



Gruff Grains

MTP2 Final Presentation

Employer: Crystal & Jody
Manuel

Interns: Anna Binion & Katie
Elliott

P2 advisor: Dr. Kuo

Summer 2024



Anna Binion



Major: Dietetics

Career Goal: Dietitian

Intern Role: Recipe developing & research

Why P2:

- Professional experience
- Working with companies
- Project based learning

Katie Elliott

Major: Nutrition and Dietetics

Career Goal: Registered Dietitian

Intern Role: Chemical Analyst

Why P2: Passionate about people
being nourished in sustainable
and safe ways



Significance

Gruff Grains, LLC

- Gruff Ancient Grain Grit
- USDA Organic
- Regenerative Organic Certified

ROC Farming

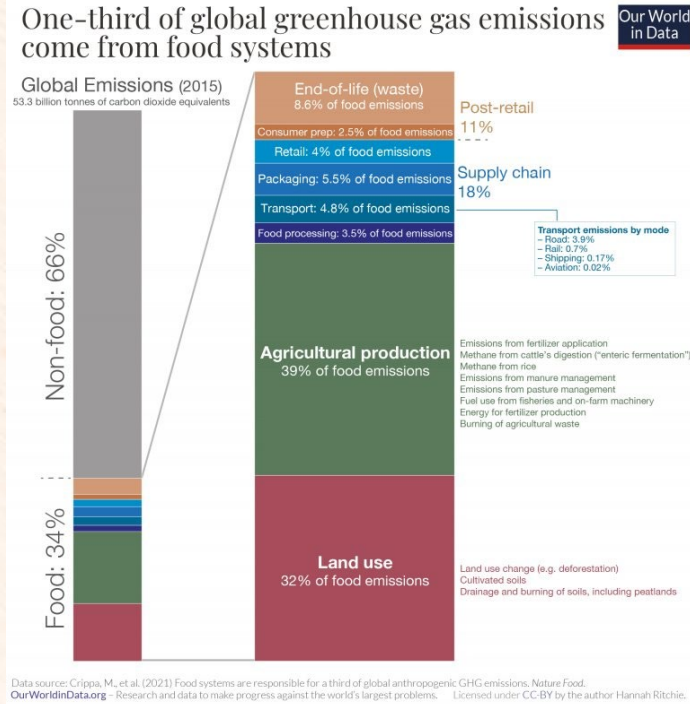
- Reduce soil disturbances
- Use of perennial crops
- Ground cover use
- No synthetic chemicals
- No Genetically Modified inputs

Impact

- Reduces carbon emissions
- “Global adoption of regenerative practices across both grasslands and arable acreage could sequester more than 100% of current anthropogenic emissions of CO₂”

Regenerative organic agriculture and the Soil Carbon Solution. Rodale Institute. (2022, October 12).
<https://rodaleinstitute.org/education/resources/regenerative-agriculture-and-the-soil-carbon-solution/>

Significance



- Vast majority of carbon emissions in our food system comes from the farm.
- We need to find better solutions and more sustainable farming practices.
- Agriculture production accounts for around ten percent of annual emissions (6.2 Gt Co2e) [11]

Regenerative organic agriculture and the Soil Carbon Solution. Rodale Institute. (2022, October 12).
<https://rodaleinstitute.org/education/resources/regenerative-agriculture-and-the-soil-carbon-solution/>

Gruff Grains

History

- Bought the farm
- Faced a health scare in the early 2000s
- Embarked on a health journey that led to discovering organic practices
- Successfully transitioned the grain farm to ROC in 2021

Expressed interests in P2

- Introducing a new 3-grain blend
- Repurposing canvas tote waste from the plant
- Utilizing whole wheat by-products from production
- Committed to educating the community

P2 Area of Focus

- Testing for contaminants – heavy metals
- Establishing protocol for future PFAS testing
- Comparing mineral content of ROC grains to conventional farming
- Bolstering the ROC farming techniques with data

NRDC Learn About the Climate Crisis Our Work Stay Informed Take Act


[← See all News & Commentary](#)

Explainer

“Forever Chemicals” Called PFAS Show Up in Your Food, Clothes, and Home

These toxic chemicals are so common in consumer products and manufacturing that they're everywhere—including inside our bodies.

April 10, 2024

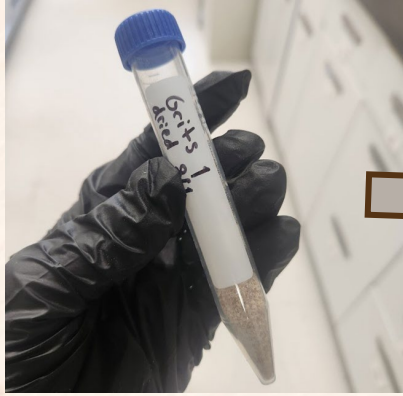


| | |
|-----------|----------|
| 33 | 74.92159 |
| As | |
| Arsenic | |
| Metalloid | |

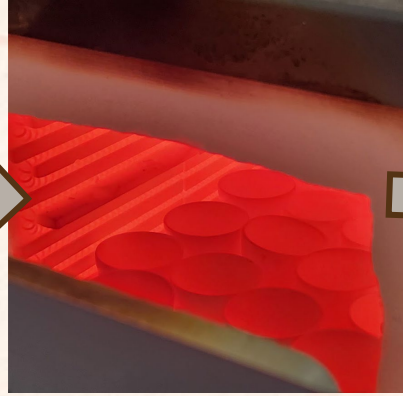
| | |
|------------------|--------|
| 48 | 112.41 |
| Cd | |
| Cadmium | |
| Transition Metal | |

| | |
|----------------------|-----|
| 82 | 208 |
| Pb | |
| Lead | |
| Post-Transition M... | |

Prepping



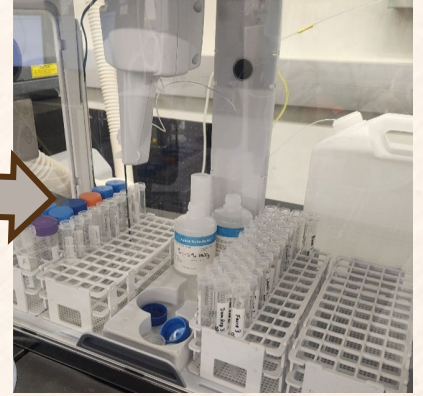
Ashing



Acid Treatment



ICP-MS

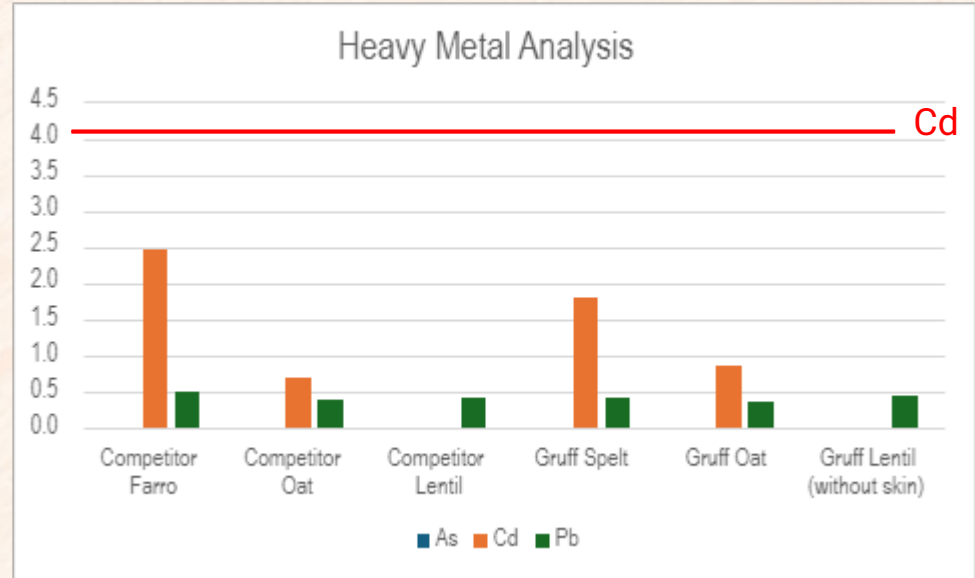


Chemical Testing

- Gruff Grits from the box
- Grains straight from the farm
- Competitor Grains

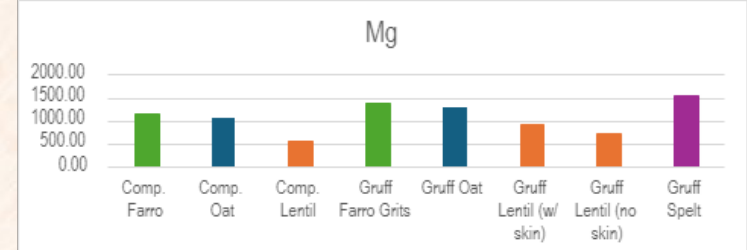
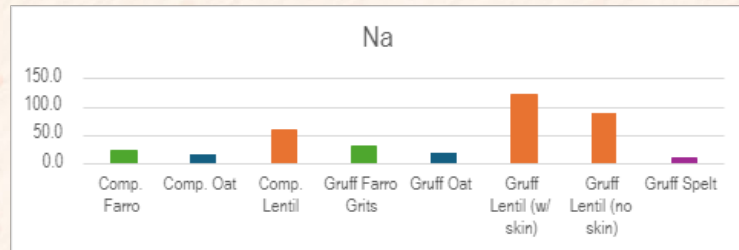
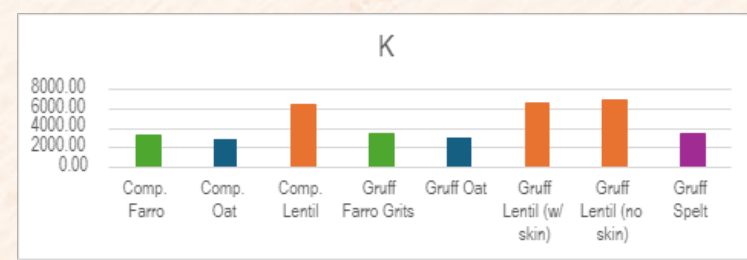
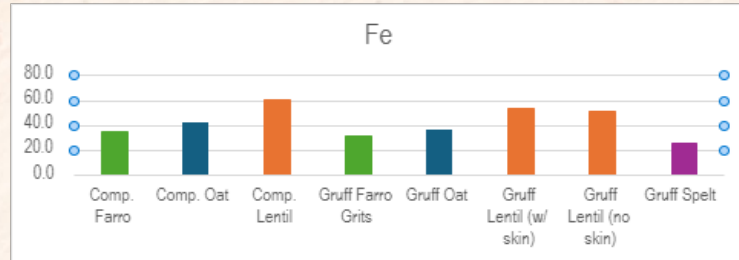
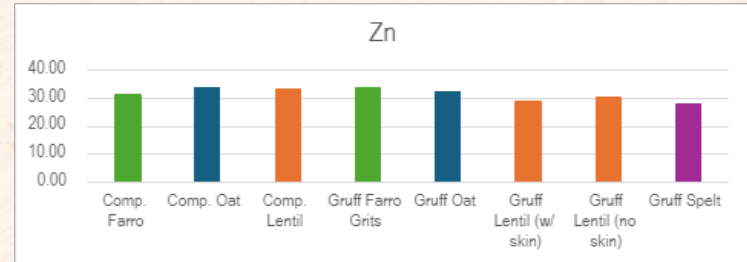
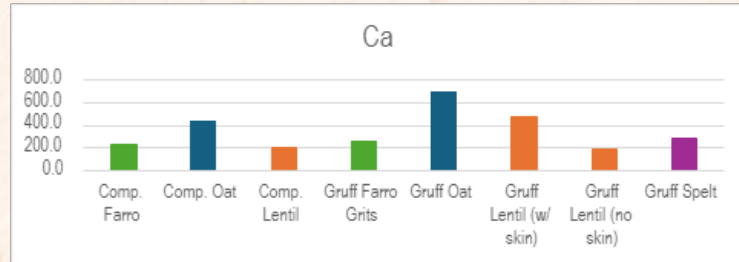
Data and Results

- ug per 50g serving of grains
- Three competitor grains compared to Gruff Grain products
- All below the strictest consumption reference value



Data and Results

Minerals



Data and Results

PFAS Testing

- Not enough time to perform tests.
- PFAS protocol establishment started.
- Lab facility managers contacted and communicated with.
- Reagents and equipment identified and located.



FDA Foods Program Compendium of Analytical Laboratory Methods: Chemical Analytical Manual (CAM)

METHOD NUMBER: C-010.03

POSTING DATE: 04/12/2024

POSTING EXPIRATION DATE: 04/12/2026

PFAS Analysis Protocol

Montana State University

Steps

Adapted from Food and Drug Administration, 2024

1. Grind food item to produce 5 g of thoroughly homogenized sample. (The FDA used “IKA tube mill with a disposable 100 mL polypropylene grinding chamber... ground at 5000 rpm for approximately 2 minutes” for normal food samples and “dry ice in a Robot Coupe **Blixer**” for animal feed samples.)
2. Add 5 grams of food sample to a 50 mL PP centrifuge tube.
3. Add 50 µL of 200 ng/mL isotopically labeled surrogate standard solution to the sample to give a final concentration of 1 ng/mL in the final extract.
4. Add 5 mL of LC/MS grade Optima water if the sample is fruit or vegetable based to the 50 mL PP conical centrifuge tube. Dry samples (< 25% water content) will need additional water. For most dry foods, the addition of 15 mL of water is sufficient. In some cases (e.g. protein powder) up to 25 mL of additional water is needed to adequately swell the matrix. In the cases of very dry food samples (e.g. protein powder), the protocol

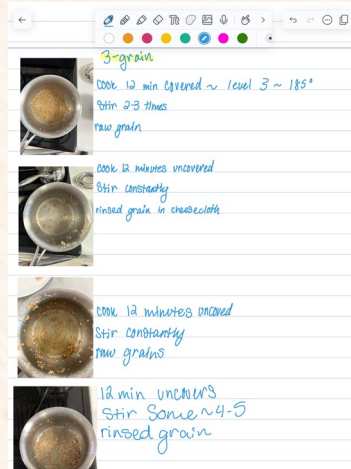
fluoroalkyl Substances (PFAS) in Food
Spectrometry (LC-MS/MS)
ion (L2) per the [Guidelines for the program 3rd Edition](#)

PFAS in food and feed using LC-MS/MS.
following food matrices:

| Date | Analyst |
|------|--|
| 2023 | Susan Genauldi Wendy Young Elsie Peprah Cynthia Srigley Brian Ng |

c acid, Perfluorohexanoic acid,
azoronanoic acid, Perfluorodecanoic
acid, Perfluorotridecanoic acid,
acid, Perfluoropentanesulfonic acid,
c acid, Perfluorooctanesulfonic acid,
; acid, Perfluoroundecanesulfonic acid,
fonic acid, Perfluorooctanesulfonamide,
ylene oxide dimer acid, 9-
1-chloroicosafluoro-3-oxaundecane-1-
c acid, 1H,1H, 2H, 2H-Perfluorooctane
; acid, 1H,1H, 2H, 2H-Perfluorododecane

P2 Area of Focus



- Research comparing ROC and conventional grain farming and their environmental impacts
- Finalizing the 3-grain blend
- Identifying a use for the canvas tote bags
- Educating the public, including outreach to the MSU Bobcat football team

Overview of Production



Farm

ROC Organic farming practices

- Excess water usage
- Reduced runoff pollution
- Degradation of soil health,



Plant

Handle, Process, Package, and Send

- Material waste
- Canvas tote waste
- Inefficiencies in energy use



Stores

Sprouts

- Product transportation
- Packaging waste



Consumer

- Packaging waste
- Food waste

Attempt/Trials/Research/Results

Testing different Consistency for Grain Blends

- Comparing fluffy vs. creamy consistencies
- Troubleshooting issues with the product sticking to the pan

Research

- Liz Carlisle's books
- Bob Quinn
 - Research conducted in Big Sandy, MT
- Review of research papers
- Ongoing conversations and discussions

ROC farming vs. Conventional and the effects on the environment

- Water – “Crop rotation and no tillage, boosted soil water infiltration from 20 mm/h with conventional tillage to 45 mm/h with no tillage” (Khangura)
- Hazardous Waste
- Time/Machinery Use
- Emissions – 60% more biomass from soil microorganisms in organically managed farm systems versus conventional (Roland)
- The goodness of using lentils
 - Lower Carbon emissions ~5 kg less CO₂e/ha for pulse containing rotations (MacWilliam)

P2 Outcomes

| One-time Cost to Implement (\$) | Savings from P2 Action (\$) | Reductions in | | | | | |
|---------------------------------|-----------------------------|--|-----------------------|---------------------|-----------------------|--------------------------------------|------------------|
| | | Hazardous Material input (lbs) | Hazardous waste (lbs) | Air emissions (lbs) | Water pollution (lbs) | MTCO ₂ e emissions (tons) | Water use (gal.) |
| | | ~\$25-30/acre ~\$125,000-\$150,000/5,000 acre | | | | 13.15 MTCO ₂ e /acre | |

Reflections/Recommendations

- Do your research, then conduct some more
- PFAS testing
- Lots of personal learning
- More on-site work

MTP2



Acknowledgments

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Montana State University is located upon the homelands of indigenous peoples: people with proud heritage, a vibrant present, and a bright future. We acknowledge the Assiniboine, Blackfeet, Chippewa Cree, Crow, Gros Ventre, Kootenai, Little Shell, Northern Cheyenne, Pend d'Oreille, Plains Cree, Salish, Sioux, Hidatsa, Mandan, Arikara, and the other indigenous nations of this region in the past, present, and future. We recognize that this rich human tapestry is central to our institutional mission of learning, discovery, and engagement