 79	24,076	6/4/2021	16a	7/28/2021	0.5	83.3a
Futura 83	24,759	6/4/2021	7a	7/28/2021	0.5	86.5a
Henola	30,962	6/4/2021	8a	7/17/2021	0	57.8c
Hlesiia	29,818	6/4/2021	6a	7/17/2021	0	65.5bc
Hliana	27,294	6/4/2021	5a	7/17/2021	0	49.5c
Santhica	29,302	6/4/2021	18a	7/28/2021	0.75	80.8ab
Average	**28,614**	**6/4/2021**	**10**	**7/19/2021**	**0.39**	**69.8**

Table 2. Fiber Hemp Yields

Cultivar	Harvest Date	Dry Matter Yield (lb/ac)	Stem Diameter	THC (%)	CBD (%)
Bialobrzeskie	8/19/2021	2,490a	7.00ab	0.11	2.06
Fibror 79	8/19/2021	5,352a	8.51ab	0.06	1.98
Futura 83	8/19/2021	4,916a	9.05a	0.04	1.55
Henola	8/19/2021	2,782a	7.03ab	0.05	1.67
Hlesiia	8/19/2021	1,643a	7.57ab	ND	0.03
Hliana	8/19/2021	1,697a	6.37b	0.10	0.99
Santhica 70	8/19/2021	5,244a	8.28ab	ND	0.46
Average	**8/19/2021**	**3,308**	**7.69**	**0.07**	**1.25**

Fig 1. Fiber hemp plot 6 weeks after planting.

Fig 2. Each bundle represents a different fiber hemp cultivar.

Table 3. Grain Hemp Observations

Cultivar	Seeds/lb	Plant Date	Stand (1 ft^2)	Flower Date	Herbicide Injury (0-5)	Height (in)
Amaze Auto	39,999	6/4/2021	8a	7/3/2021	0.50	28b
Grandi	28,965	6/5/2021	6a	7/3/2021	0.50	37b
Katani	32,170	6/6/2021	5a	7/3/2021	0.25	32b
Picolo	29,359	6/7/2021	6a	7/3/2021	0.25	32b
CFX-2	28,104	6/4/2021	5a	7/3/2021	0	32b
NWG 2730	36,143	6/4/2021	7a	7/28/2021	0.75	75a
NWG 2463	31,707	6/4/2021	3a	7/28/2021	0	70a
NWG 4000	29,747	6/4/2021	7a	7/28/2021	1	68a
NWG 4113	31,489	6/4/2021	6a	7/28/2021	1	69a
Average	**31,965**	**6/4/2021**	**6**	**7/14/2021**	**0.44**	**49**

Table 4. Grain Hemp Yields

Cultivar	Harvest Date	Grain Yield (lb/ac)	DM Fiber Yield (lb/ac)	THC (%)	CBD (%)
Amaze Auto	8/31/2021	172a	NA	0.03	1.17
Grandi	8/31/2021	247a	NA	0.11	0.75
Katani	8/31/2021	168a	NA	0.10	1.23
Picolo	8/31/2021	194a	NA	0.18	1.25
CFX-2	8/31/2021	146a	NA	ND	0.93
NWG 2730	10/1/2021	NA	5,528a	0.11	3.64
NWG 2463	10/1/2021	NA	2,666a	0.11	3.40
NWG 4000	10/1/2021	NA	2,595a	0.13	3.86
NWG 4113	10/1/2021	NA	4,004a	0.10	3.27
Average	**9/13/2021**	**185**	**3,698**	**0.11**	**2.17**

Fig 3. A grain hemp plot with excessive weed competition.

Fig 4. Damage in late maturing grain plots caused by excessive wind and rain.