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Effect of feeding red osier dogwood on digestibility and acute phase response in beef heifers

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Introduction

- Red osier dogwood (ROD) is a native shrub plant across North America and it is rich in bioactive compounds with total phenolic concentration varying from 4 to 22% depending on the season (Scales, 2015).
- Phenolics include anthocyanins, gallic acid, ellagic acid, quercetin, and cyanin have both antioxidant and antimicrobial properties.
- Studies demonstrated that feeding ROD may reduce the use of antibiotics in livestock animals.

Objectives

To determine the effect of increasing substitution of ROD for barley silage in high-grain ration on feed intake, nutrient digestibility in the total digestive tract and acute phase response in beef heifers.

Materials and methods

- Animal: 5 rumen cannulated beef heifers (BW = 660 ± 40.8 kg)
- Design: a 5 × 5 Latin square design (21 d/period)
- Treatments: control (15% silage and 85% barley); 3, 7 or 15% ROD in place of barley silage (DM basis); and antibiotics (**ANT**; monensin, 330 mg/d + tylosin, 110 mg/d; Table 1).
- Rumen pH was monitored continuously for 4d using wireless pH probe.
- Digestibility was measured using an external marker Cr_2O_3

Table 1. Ingredients and chemical composition of the experimental diet

	Diets, % of ROD				
Item	0	3	7	10	ANT
Ingredient, %					
Barley silage	15	12	8	5	15
Red osier dogwood	…	3	7	10	…
Barley grain, dry-rolled	82	82	82	82	82
Supplement	3	3	3	3	3
Composition, % DM					
DM, %	83.6	85.4	87.7	89.4	83.6
NDF	25.4	25.1	24.7	24.4	25.4
CP	13.5	13.4	13.2	13.2	13.5

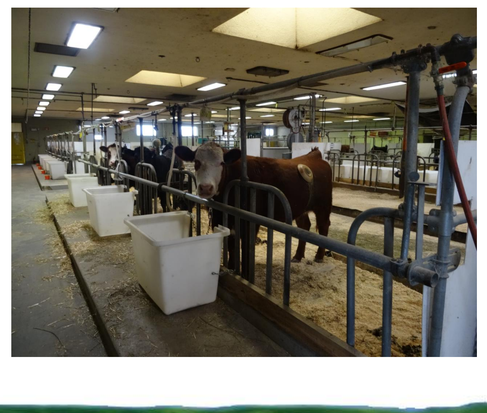
Results

Intake and digestibility (Table 2)

- DMI quadratically (P<0.02) increased with increasing ROD
- Digestibility of DM linearly (P<0.04) increased with increasing ROD.
- Feeding ROD vs. antibiotics increased DMI and DM digestibility (75 vs. 72%).

Table 2. Effects of ROD supplementation on intake and digestibility

	ROD, % of DM						Contrasts, P <		
Item	0	3	7	10	ANT	SEM	L	Q	R vs A
DMI, kg/d	11.5	12.1	12.4	11.8	11.2	0.82	0.60	0.02	0.01
Digestibility, %									
DM	72.1	74.2	76.1	74.9	71.9	2.04	0.04	0.05	0.01
NDF	46.6	48.6	56.1	52.4	43.7	4.95	0.10	0.11	0.02
CP	60.4	63.8	63.5	61.2	64.9	3.23	0.98	0.06	0.21



Results

Ruminal pH and fermentation characteristics (Table 3)

- Mean ruminal pH were not affected by diets, and no effects of diets on total VFA concentration were observed
- Ruminal NH_3-N concentration linearly (P<0.01) decreased with increasing ROD
- Feeding ROD vs. antibiotics increased VFA concentration (141 vs. 128 mM; P<0.05).

Table 3. Effects of ROD supplementation on rumen pH and fermentation

	ROD, % of DM						Contrasts[2], P <		
Item	0	3	7	10	ANT	SEM	L	Q	R vs ANT
Mean rumen pH	6.05	5.95	6.14	6.13	6.08	0.16	0.53	0.98	0.95
Total VFA, mM	134	140	144	140	128	5.6	0.48	0.15	0.05
Individual VFA, %									
Acetate (A)	55.0	54.8	54.3	54.6	56.2	1.82	0.85	0.82	0.56
Propionate (P)	29.6	32.0	31.8	31.3	33.4	3.39	0.73	0.55	0.50
Butyrate	10.0	8.9	9.4	10.0	9.0	1.24	0.76	0.41	0.60
A:P	1.93	1.76	1.83	1.89	1.65	0.23	0.98	0.76	0.15
NH_3, mM	10.7	9.0	9.8	8.0	10.2	1.32	0.01	0.93	0.02
Protozoa, $\times 10^5$/ml	7.49	8.40	9.13	9.98	8.54	1.35	0.08	0.92	0.31

Serum acute phase protein and antioxidants (Table 4)

- Plasma concentration of haptoglobin linearly (P < 0.01) increased
- Concentration of serum amyloid A increased (P = 0.06) with increasing ROD
- Blood antioxidant capacity (P<0.08) and superoxide dismutase (P<0.02) linearly increased with increasing dietary ROD

Table 4. Effects of ROD supplementation on acute phase protein and antioxidants

	Diets, % of ROD						P <		
Item	0	3	7	10	ANT	SEM	L	Q	R vs A
APP									
Haptoglobin, mg/mL	0.92	1.03	1.21	1.78	1.09	0.23	0.01	0.51	0.27
SAA, µg/mL	39.6	39.8	43.7	50.5	47.8	8.2	0.06	0.69	0.53
LBP, µg/mL	2.36	2.11	2.14	2.15	2.24	0.14	0.40	0.29	0.50
Blood antioxidant									
Antioxidant, mM	3.34	4.65	4.87	4.93	4.15	0.69	0.08	0.17	0.30
SOD, U/ml	7.31	7.48	7.97	8.27	7.28	0.28	0.02	0.74	0.07
CAT, nmol/min/ml	7.81	8.37	8.75	7.56	9.24	1.05	0.80	0.39	0.40
GPX, nmol/min/ml	46.4	47.4	49.5	51.7	50.6	2.99	0.19	0.95	0.79

APP, acute phase proteins; SAA, serum amyloid A; LBP, lipopolysaccharide binding protein; SOD, superoxide dismutase; CAT, catalase; and GPX, glutathione peroxidase.

Conclusions

- These results indicate greater feed value of ROD vs. barley silage or antibiotics but it was dose-dependant
- Feeding ROD potentially improves immune status and antioxidant activity in finishing beef heifers.
- ROD could be fed potentially as an alternative to antibiotics in beef cattle.

Acknowledgement

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References

Anti-oxidant properties of cornus sericea, Patent #US20150093460 A1, Inventors Robert Scales; Applicant Red Dog Enterprises Ltd.

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