Lessons Learned from Initial Field Trials of Hemp in New Mexico

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Hemp Trials at NMSU

- NMSU initial variety trial work (2019-2020)
  - Support: Navajo Nation
- Phytoremediation trial (2019-2020)
  - Support: BHP/Rio Algom Mining
  - Focus on legacy uranium mines in northwest NM
- **Expanded variety trials (2021-2022)**
  - **Support: COE (2021), AES (2021-22), CESFAS (2021-22), WSARE (2022-23)**

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2021-2022 Field Trial Objectives

Original Objectives

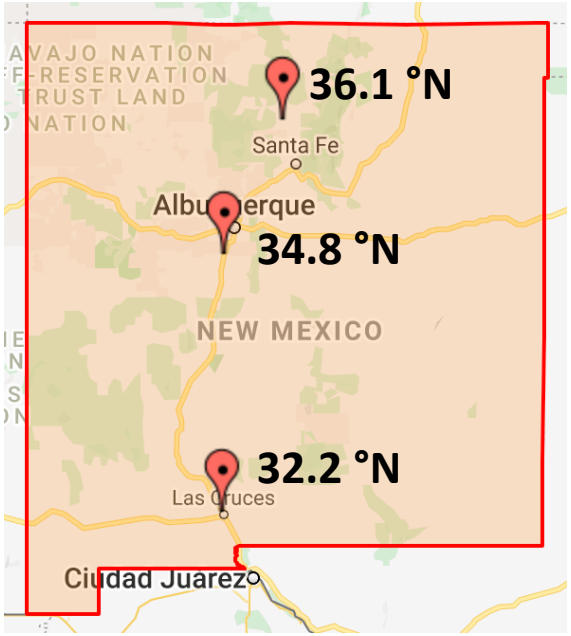
- Observe photoperiod response of fiber and grain varieties
- Determine whole plant vs. flower yield of high-cannabidiol (CBD) varieties
- Characterize floral material from high-CBD varieties
- Investigate sustainability interests in water stress, pest management, and organic management

Expanded Research Objectives

- Investigate beet leaf hopper pressure
- Characterize waste fiber residues

Varieties, Dates, & Locations

Variety Details			
Year	***Variety***	***Type***	***Planting Method***
2021/2022	The Wife	CBD	Transplants, 3 ft spacing
2021/2022	Sweetened	CBD	
2021	Anka	Fiber/Grain	Direct seeded at 40 lbs/acre
2021	Altair	Fiber/Grain	
2021	Earlina	Fiber/Grain	
2021	MS77	Fiber	
2022	Orion 33	Fiber/Grain	Direct seeded at 40 lbs/acre
2022	Félina 32	Fiber/Grain	
2022	Futura 83	Fiber	



Planting and Harvest Dates Hemp Trials				
Location	***Year***	***Planting Date***	***Harvest Date***	***Days in Season***
Leyendecker Plant Science Research Center	2021	May 26	Sept. 14	111
	2022	April 18	Sept. 13	148
Agricultural Science Center at Los Lunas	2021	June 24	Sept. 23	91
	2022	May 4	Sept. 21	140
Sustainable Agricultural Science Center at Alcalde	2021	July 16	Sept. 29	75
	2022	May 13	Sept. 28	138

Plot Management

- Duplicate plots in 2022 for additional treatments
- All sites: drip irrigation, manual weed control, free of pesticide use
- Standard plot (common to all sites): sufficient watering; bi-weekly fertilizer applications with Miracle Gro LiquaFeed (12-4-8)
- Pest trapping: yellow sticky traps at plot perimeters collected approx. every 2 weeks

Treatment for Duplicate Plots in 2022	
Location	***Treatment Plot***
Leyendecker Plant Science Research Center	Water stress: watered with 50% lower frequency than standard plot
~~Agricultural Science Center at Los Lunas~~	~~Pest management~~
Sustainable Agricultural Science Center at Alcalde	Organic fertilizer: treated with OMRI certified organic fertilizer (11-3-8)

Harvest & Drying

- Harvest inspection by NMDA
- Complaint varieties harvested/dried under ambient conditions to flower moisture content < 10%
- Whole vs. bucked dry plant weight recorded

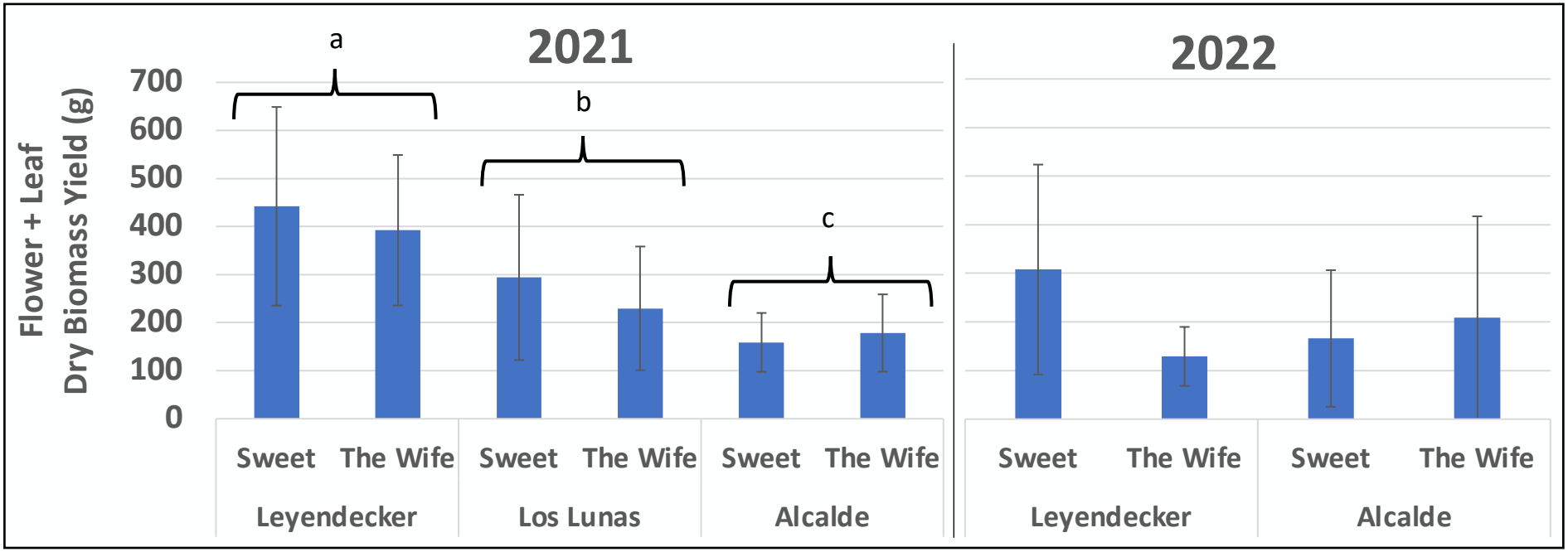
2022 Cannabinoid Content at Harvest

2022 Harvest Potency Analysis					
Variety	Site	Total CBD (w/w %)		Total THC (w/w %)	
		Act	Exp	Act	Exp
Sweetened	Leyendecker	16.26	9-12	0.34	< 0.3
	Leyendecker (WS)	9.69		0.09	
	Los Lunas	17.00		0.62	
	Alcalde	9.18		0.32	
	Alcalde (O)	6.91		0.26	
The Wife	Leyendecker	13.32	10-14	0.27	
	Leyendecker (WS)	10.79		0.014	
	Los Lunas	15.32		0.60	
	Alcalde	8.72		0.32	
	Alcalde (O)	9.08		0.43	
Orion 33	Leyendecker	2.25	2-5	0.07	
	Los Lunas	0.09		< LOQ	
	Alcalde	1.68		0.03	
Felina 32	Leyendecker	4.92	2-3	0.3	
	Los Lunas	1.19		0.04	
	Alcalde	2.26		0.04	
Futura 83	Leyendecker	1.93	2-3	1.92	

- NMDA supervised destruction of non-compliant varieties
- Discrepancy between NMDA and self-sampled results

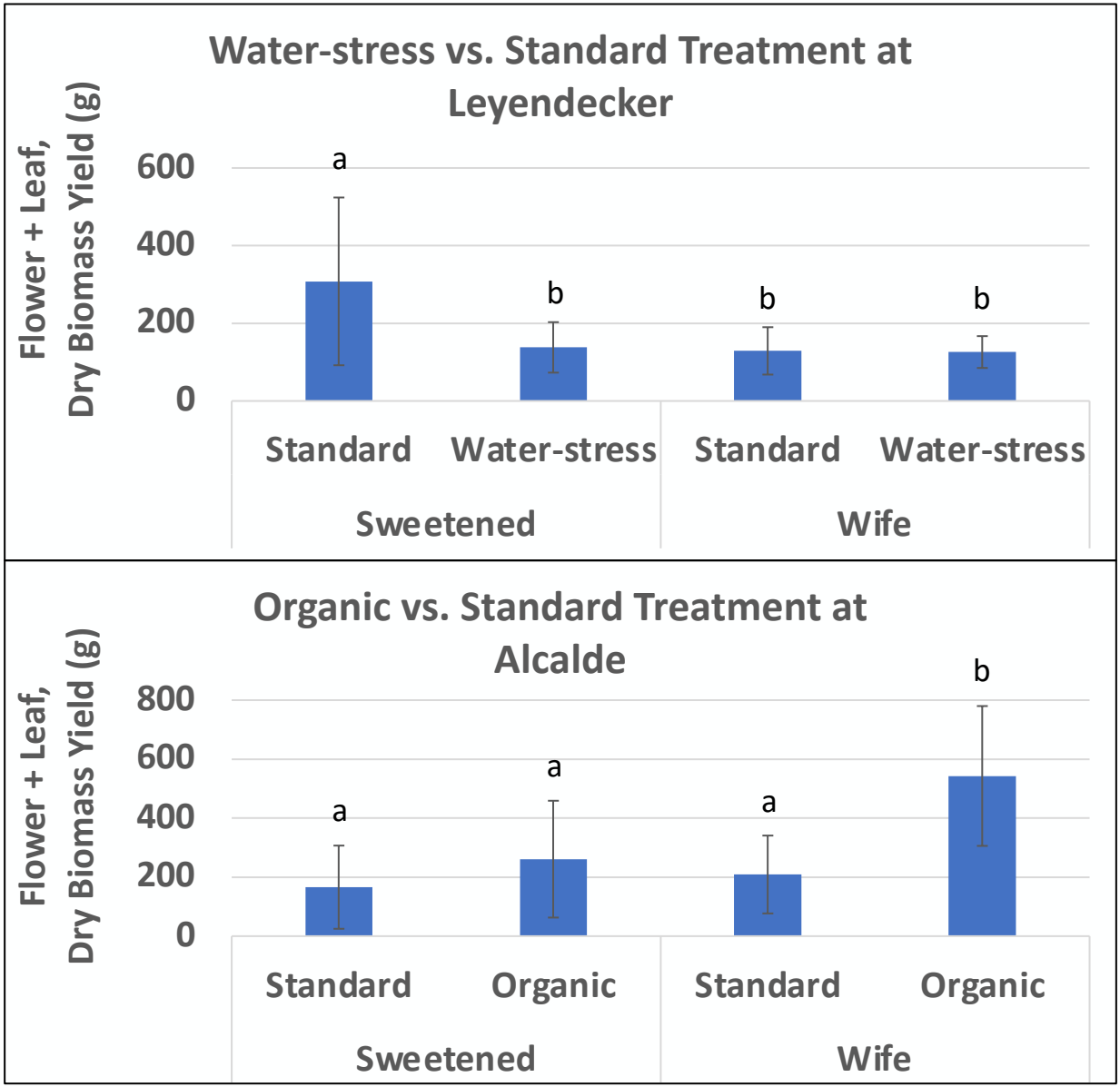
Flower Yield (Common Plots)

- Yields are poor compared to indoor potential
- 30-70% of total crop weight was fiber across all sites/varieties



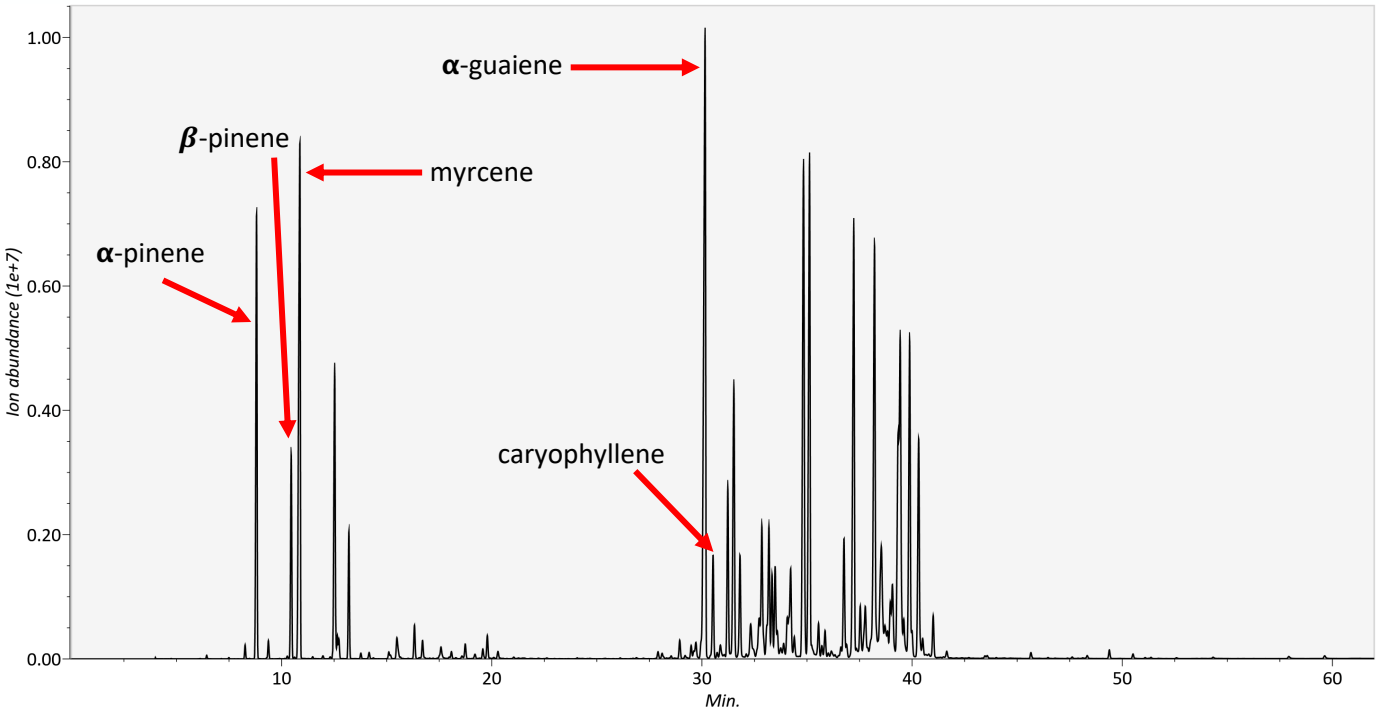
Flower Yield, (Treatment Plots)

- Water stress decreased yields at Leyendecker
- Organically-grown 'The Wife' had average yield higher than other samples at Alcalde



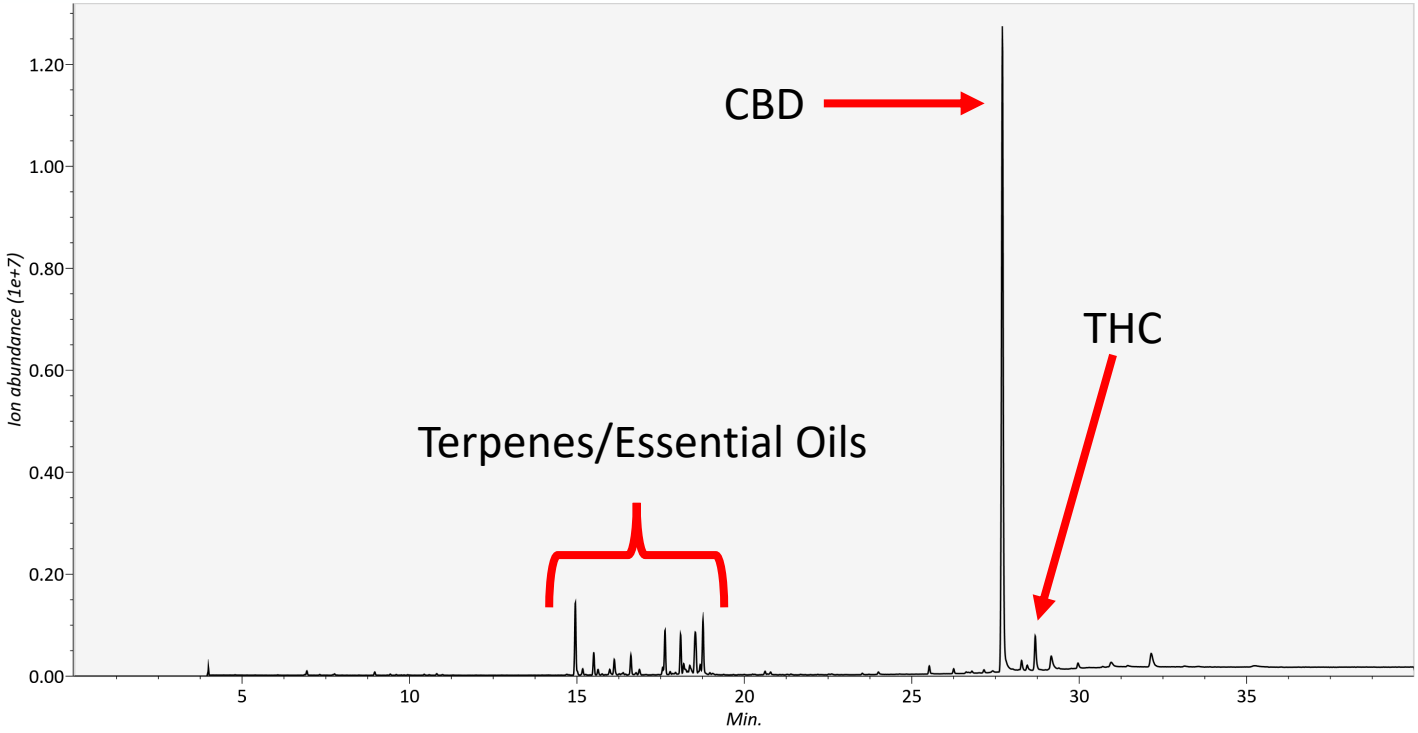
Essential Oil Profile: Steam Distillation

- GC-MS analysis
- 330 unique compounds detected
- 188 unknowns



Essential Oil & Cannabinoid Profile: Supercritical Carbon Dioxide Extract

- GC-MS analysis
- 96 unique compounds detected
- 59 unknowns
- Losses during post-processing



MAJOR LESSONS LEARNED…

1) Screen industrial varieties for response to regional photoperiods prior to planting

- 6 of 7 varieties exhibited early reproductive behavior
- Only MS-77 grew normally at southernmost field site

Growth Stages Key	
	Sowing
	Vegetative Growth
	Reproductive Growth / Maturation
	Harvest

A. Anka (2021)

Site	Days in Season	April	May	June	July	August	September
Expected	92-113			~75 days			
Leyendecker	111			25			
Alcalde	75				30		

B. Altair (2021)

	Days in Season	April	May	June	July	August	September
Expected	92-113			~ 75 days			
Leyendecker	111			25			
Alcalde	75				30		

C. Earlina (2021)

	Days in Season	April	May	June	July	August	September
Expected	115-120			~ 75 days			
Leyendecker	111			13			
Alcalde	75				22		

D. MS77 (2021)

	Days in Season	April	May	June	July	August	September
Expected		Data not available					
Leyendecker	111				N/A [i]		
Alcalde	75					N/A [i]	

E. Orion 33 (2022)

	Days in Season	April	May	June	July	August	September
Expected	138-143			~ 100 days			
Leyendecker	148		44				
Los Lunas	140			50			
Alcalde	138			55			

F. Felina 32 (2022)

	Days in Season	April	May	June	July	August	September
Expected	133-138			~ 100 days			
Leyendecker	148		44				
Los Lunas	140			50			
Alcalde	138			55			

G. Futura 83 (2022)

	Days in Season	April	May	June	July	August	September
Expected	112-117			~ 100 days			
Leyendecker	148		55				

[i] Plot was harvested before ½ of the plants exhibited flowering; although pollination was observed

- Vegetative → Reproductive: terminal flowering (CBD/grain) or pollination (fiber) in 50% of individuals

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	Days in Season	April	May	June	July	August	September
Expected	115-120			~ 75 days			
Leyendecker	111			13			
Alcalde	75				22		

D. MS77 (2021)

	Days in Season	April	May	June	July	August	September
Expected		Data not available					
Leyendecker	111				N/A [1]		
Alcalde	75					N/A [1]	

E. Orion 33 (2022)

	Days in Season	April	May	June	July	August	September
Expected	138-143			~ 100 days			
Leyendecker	148		44				
Los Lunas	140			50			
Alcalde	138			55			

2) Ensure healthy transplant materials for high-CBD varieties

- Many root-bound plants did not recover
- Stunted plants were more susceptible to pests/disease

3) Investigate the effects of organic management practices

- Only significant result was the higher yield of Wife grown organically, compared to either variety in standard plot
- All had lower CBD content than expected

Standard

Organic

4) Beware of beet leaf hoppers

- Beet leaf hopper (*Circulifer tenellus*) is the sole vector of beet curly top virus
- Effects western states in U.S.
- Common pest in chile, tomatoes, sugar beets, cucurbits, and more

Creamer, R., Simpson, A., Rheay, H.T., & Brewer, C.E. (2023). Beet leafhopper, vector of beet curly top, and its interactions with hemp. *Environmental Entomology*. https://doi.org/10.1093/ee/nvad069

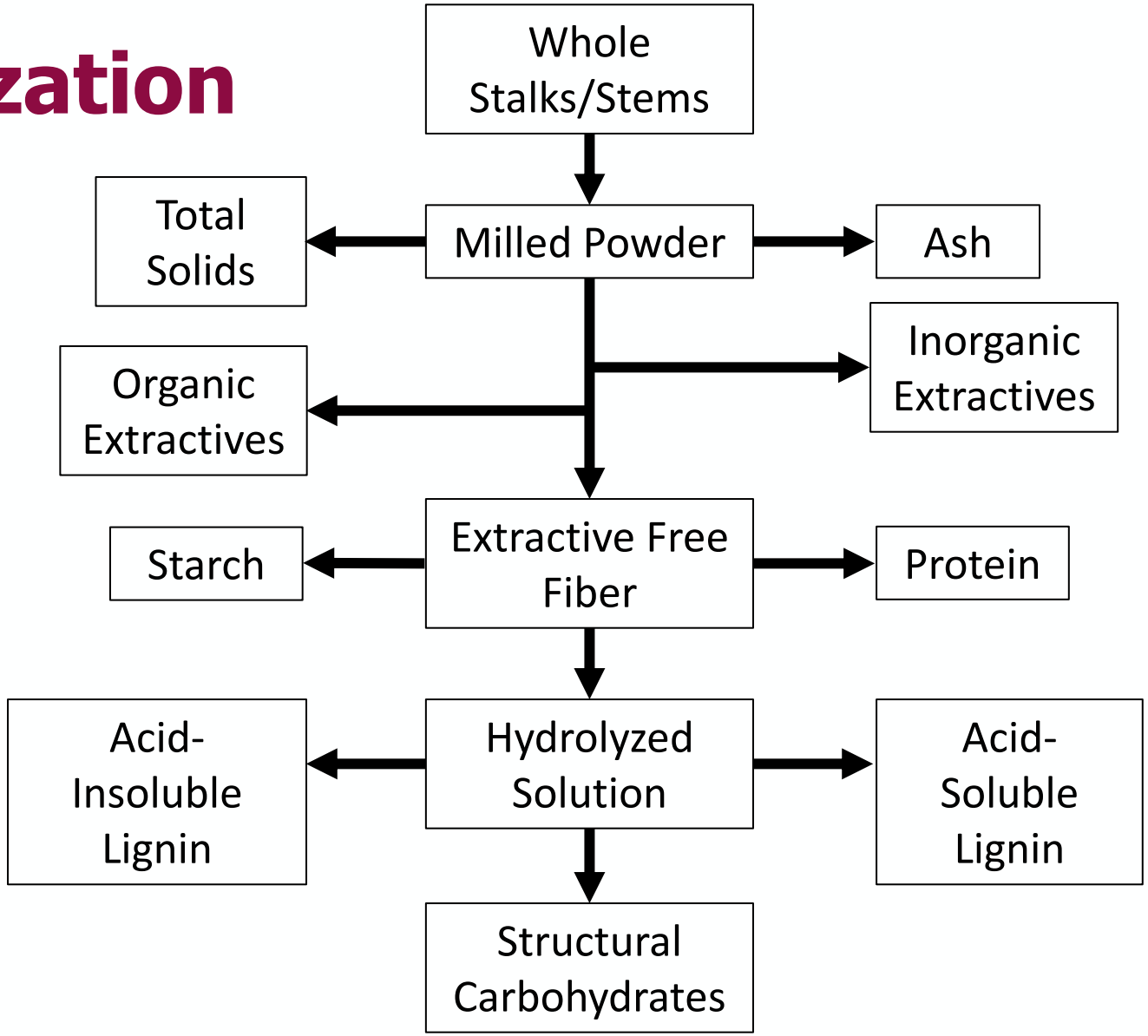
WHAT'S NEXT?

Hemp's Future at NMSU

- No trials in 2023
  - No current plans at NMSU to continue variety trials
  - Production for CBD should be shifted indoors; focus on outdoor industrial production as an agronomic crop
  - Phytoremediation project saw promising results but was not continued by funding agency
- **Fiber characterization and bio-based chemical processing (ongoing)**
- Product research by other NMSU groups (food science, biochemistry) should be integrated with cultivation research to support a viable state industry

Characterization of Waste Fibers

- Supplemental feedstock for other hemp bio-based chemicals?
- Also: pyrolysis for biochar



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Questions?

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