

# NMSU Hemp Research & Variety Trials

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# Outline

- Hemp Research at NMSU
  - ❖ NMSU Farmington Agricultural Science Center Trials, 2019-2020
  - ❖ Uranium Phytoremediation Research
  - ❖ Class Project: Hydroponic Cultivation
  - ❖ 2021 Multi-Location, Multi-Use Variety Trials: Current Updates
  - ❖ Next Steps: Harvest & 2022 Trials
- Looking Ahead: Fiber & Seed Hemp
- Major Challenges & Roadblocks
- Lessons Learned & Moving Forward



# Hemp Research at NMSU

- First approved in 2019 with variety trial in collaboration with Navajo Nation
- Started approving additional small, specialty projects
  - Phytoremediation research (2019-2020)
  - Class projects (2021)
- 2021 multi-location variety trial supported by AES/COE



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# NMSU Farmington ASC Trials, 2019-2020

- 2019: Updated Memorandum of Understanding between NMSU and Navajo Nation to allow for hemp research
- 2-year trial
- CBD varieties (Cherry Wine, Sweetened, The Wife)
- Clones from Rich Global Hemp in Las Cruces, NM



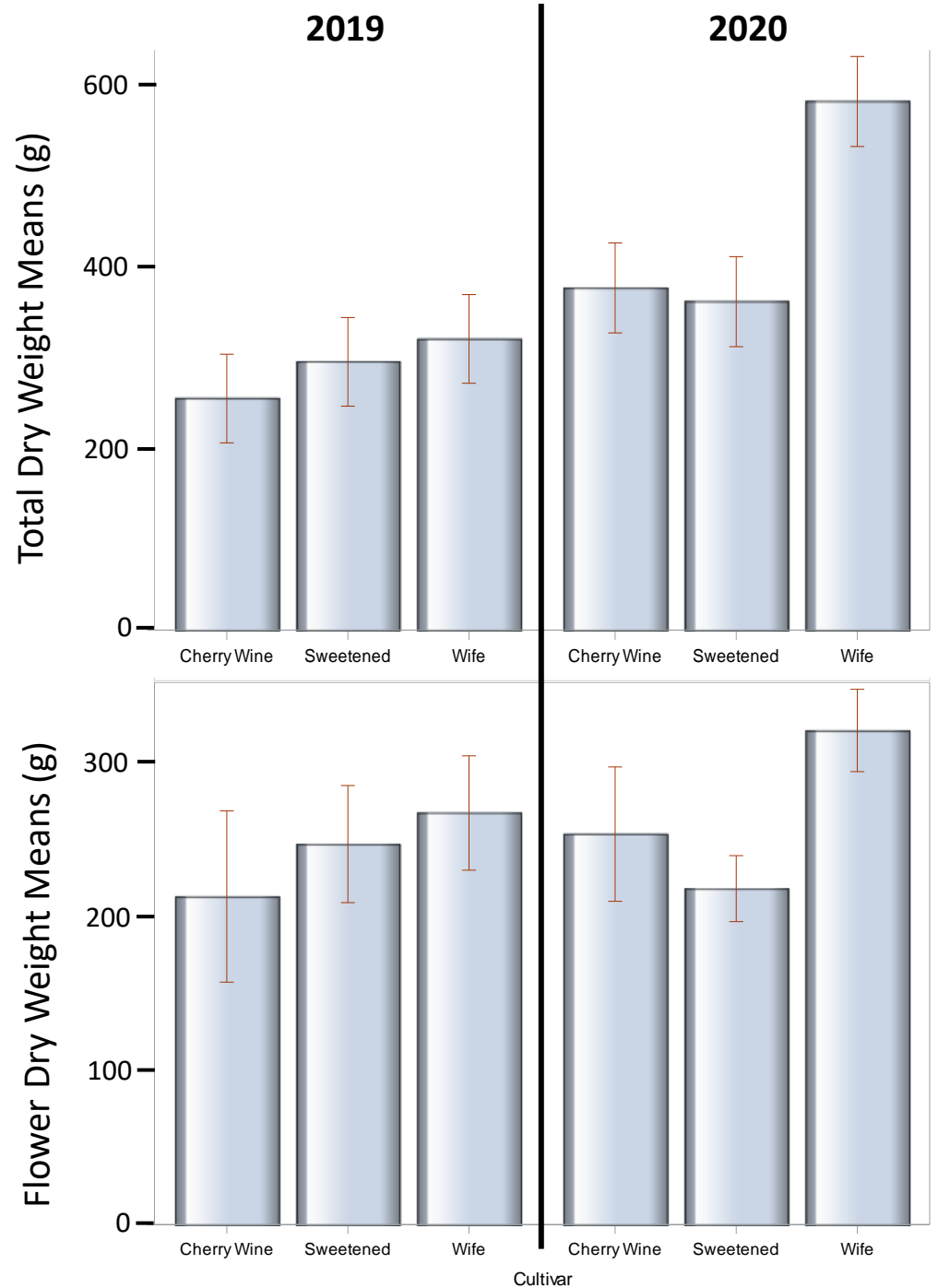
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Agricultural Science Center at Farmington

# 2019-2020 Farmington Harvest Data

- 2019: over-head sprinkler + hand fertilization; planted mid-July
- 2020: drip irrigation + fertigation; planted mid-June



# Small farm harvest: Mechanical “hemp” picker (?)



Hopster<sup>®</sup>

Hops Harvester

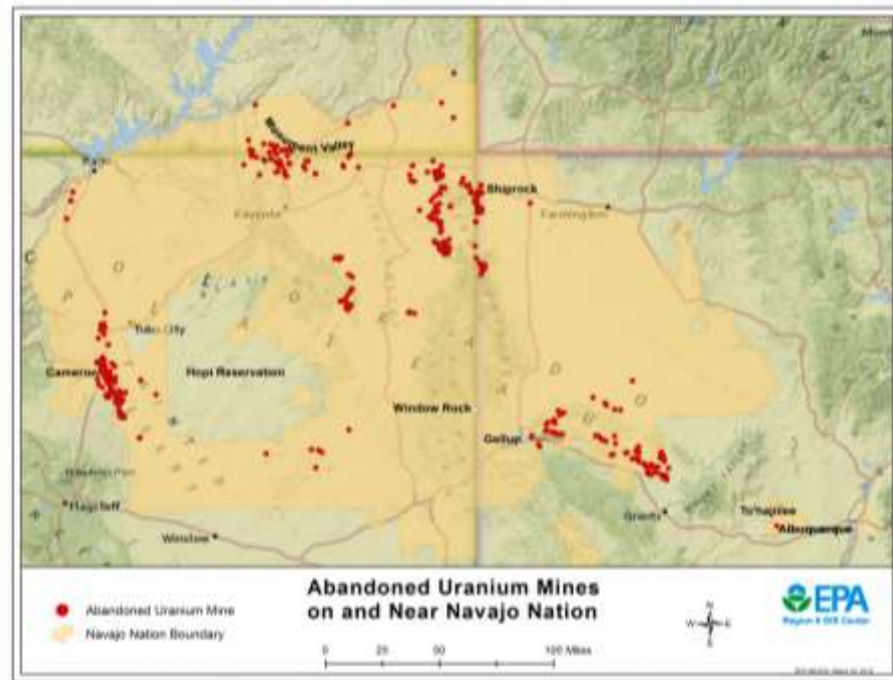
<https://hopsharvester.com/hops-harvester/>



# Uranium Phytoremediation Research

## Hypothesis

- Very little radionuclide accumulation will occur in the *hemp seed oil*, compared to accumulation in other seed fractions and remaining biomass
- The oil (relatively free of contaminants) can be used for bioenergy/industrial products



Images –  
(top) Priority abandoned uranium mines on and near Navajo Nation identified by the EPA <https://www.epa.gov/navajo-nation-uranium-cleanup/abandoned-mines-cleanup>;  
(right) plants growing in uranium contaminated soil

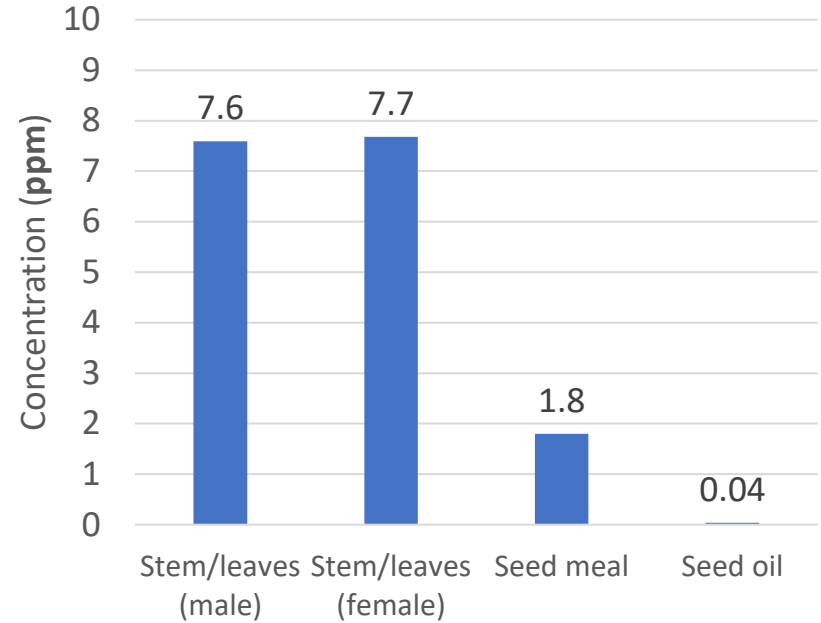


# Uranium Phytoremediation Research

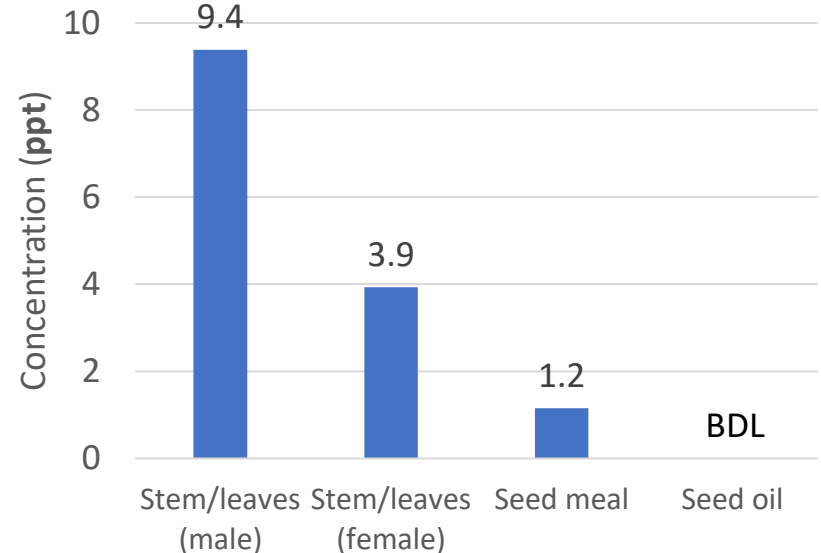
## Results & Conclusions

- Radionuclide accumulation pattern for was as expected:  
stalks/leaves > seed meal > seed oil
- Extremely low concentration of contaminants in oil increase the potential for use in non-food, fuel/material applications.

Uranium in Hemp Biomass



Radium-226 in Hemp Biomass





# Class Project: Hydroponic Cultivation (2021)

Performed by students of HORT 488

Supervised by Dr. Geno Pichionni



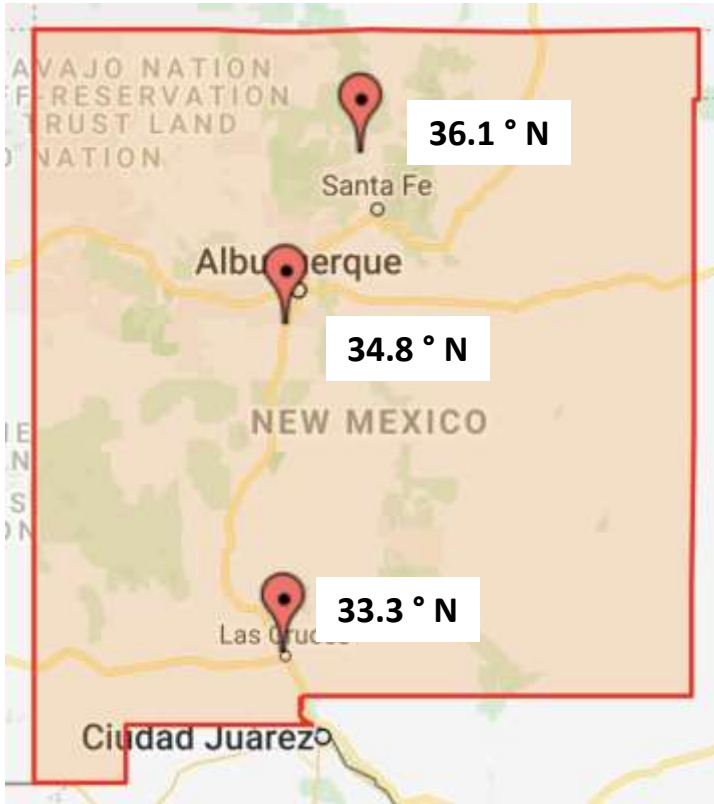
- Two varieties: Cherry Blossom and Sweetened
- Two nitrogen treatment levels: 100 ppm and 200 ppm
- Preliminary data indicates plants grew better with 100ppm nitrogen
  - Vegetative growth index and dry biomass yield were higher for both varieties under 100 ppm than 200 ppm (***counterintuitive?***)
- Issues with pythium stem rot
- Professor hopes to repeat this experiment with next spring class



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López, C.A. (2021, Apr 12). NMSU students grow, study hemp cultivars on campus. *NMSU News*. <https://news.nmsu.edu/2021/04/nmsu-students-grow,-study-hemp-cultivars-on-campus.html>

# 2021 Multi-Location, Multi-Use Variety Trials: Current Updates



Variety	Source	Location	Type
Anka	Horizon Seeds	Canada	Grain/Fiber
Altair	Horizon Seeds	Canada	Grain/Fiber
Earlina	Indiana State University	France	Grain
MS-77	EcoFibre	Australia	Fiber
The Wife	Rich Global Hemp	N/A	CBD
Sweetened	Rich Global Hemp	N/A	CBD

# 2021 Variety Trials: Current Updates

*(Through August 27, 2021)*

## Planting Dates

- 5/26 Las Cruces
- 6/24 Los Lunas
- 7/16 Alcalde

Variety	Type	Planting Method
Anka	Grain/Fiber	Direct Seed
Altair	Grain/Fiber	Direct Seed
Earlina	Grain	Direct Seed
MS-77	Fiber	Direct Seed
The Wife	CBD	Transplant
Sweetened	CBD	Transplant



Images –  
(top, left) Fiber hemp, variety MS-77;  
(top, right) Grain hemp, variety Earlina;  
(bottom) CBD hemp, variety Sweetened

# 2021 Variety Trials: Current Updates

*(Through August 27, 2021)*

## MAJOR CHALLENGE:

## PREMATURE FLOWERING –

reproductive structures appear  
as early as 19 days after seeding  
for some varieties

Images – Female (top) and male (bottom)  
reproductive structures appearing in variety Earlina  
on May 10<sup>th</sup> after being seeded on April 20<sup>th</sup> in  
Las Cruces, NM



# 2021 Variety Trials: Current Updates

(Through August 27, 2021)

## Pest and Disease Issues

- *Fusarium* root rot
- *Botrytis* bud rot
- Armyworm
- Tobacco budworm
- Beet leaf hopper  
(vector for curly top virus)



Images – (top) armyworm feeding on hemp leaf; (bottom, left) initial signs of root rot (bottom, right) complete death from root rot

# 2021 Variety Trials: Current Updates

*(Through August 27, 2021)*



All testing was performed by Scepter Labs in Santa Fe, NM

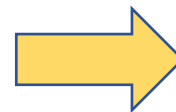
## Preliminary Cannabinoid Profile Results at Las Cruces Site (% Mass)

Variety	Δ9-THC	THCa	Total THC	CBD	CBDa	Total CBD	CBN	CBG
Anka	< 0.01	0.36	0.32	< 0.01	7.77	6.81	< 0.01	0.25
Altair	< 0.01	< 0.01	< LOQ	0.04	1.68	1.51	< 0.01	< 0.01
Earlina	< 0.01	< 0.01	< LOQ	0.13	3.01	2.77	< 0.01	0.05
The Wife	0.02	0.25	0.24	0.26	4.07	3.83	< 0.01	0.03
Sweetened	< 0.01	0.34	0.30	0.30	5.90	5.47	< 0.01	0.02

Total THC = THCa \* 0.877 + Δ9-THC

Total CBD = CBDa \* 0.877 + CBD

LOQ = Limit of Quantitation



**Harvests beginning next week!!!**



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# Next Steps: Harvest & 2022 Trials

## Harvest

- All 3 sites will be harvested over September
- Obtain yield data for grain, flower, and fiber versus whole plant
- Determine final cannabinoid profiles for harvested material



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Center of Excellence in Sustainable Food  
and Agricultural Systems

## 2022 Trials

- Funding through Western Sustainable Agriculture Research and Education (SARE) grant
- Repeat 2021 trials with top performing variety options; evaluate cultural management practices and product/extract quality



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# Looking ahead... are fiber/seed the future of hemp research?

**BUSINESS**  
**Feds Fund Research Into Hemp  
Fiber Insulation As Environmentally  
Friendly Alternative**

**Hemp Grower**  
**Researchers Earn USDA Grant to Study Hemp in Cattle  
Feed**  
The \$200,000 grant will help the researchers determine the concentrations of cannabinoids in livestock after they've eaten hemp feed.  
Sep 7, 2020



**EO East Oregonian**  
**Researchers study spent hemp biomass as animal feed**  
The project, which received a nearly \$300,000 USDA grant in February, ... the case for federal approval of hemp biomass on cattle farms, ...  
Mar 28, 2021

**Cars and disinfectant  
wipes could be the future  
for hemp**  
11/04/20 5:25 AM By Fran Howard

**Greener Pastures: Hemp's Potential as Livestock Feed - Hemp Benchmarks**  
[www.hempbenchmarks.com](http://www.hempbenchmarks.com) • 6 min read

**Hemp Industry Daily**  
**USDA creating hemp germplasm collection, funding lab to ...**  
A new \$66 million Agricultural Research Service lab where scientists will study hemp farming, fiber, and plant breeding. Developing software ...  
Feb 11, 2021



# Major Challenges & Roadblocks

- **Recreational Legalization**
  - *Can likely overtake general CBD demand from hemp*
- **Manufacturing Infrastructure**
  - *Few industrial processors exist, but are increasing in number as machinery becomes more accessible*
- **Pollen Drift**
  - *Unavoidable as fiber/grain production expands; high-cannabinoid flower or specialty products likely limited to indoor production*
- **Total THC Limits**
  - *Many well-performing fiber varieties have origins in Southern China and exceed the US legal limits for THC*



# Lessons Learned & Moving Forward

- Screen fiber/grain varieties for photoperiod response before agronomics can be optimized
- Evaluate non-traditional planting dates
- Investigate yields from dual-purpose harvests
- Gain access to small-scale decorticator
- Compare extraction methods to maximize cannabinoid recovery from residual biomass



# Acknowledgments

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