COMMISSION ON UNIVERSITY SUPPORT
MEETING
November 18, 2021
Videoconference (via Zoom)

Present: John Benner (Chair), Judy Alford, William Dougherty *for Scott Midkiff,* Alisha Ebert *for Bob Broyden,* Martha Glass, Debbie Greer for *Ken Miller,* Ariel Heminger, Kristie Caddick, *for Charlie Phlegar,* Polly Middleton, Jim Tokuhisa, Paul Winistorfer

Absent with Notice: Chis Kiwus, Martha Glass

Absent: Holly Carroll, Jeff Earley, Kimani Jackson, Patrick Pithua, Connie Stovall

Guests: Emily Burns, Rebecca Cockrum, Heather Evans, Nathan King, April Myers

1. Welcome and Roll Call

Commission Chair, John Benner, called the meeting to order at 2:00p.m.; initiated introductions and roll call. A quorum was present.

2. Approval of Agenda

Proper motion was made, seconded, and unanimously carried to adopt the November 2021 agenda.

3. Approval of the October 2021 meeting minutes

Chair Benner noted that these minutes have been voted on electronically and can be publicly accessed on the Governance Information System on the Web (http://www.governance.vt.edu).

4. Old Business

CUS 2021-22A Resolution
Current draft: Brief group discussion surrounding the number of representatives being added led to a determination that John needs to meet with Kelly Oaks and Gabby McCollum prior to the December 6 University Council meeting.

5. New Business

Guest Speaker
Dr. Rebecca Cockrum, Assistant Professor, Dairy Genetics provided an interesting presentation on the application of Biopolymers in Agriculture, specifically in dairy cattle. A copy of her presentation is incorporated herein and made a part of these minutes.

GPSS Resolution 2021-2022K Resolution to End Prison Labor Contracts
Before moving forward with a first or second reading, the Commission needs additional information including:

- Have they reached out to Procurement and Human Resources and the Commonwealth of Virginia.
- Need details of this program before the Commission proceeds with a discussion on this resolution.
- How does this affect other entities; this is above Virginia Tech; there are state guidelines to consider.

6. Updates from Committee Representatives

Campus Development Committee – No representative present for the meeting; no updates from the committee.

Energy and Sustainability Committee – Nathan King reported their process is continuing with their name/charge/membership changes and are close to bringing a Resolution before the Commission; a Task Force is working to update Policy 5505 as it has not been updated since 2016; there have been over 30 Green RFP submission over the last two years and the submission periods ends November 19th; good work continues on the CAC.

IT Services and Systems Committee – William Dougherty reported there are no updates and latest minutes will be completed and ready to submit soon; The Infrastructure sub-committee did meet; the AVAYA phone system will be upgraded this weekend.

Transportation and Parking Committee – No representative present for the meeting.

7. Acceptance of Committee Minutes

Campus Development Committee – No new minutes submitted to the Commission.

Energy and Sustainability Committee – September 27, 2021 and October 25, 2021 minutes were submitted to the Commission. Both meeting minutes were unanimously accepted and approved.

IT Services and Systems Committee – No new minutes submitted to the Commission.

Transportation and Parking Committee - No new minutes submitted to the Commission.

8. Next Meeting Date

Next meeting date is December 16, 2021. Chair Benner shared he is working out the details for a guest speaker for this meeting.

9. Adjournment

There being no further business and with proper motion, the meeting adjourned at 3:05pm.

Application of Biopolymers in Agriculture

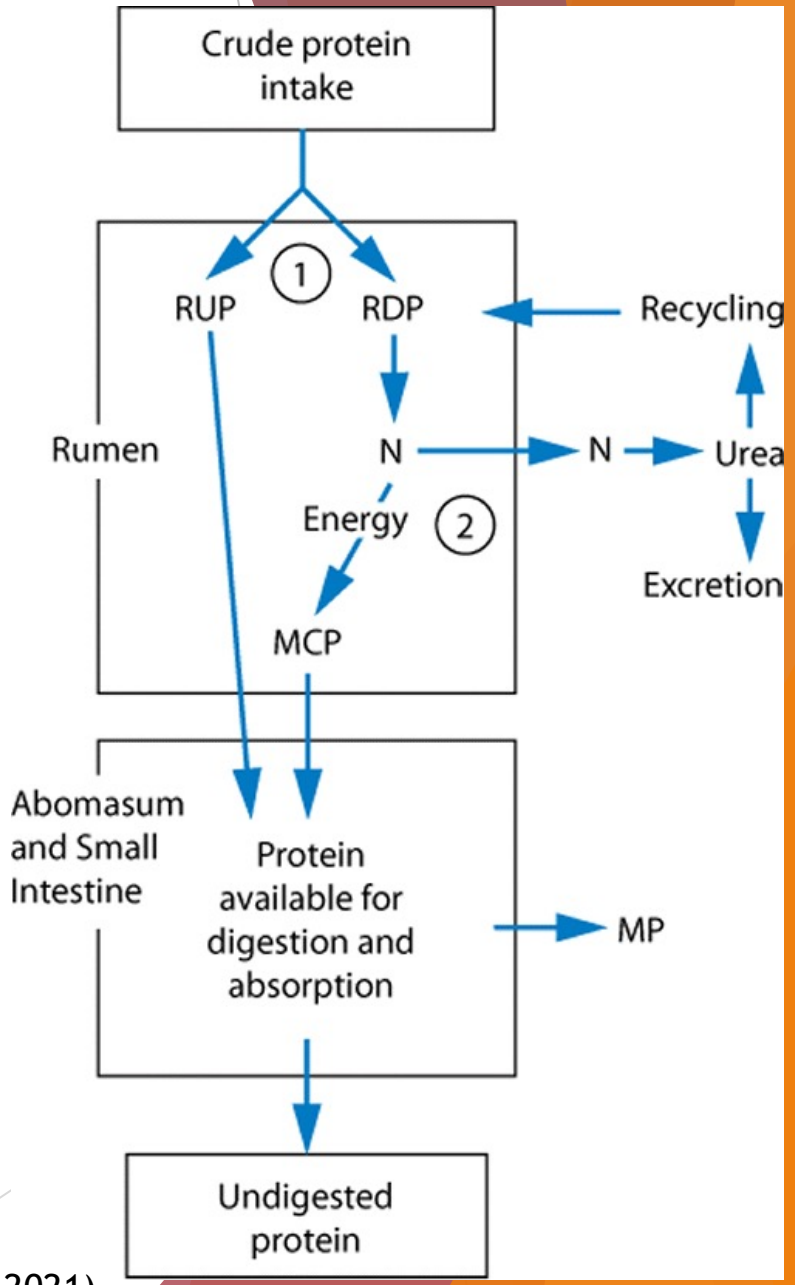
Dr. Rebecca R. Cockrum

Assistant Professor - Dairy Genetics

Department of Dairy Science

Feeding and Nutritional Management Dairy Production

- Total Mixed Rations - uniform product
- Unmixed or component-fed rations - concentrates fed separately from forages
- Pasture-based feeding - optimal use of forage resources



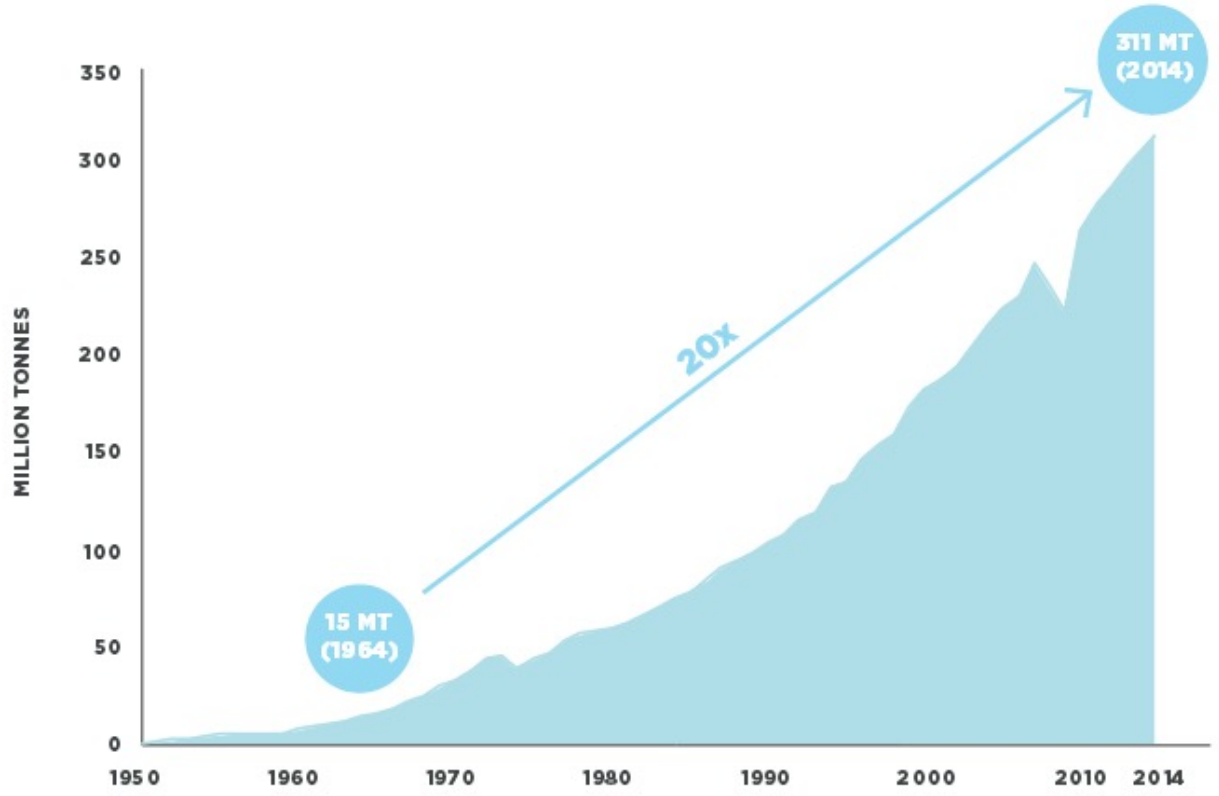
(Merck Manual, 2021)

Feed storage

Global plastic use

- Agriculture accounts for ~2% of global plastics
  - Globally: 6.96 million tons
  - US: 816 million lbs
- Expected to drastically increase

Figure 1: Growth in Global Plastics Production 1950–2014



Note: Production from virgin petroleum-based feedstock only (does not include bio-based, greenhouse gas-based or recycled feedstock)
Source: PlasticsEurope, Plastics – the Facts 2013 (2013); PlasticsEurope, Plastics – the Facts 2015 (2015).

(Jansen et al., 2019)
(Janke and Trechter, 2015)

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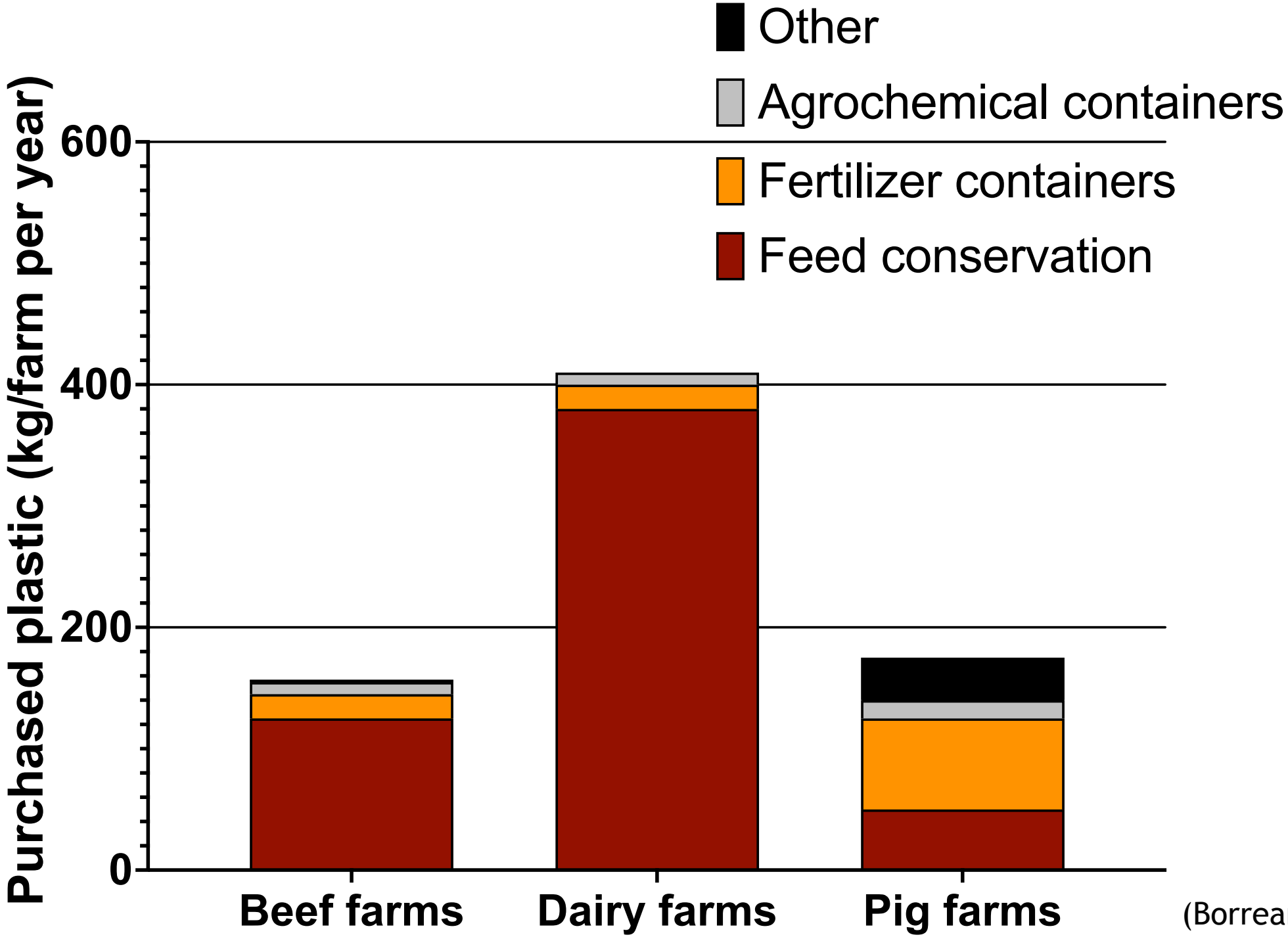

(Borreanni and Tabacco, 2017)

Where does the plastic waste go?

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Pounds of plastic waste generated by type per year

Type	0	< 500	501 - 1,000	> 1001
Farm plastic containers	43%	53%	3%	1%
Bale twine	50%	43%	5%	1%
Silage bags	57%	17%	10%	17%
Bale netting	61%	32%	5%	1%
Pesticide containers	62%	37%	1%	0%
Bale wrap	63%	21%	8%	7%
Other chemical containers	72%	27%	1%	0%
Bunker silo cover	79%	6%	4%	12%
Greenhouse flexible plastic covers	87%	10%	2%	1%
Other	91%	7%	1%	1%
Boat wrap	93%	4%	1%	1%
Mulch film	94%	5%	1%	0%
Greenhouse rigid plastic panels	97%	2%	0%	0%

(Janke and Trechter, 2015)

Comments about waste plastic and recycling

Topic	Count	%
Good idea/Support recycling -general	322	42
Collection - systems, method, sites	152	20
Cost/Price	101	13
Container plastic	47	6
Wrap/Film/Sheet plastic	39	5
Bags	31	4
Contamination/Cleaning concerns - general	17	2
Burning	12	2
Other	38	5
Total	759	100

(Janke and Trechter, 2015)

How are plastics ingested?

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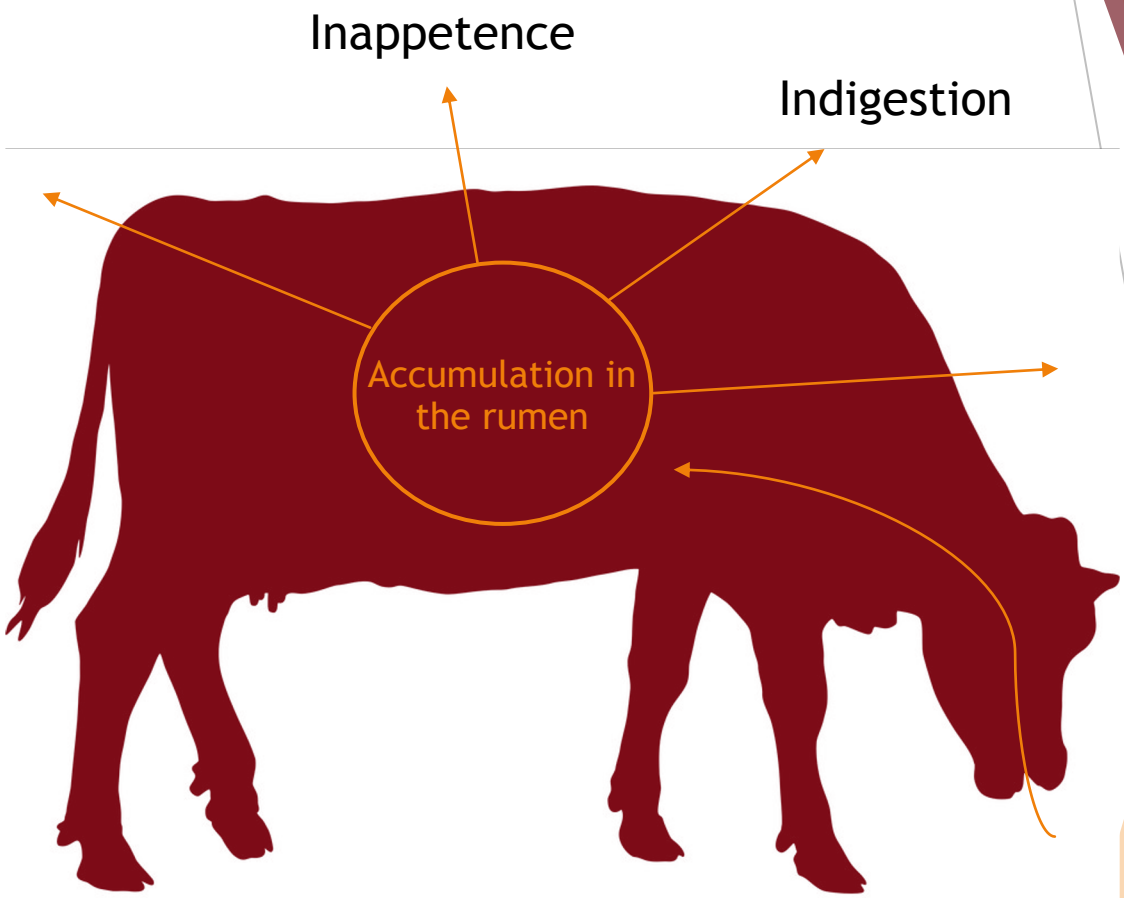
The problem

(Pizol et al., 2017)



Reduced weight gain, reduced production, and poor animal health!!!

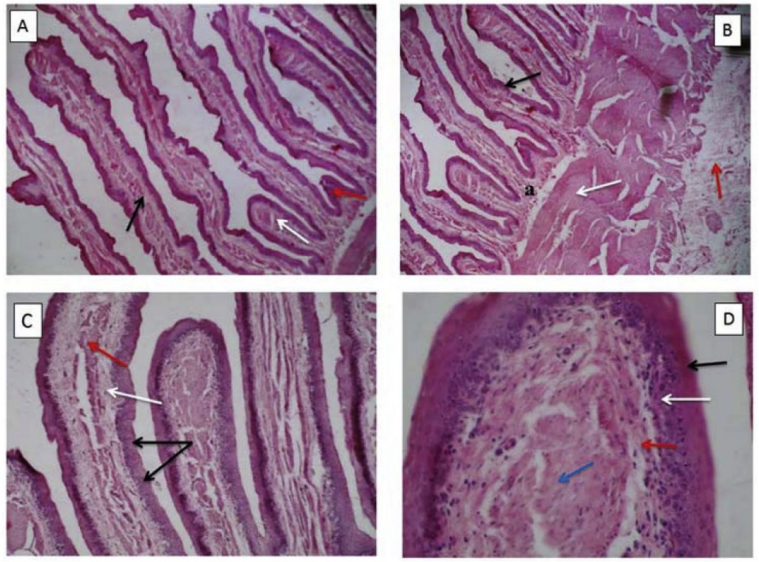
Ingestion of plastics mixed in ration or on pasture

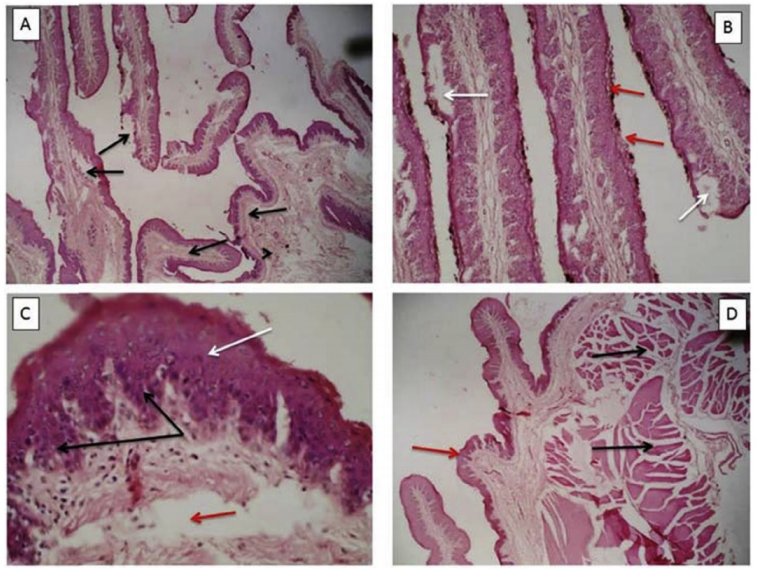
(Akraiem et al., 2016)
(Mekuanint et al., 2017)
(Muchonga et al., 2015)

Histopathological effects – sheep rumen epithelium

(Otsyina et al., 2017)

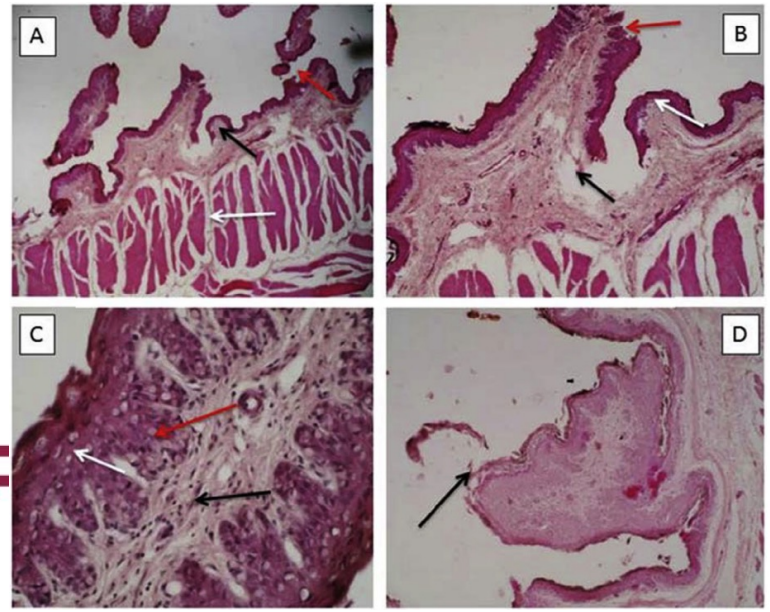
Control

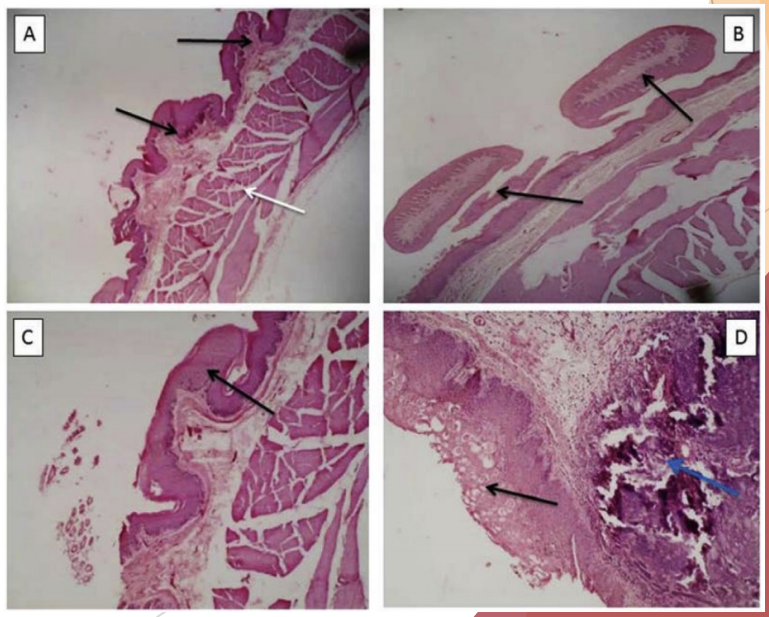




128 g

258 g





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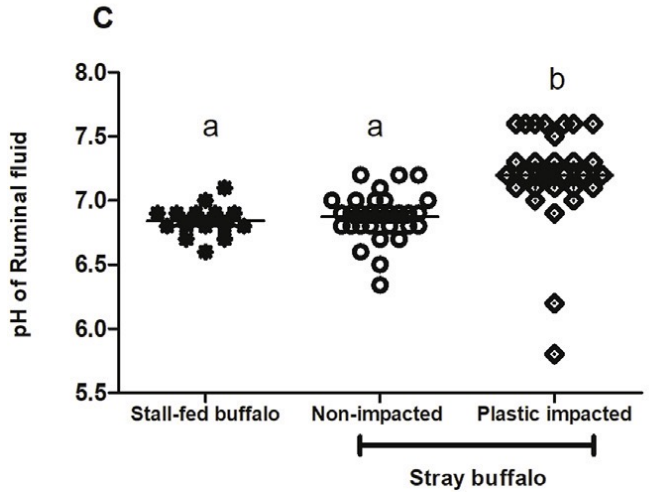
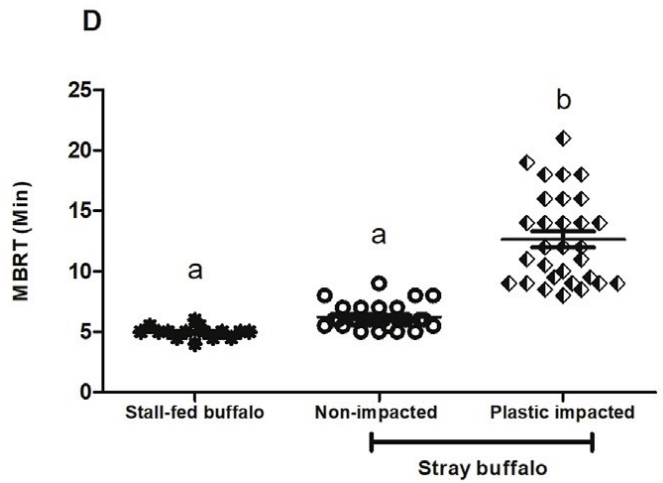
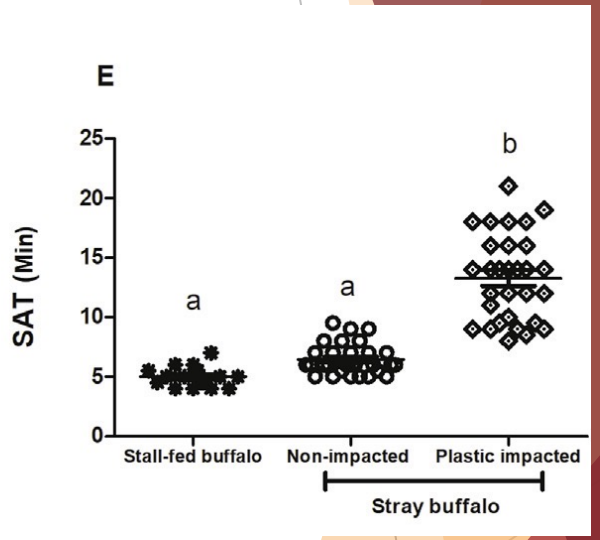
Rumen function







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(Mahadappa et al., 2020)

Rumen function

Rumen function tests	Heavy metal concentration in rumen fluid				
	Mercury	Cadmium	Chromium	Lead	Copper
Protozoal motility score	-0.70***	-0.24	0.06	-0.46**	-0.17
Protozoal density score	-0.40*	-0.25	-0.00	-0.50**	0.03
Sedimentation activity time (min)	0.53**	0.39*	0.05	0.52**	0.10
MBRT (min)	0.02	0.23	0.20	0.43*	0.17

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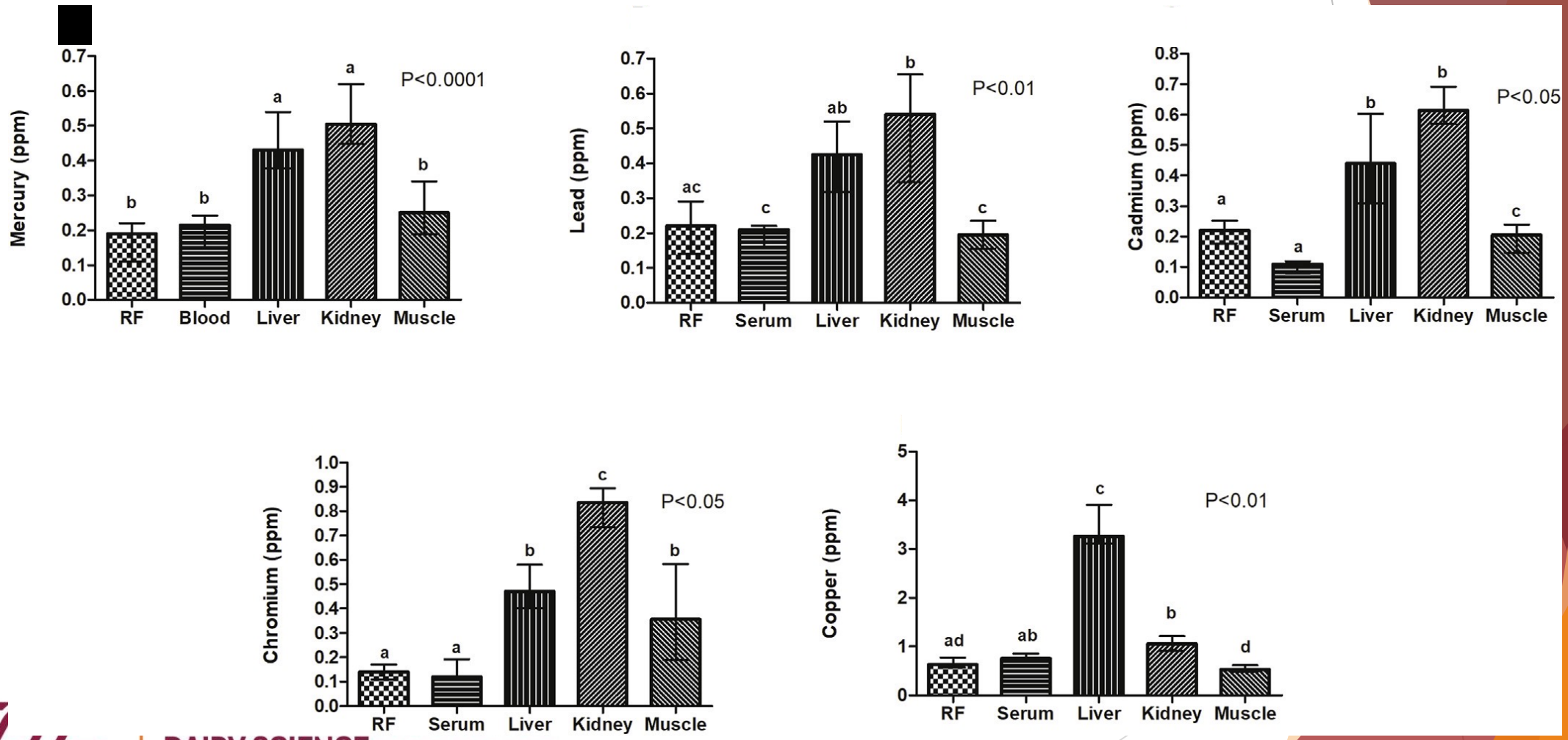
(Adapted from Mahadappa et al., 2020)

Heavy metal accumulation



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(Mahadappa et al., 2020)

Though producers know about it, still a prevalent issue

‘Software disease’ — The hazards of plastic, net wrap and twines

Animal Health: Ingestion of plastics has become a common killer

PLASTIC DISEASE: The New Hardware Disease in Cattle

Plastic Disease: Another reminder to remove net-wrap

Why You Must Remove Net Wrap On Round Bales Before Feeding To Cattle

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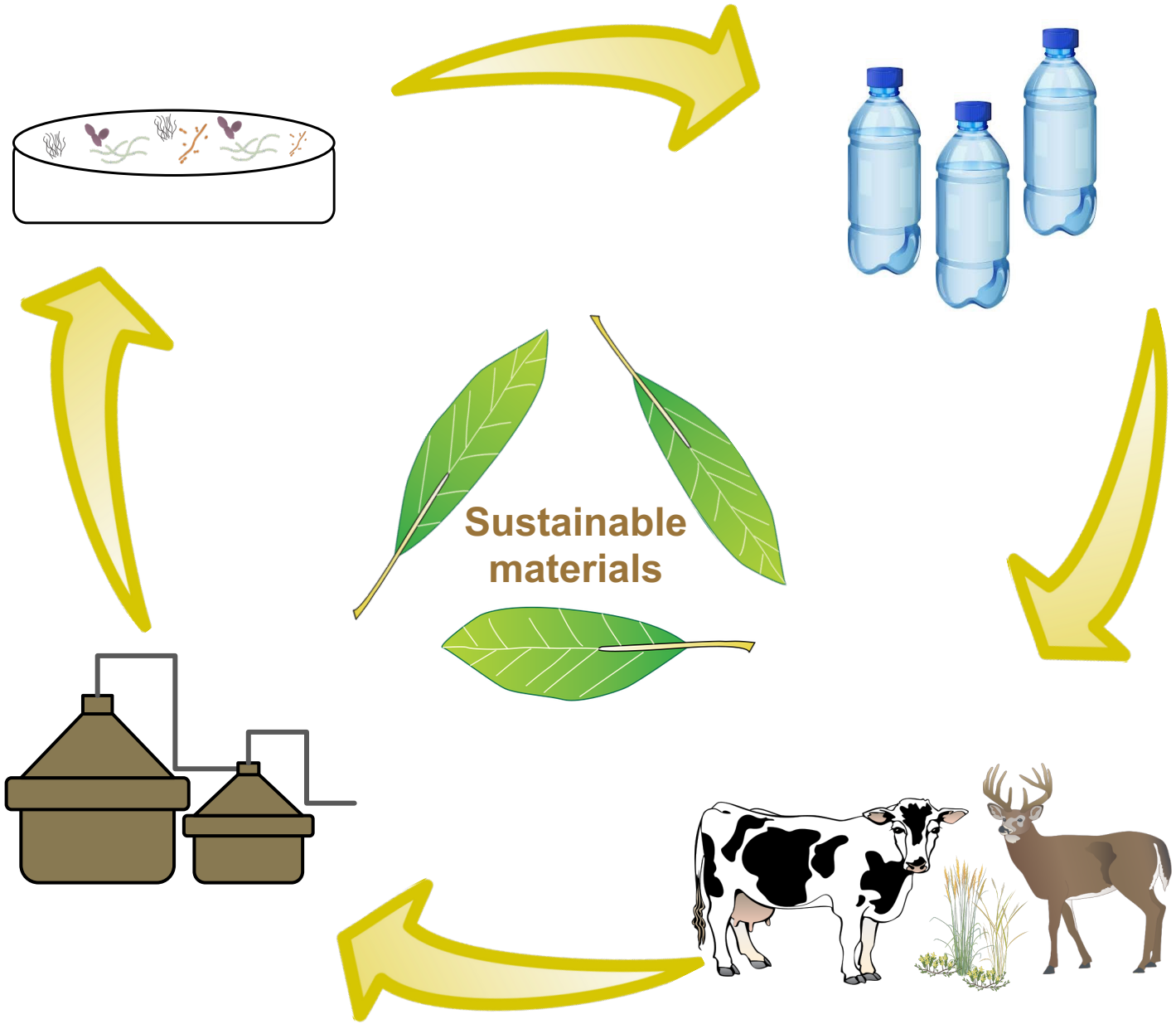
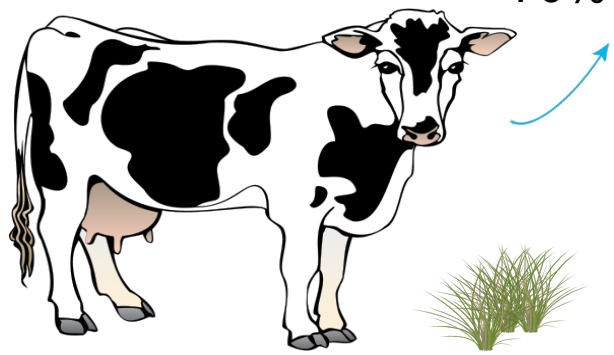
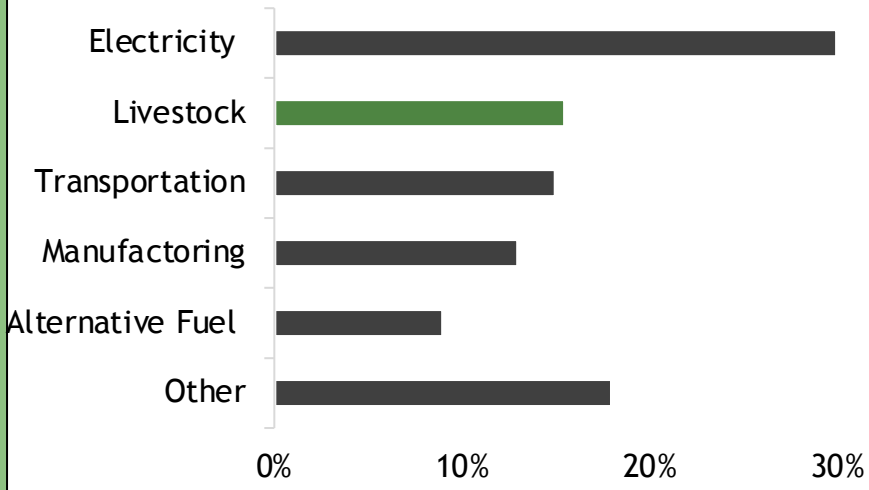
The incredible EDIBLE….plastic???



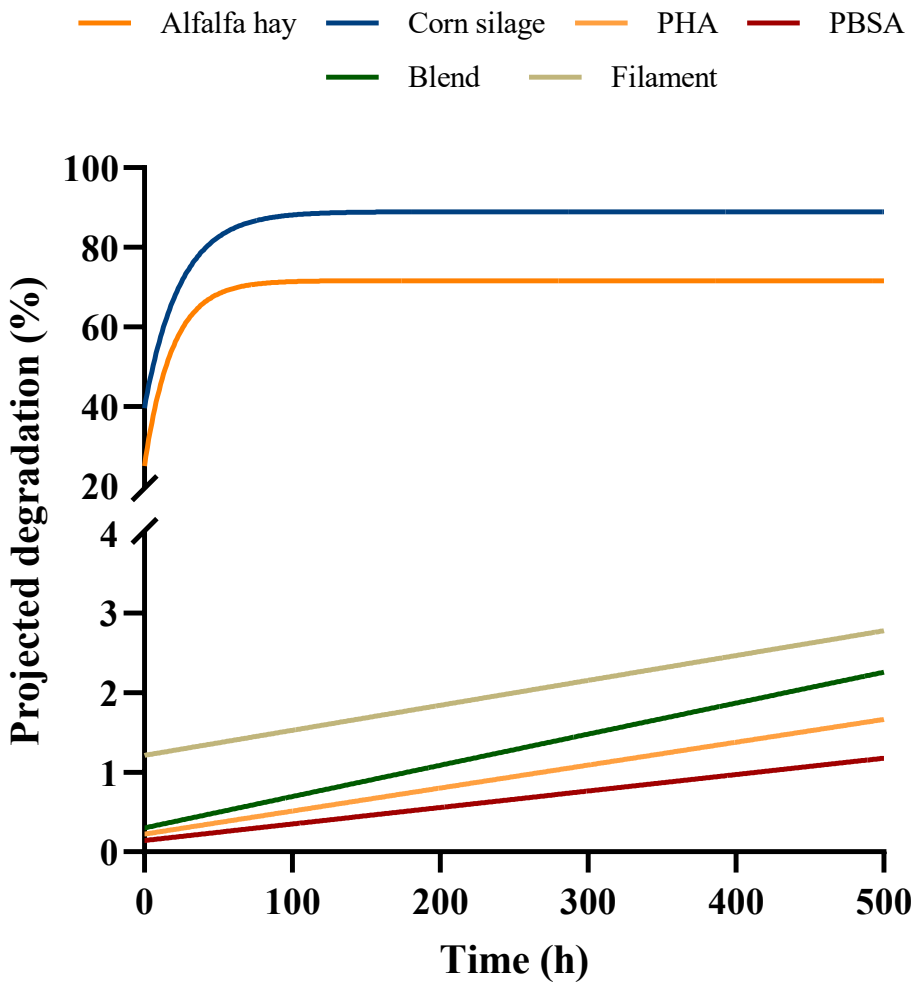
Agriculture Industry Challenges



Greenhouse gas emissions

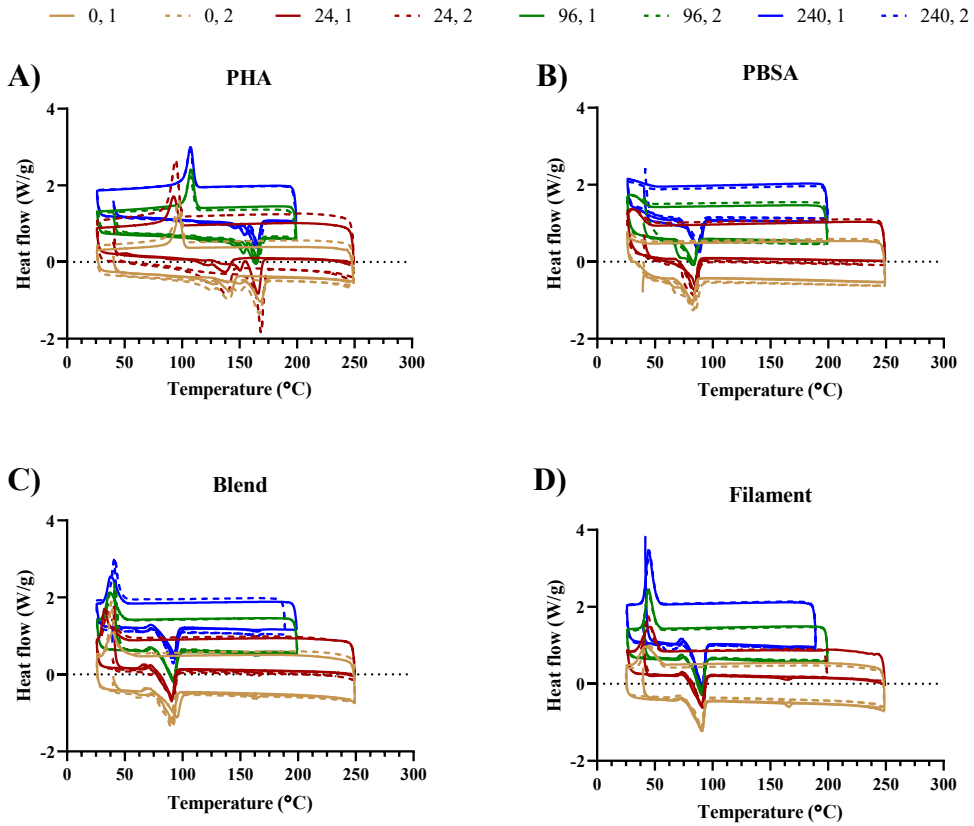


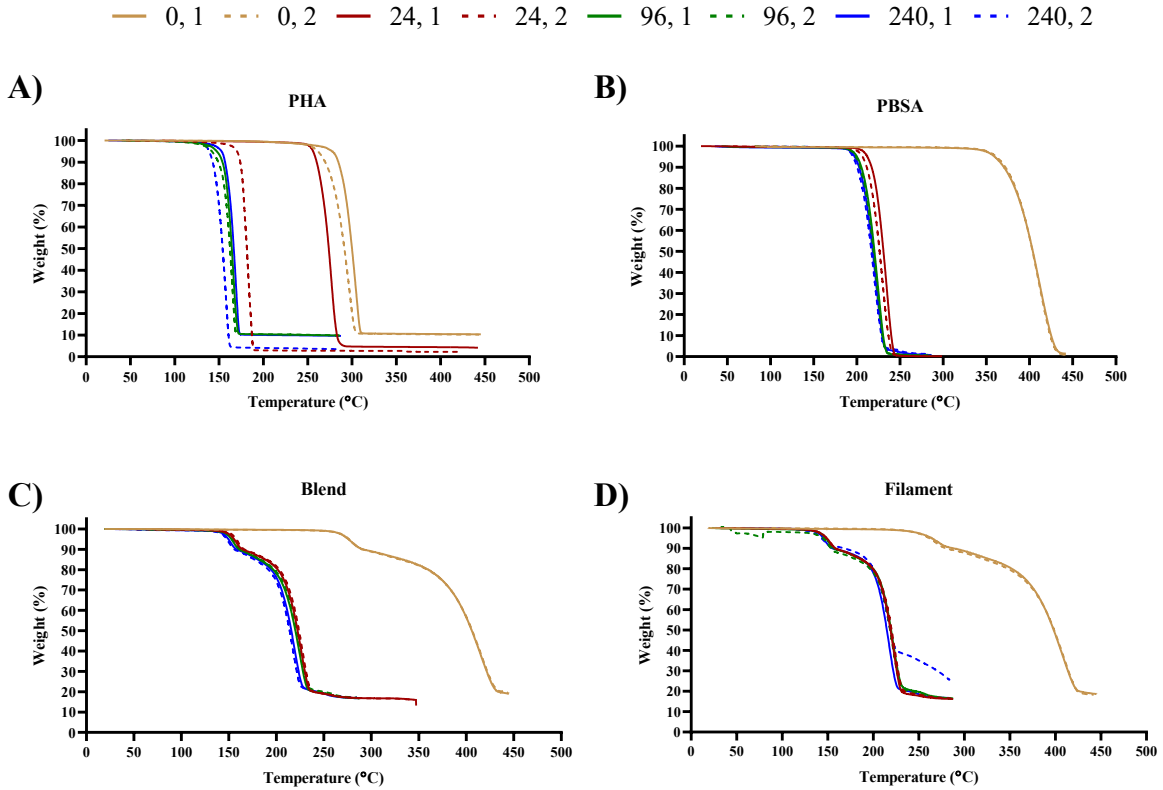
Form of the material will impact degradation time



(Galyon and Vibostok, *in-preparation*)

PBSA-based materials may be able to withstand environmental temperatures experienced with feed storage



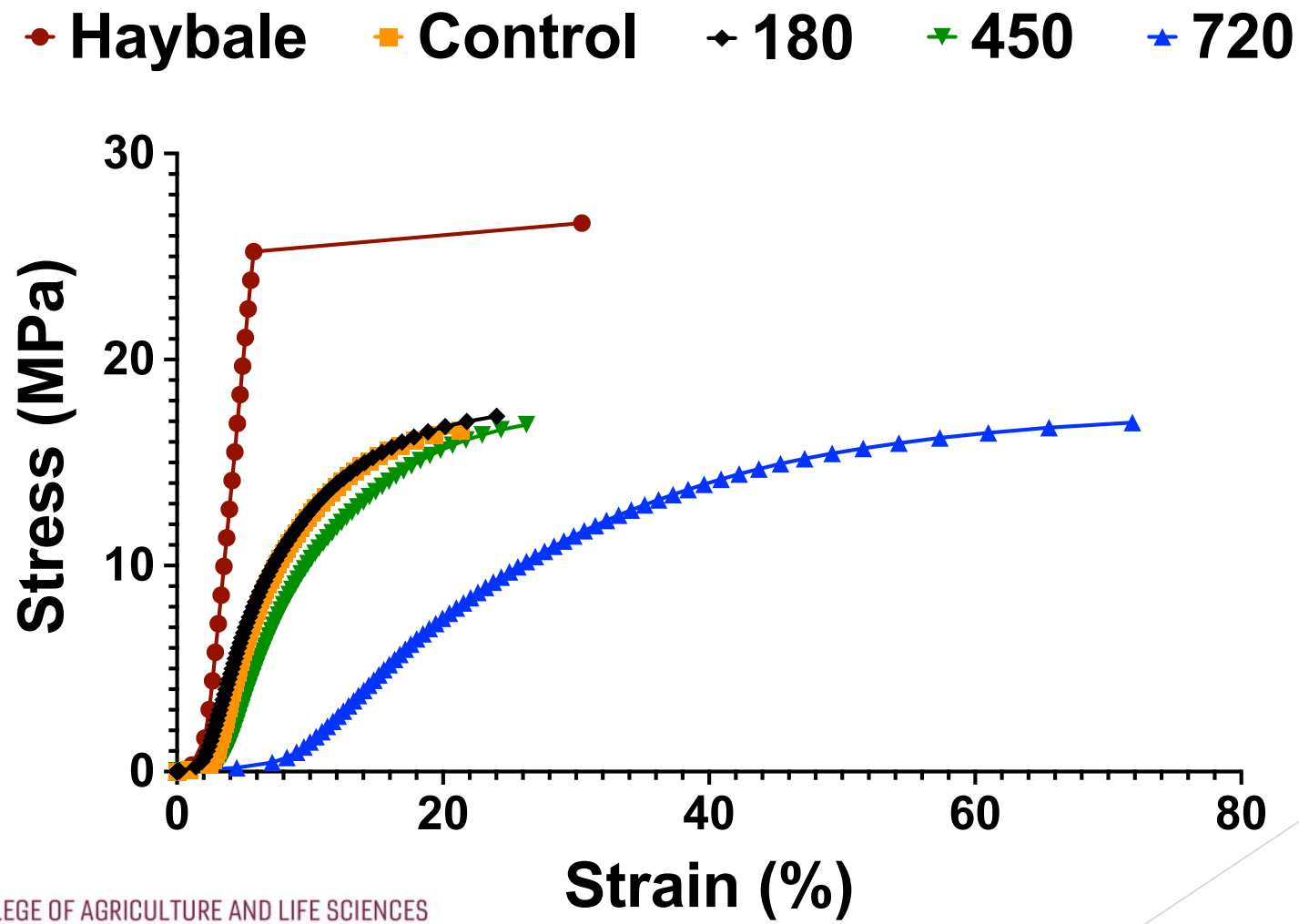


Biopolymers with PBSA decreased in weight at a higher temperature and changes occurred as early as 24 hrs

Differential scanning calorimetry demonstrated crystallization within the first 24 hrs

(Galyon and Vibostok, *in-preparation*)

Mechanical twist improved tensile strength by 50%



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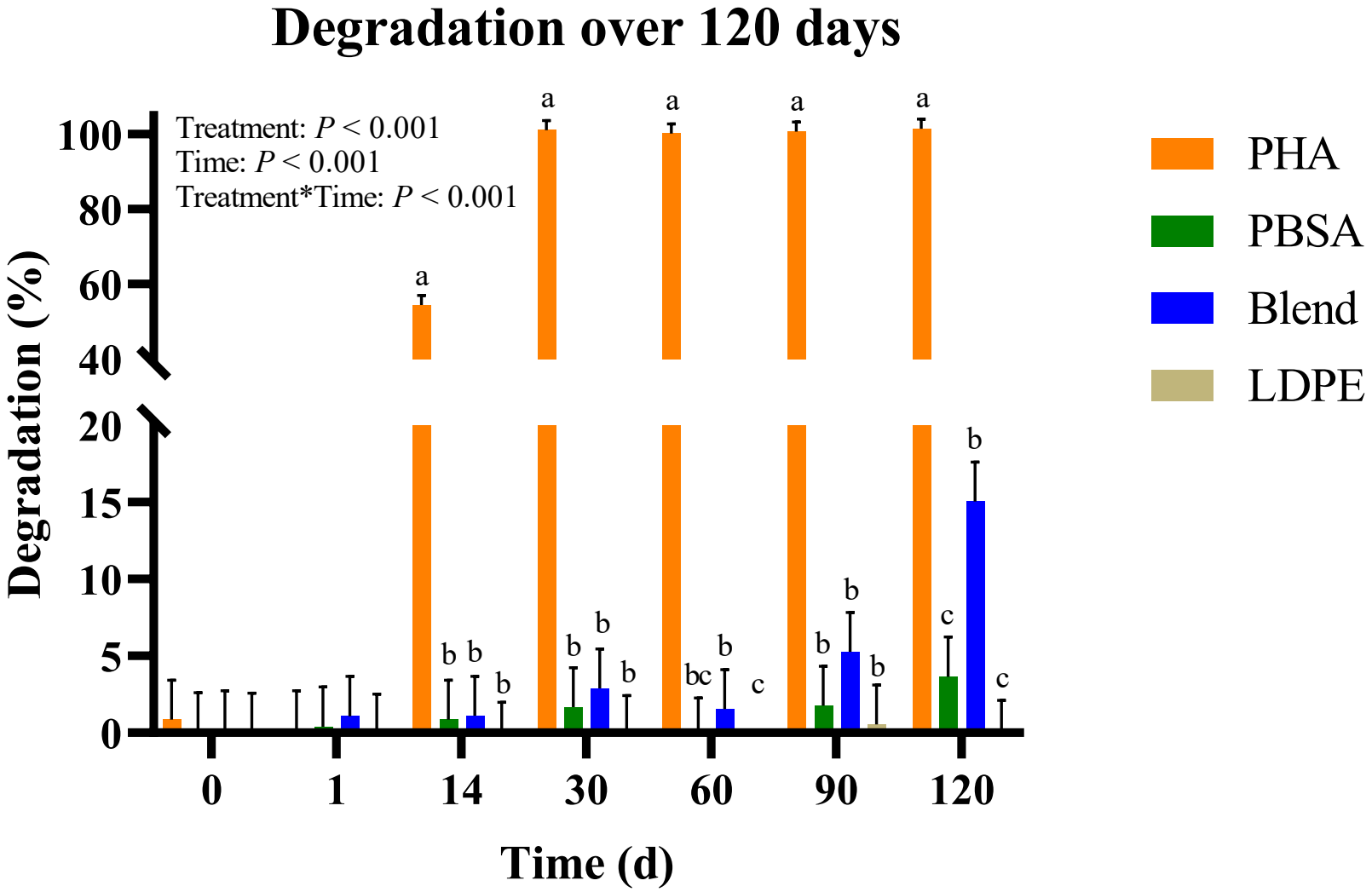
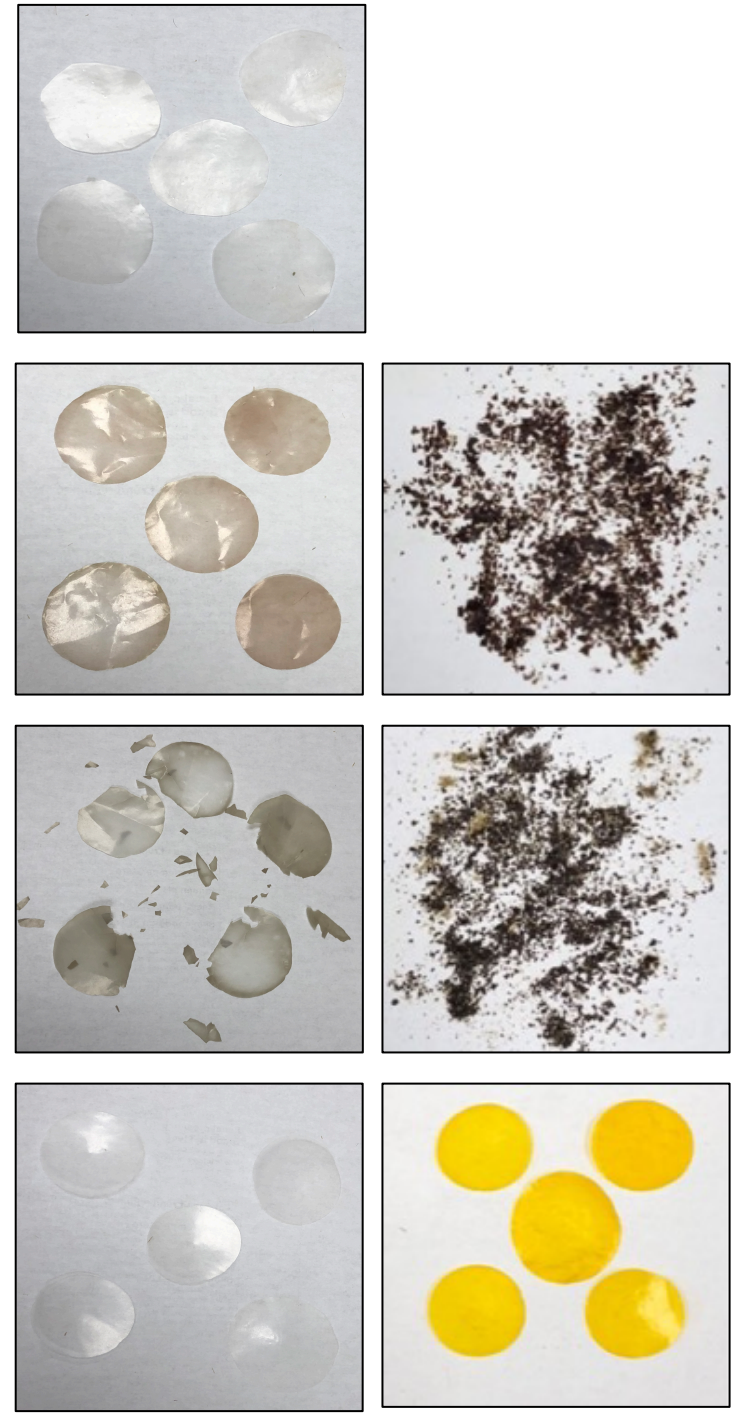
(Whittington et al., *under-review*)

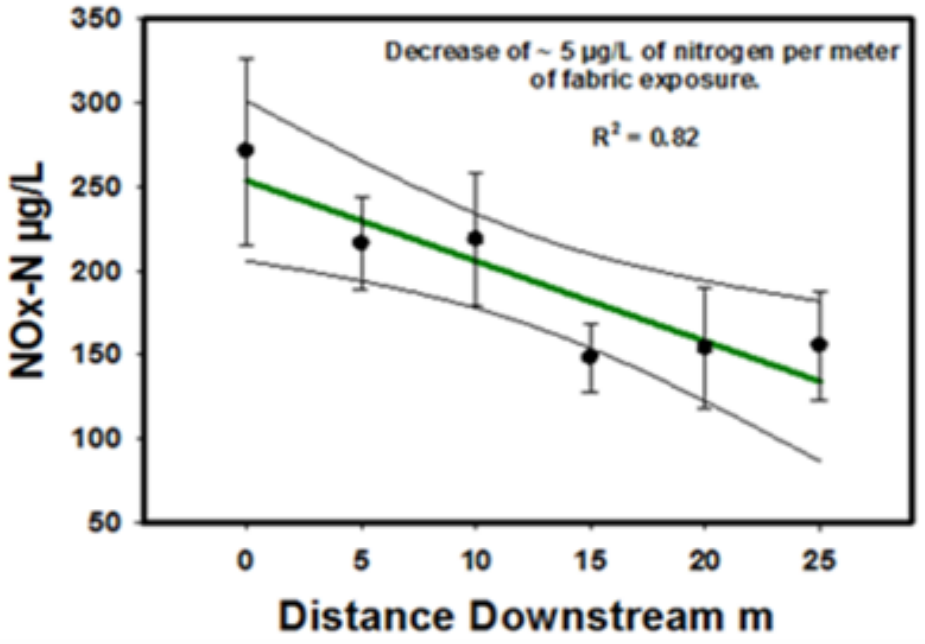
I. Biopolymers readily degrade in the rumen as early as 24 hrs. PBSA - based materials are more tolerant to rumen conditions



(Galyon et al., *in-progress*)

II.





Nitrate concentrations reduced by half when PBSA-based copolymer used for erosion control

(Havens et al., *in-preparation*)

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Conclusions and recommendations

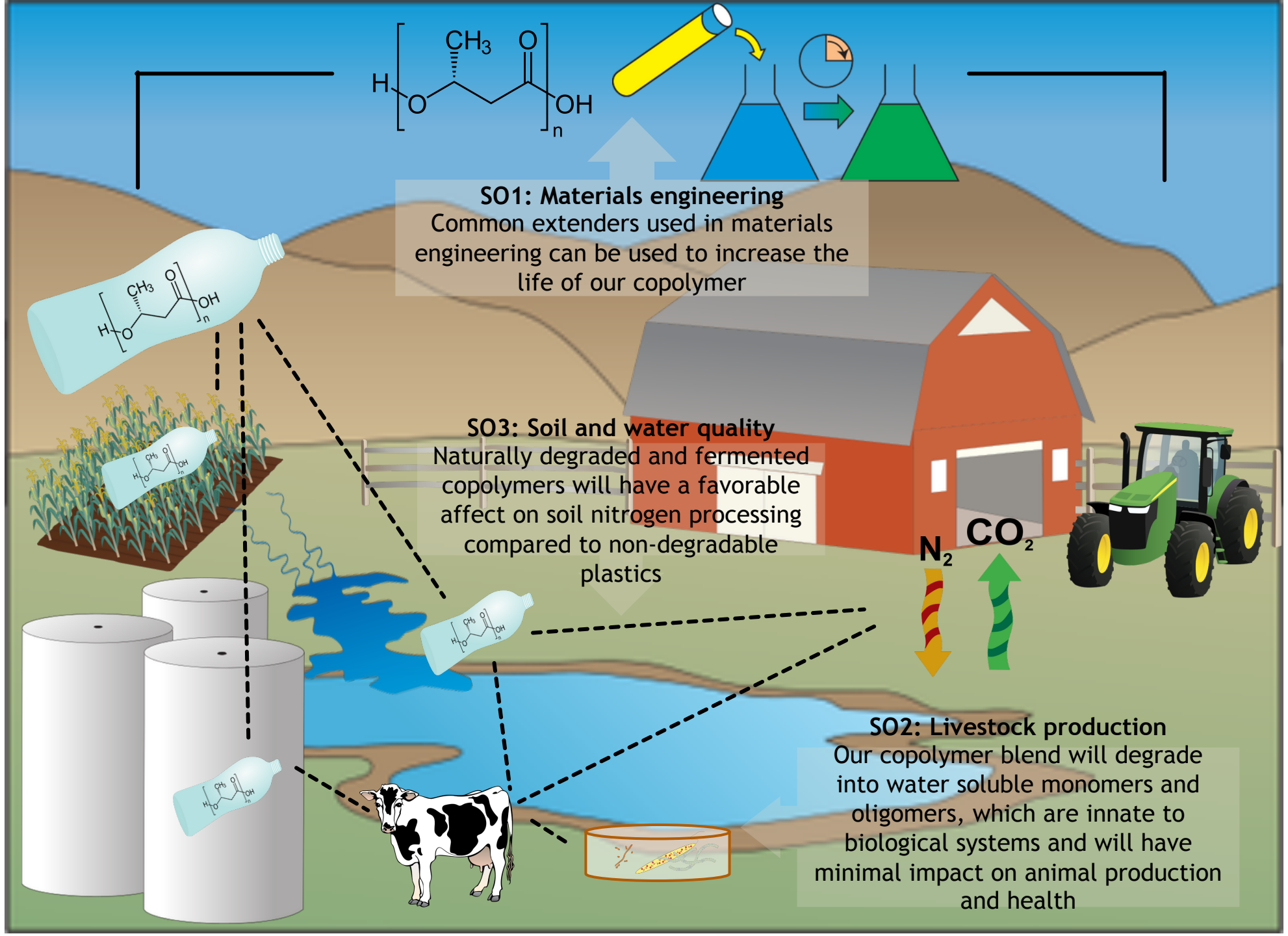
- Plastic disease is a more prevalent issue
  - Global usage increasing
  - Histopathologic alterations
  - Potential toxicity
  - A critical lack of literature
- Close management of feeds and pastures
  - Stop feeding animals plastics

Future direction and collaborations

- Determine the impact of bio-based polymers on the digestive physiology of ruminants - *Virginia Agricultural Council*
- Reducing agricultural methane through biopolymers - *Institute for Critical Technology and Applied Science*
- Identify depolymerase-producing bacteria in rumen fluid - *Fralin Biomedical Research Institute*

Pending grant - Identification of biodegradable extenders to improve biopolymer mechanical dynamics and subsequent impact on livestock and environmental sustainability - *USDA-NIFA*

- Partners
  - William & Mary
    - Virginia Institute of Marine Science - Dr. Kirk Havens,
    - W.M. Keck Environmental Field Laboratory - Dr. Randy Chambers
    - Technology Transfer/Chemical Engineering - Dr. Jason McDevitt
  - Virginia Tech
    - Department of Materials Science and Engineering - Dr. Abby Whittington, Sam Vibostok
    - School of Plant and Environmental Sciences - Dr. Meredith Steele
    - Department of Dairy Science - Dr. Ben Corl, Dr. Gonzalo Ferreira, Hailey Galyon


SO1: Materials engineering
Common extenders used in materials engineering can be used to increase the life of our copolymer
SO3: Soil and water quality
Naturally degraded and fermented copolymers will have a favorable affect on soil nitrogen processing compared to non-degradable plastics
N_2
CO_2
SO2: Livestock production
Our copolymer blend will degrade into water soluble monomers and oligomers, which are innate to biological systems and will have minimal impact on animal production and health

Broader Impacts

Environmental footprint

- ↓ Plastic waste
- ↓ Greenhouse gas production
- ↑ Nutrient management efficiency
- ↓ Wild and domestic animal death

Profitability

- ↑ Feed efficiency
- ↑ Production efficiency
- ↓ Single-use plastic products