Cornell Hemp

http://hemp.cals.cornell.edu

Breeding for Grain Quality

Jacob Toth, Martin Liu, Jamie Crawford, Larry Smart, Ginny Moore, Alireza Abbaspourrad

There is heritable variation in grain protein content and TKW

Grain protein and thousand kernel weight (TKW) have significant genetic components and are weakly anti-correlated.

We can breed for higher protein content and TKW

Grain protein content can be assessed through wet chemistry or NIR models. We have used NIR to select for higher grain protein in some of our breeding populations.

TKW was very high in some cultivars from China (Han-NW, Han-NE, Han-FN-H). We have selected within these cultivars for adaptation to NY and low THC %.

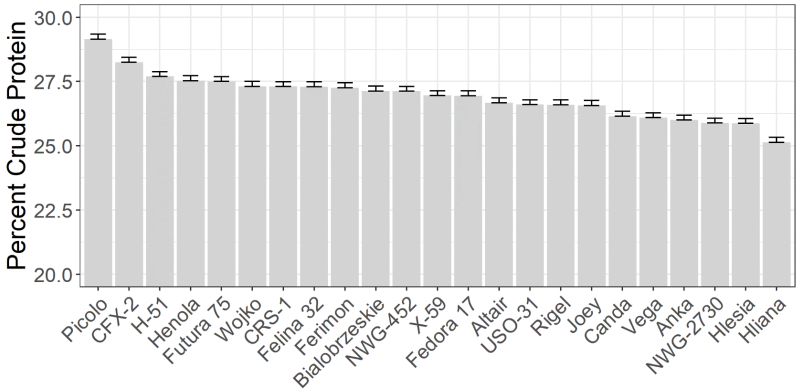


Figure 1. Crude protein content of 23 cultivars grown in 2020.

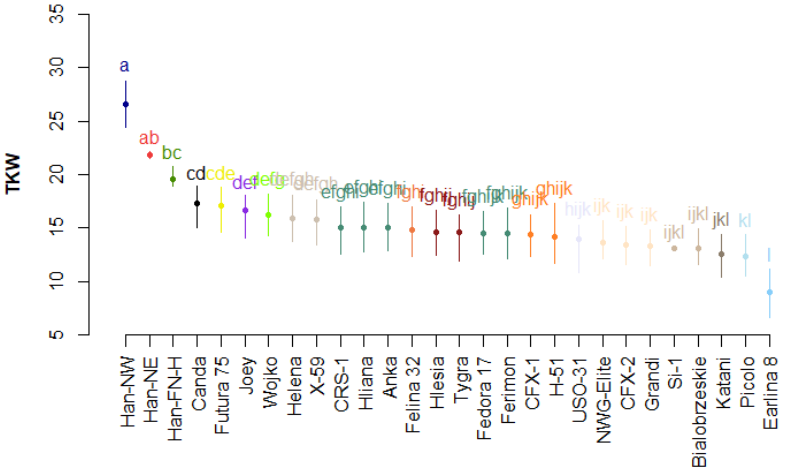
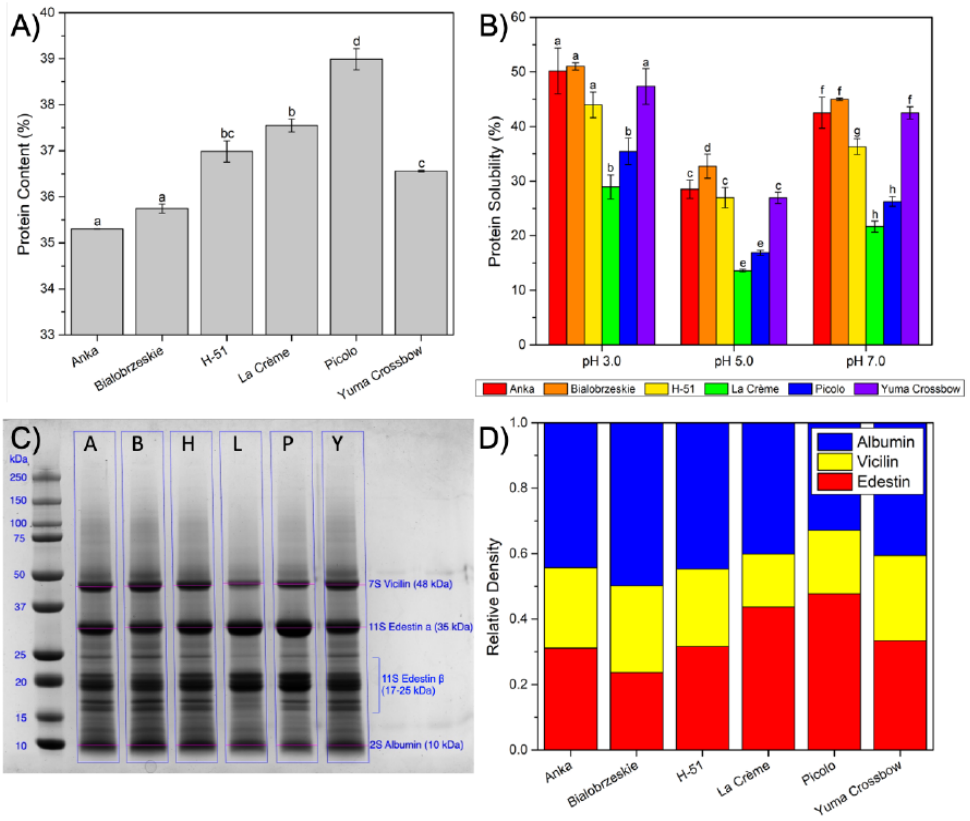


Figure 2. Thousand kernel weight of 28 cultivars grown in 2019.

Acknowledgements: We are very grateful for technical help from the Smart, Viands, Moore, and Abbaspourad labs for these projects, notably from Ryan Crawford, Emily McFadden, and Craig Carlson.

Functional characterization of hemp protein

We characterized the protein from press cake of dehulled seeds from six cultivars for solubility, foaming, and emulsion parameters. We also determined proportions of specific seed storage proteins (edestin, vicilin, and albumin).



Cultivars with a higher proportion of edestin had higher protein content but also lower solubility. Breeding for higher protein without increasing edestin proportion might lead to greater amounts of functional protein.

Figure 3. Protein content, solubility, and composition of six hemp seed cultivars. A) Protein concentration in dehulled hemp hearts. B) Solubility of hemp seed protein isolates at a pH of 3.0, 5.0, and 7.0. C) SDS-PAGE gel of protein isolates and D) quantified relative band densities for vicilin, α edestin, and albumin bands.

			Solubility			Functionality at pH 7.0				
Market Classification	**Cultivar Name**	**Protein Content**	**pH 3.0**	**pH 5.0**	**pH 7.0**	**Emulsion Activity**	**Emulsion Stability**	**Emulsion Droplet Size**	**Foaming Capacity**	**Foaming Stability**
Fiber/Grain	**Anka**	-	+		+	+		+		
Fiber/Grain	**Bialobrzeskie**		+	+	+	+			+	
Fiber	**H-51**		+				-	-		
Cannabinoid	**La Crème**		-	-	-	-		-	-	
Grain	**Picolo**	+	-	-	-	-		-	-	
Fiber/Grain	**Yuma Crossbow**		+		+			+		

Table 1. Qualitative comparison of protein content, solubility, and functionality for six cultivars