



EVALUATION OF HYBRID RYE ON GROWTH PERFORMANCE, CARCASS TRAITS, AND EFFICIENCY OF NET ENERGY UTILIZATION IN FINISHING STEERS



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WHY STUDY CEREAL RYE?

- Cereal rye offers number of agronomic benefits in a crop rotation.
 - Potential improvements in system resiliency
 - Soil health benefits
- New hybrid germplasm offers increased yield potential with reduced ergot incidence compared to population genetics.



RYE AS A CATTLE FEED GRAIN

- Very little data on feeding value in finishing cattle.
 - Greater concentration of ergot alkaloids than new germplasm.
 - Prior to adoption of corn processing co-products.
- Questions to answer and objectives of our study:
 - How well will cattle consume diets containing rye?
 - What if any differences will there be in performance and efficiency?
 - What is the energy value of rye compared to corn?



CATTLE DESCRIPTION AND MANAGEMENT

- All procedures approved by SDSU IACUC (#19-047E).
- Predominately Angus steers (n = 240, initial shrunk BW 404 ± 18.5 kg) sourced from a single consignment at a SD auction facility and delivered to Southeast Research Farm (SERF) near Beresford, SD
- Steers were vaccinated against respiratory pathogens (IBR, BRSV, PI3, BVD types 1 and 2) and clostridial diseases and treated for internal and external parasites with moxidectin on d -1.
- Steers implanted with 200 mg trenbolone acetate and 28 mg EB on d 19.



EXPERIMENTAL DESIGN

- Completely randomized design
 - 24 pens, 10 steers per pen
 - n = 6 pens per treatment
- Four treatments
 - Base diet, 60% dry rolled corn (**DRC; 60:0**)
 - 20% rye (**40:20**)
 - 40% rye (**20:40**)
 - 60% rye (**0:60**)



RYE GRAIN

- Hybrid rye provided by KWS Cereals USA, LLC
 - KWS Bono
 - Grown at single location in MN
- Ergot alkaloid concentration, 392 ppb, (DM basis).
(NSDU Veterinary Diagnostic Laboratory)
- Cracked using a roller mill
 - Lone Star Enterprises, Lennox
 - Processing index = 78.8 ± 2.29
 - Bulk density of processed rye/bulk density of whole rye *100



DIETS AND INTAKE MANAGEMENT

- Steers were stepped up to the final diet over a 19-d period.
- Rye was introduced to experimental diets on d 8
 - d 8 to d 14 (0, 8, 16, and 24% inclusion, DM basis).
 - d 15 to trial completion (0, 20, 40 and 60%, DM basis)
- Steers were fed once daily
- Bunks were managed to be slick at 0800h most mornings



FINAL DIET COMPOSITION (DRC:RYE)

Ingredients ¹	60:0	40:20	20:40	0:60
Dry rolled corn, %	60.34	40.33	20.22	0.00
Hybrid rye, %	0.00	19.91	39.93	60.04
MDGS, %	18.90	18.95	19.00	19.05
Corn silage, %	16.84	16.89	16.93	16.97
Liq. Suppl.,% ²	3.91	3.92	3.93	3.94
	Nutrient Composition ³			
CP, %	12.78	13.62	14.47	15.32
NDF, %	18.9	20.91	22.94	24.98
NE g, Mcal/kg	1.41	1.35	1.30	1.23

¹All values on a DM basis

²Provided 30g/ton of monensin as well as vitamins and minerals to exceed requirements (NASEM, 2016).

³Tabular NE from Preston (2016)) and actual nutrient compositions from weekly composite ingredient samples



STUDY TERMINATION AND CARCASS DATA COLLECTION

- Steers were weighed off test on d 117 when visually appraised to have 1.27 cm backfat.
- Shipped 48 h after final BW measurement to Tyson Fresh Meats, Dakota City, NE.
- Liver abscess prevalence and severity determined using Elanco scoring system with HCW and video image data provided by harvest facility.
- Final performance measures calculated by dividing HCW by 0.625.



STATISTICAL ANALYSIS

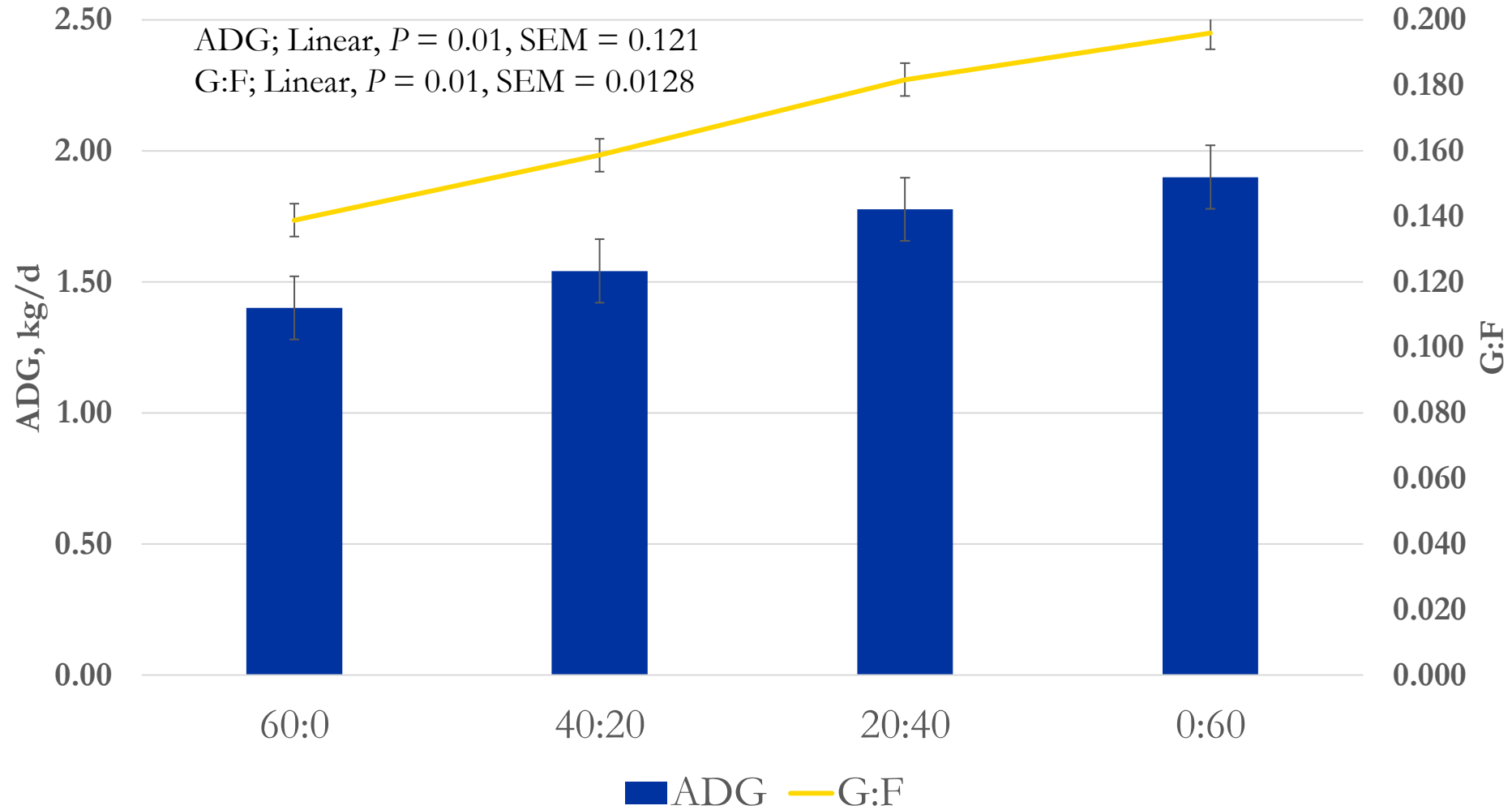
- Analyzed as a completely randomized design using GLIMMIX procedure of SAS 9.4 (SAS Inst. Inc.).
- Pen was the experimental unit and model included fixed effects of dietary treatment.
- Treatment effects tested with orthogonal polynomials. Dry matter intake tested using repeated measures.
- Quality grade, YG, and liver abscess score distributions evaluated as binomial proportions using GLIMMIX.
- An $\alpha \leq 0.05$ determined significance



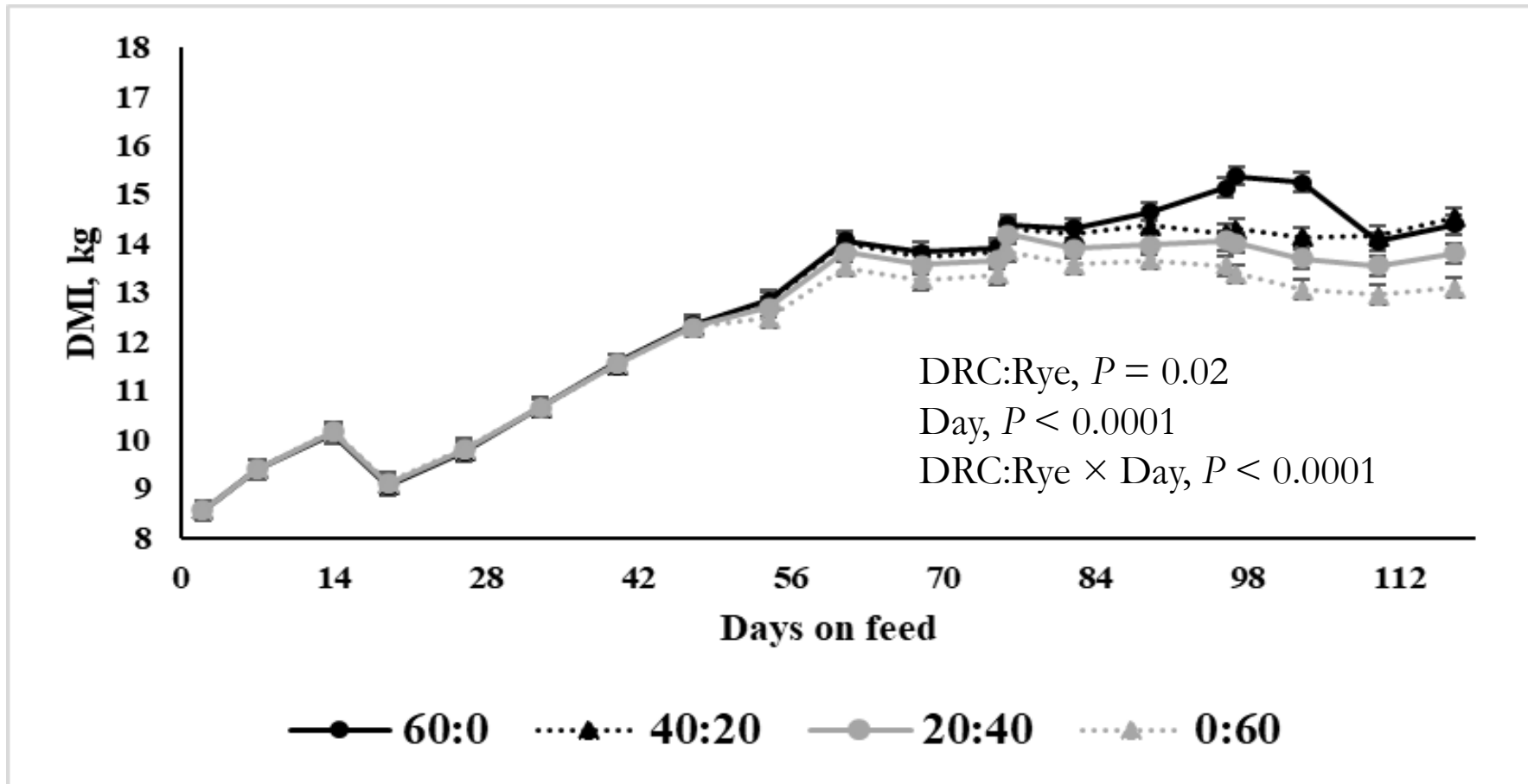
RESULTS



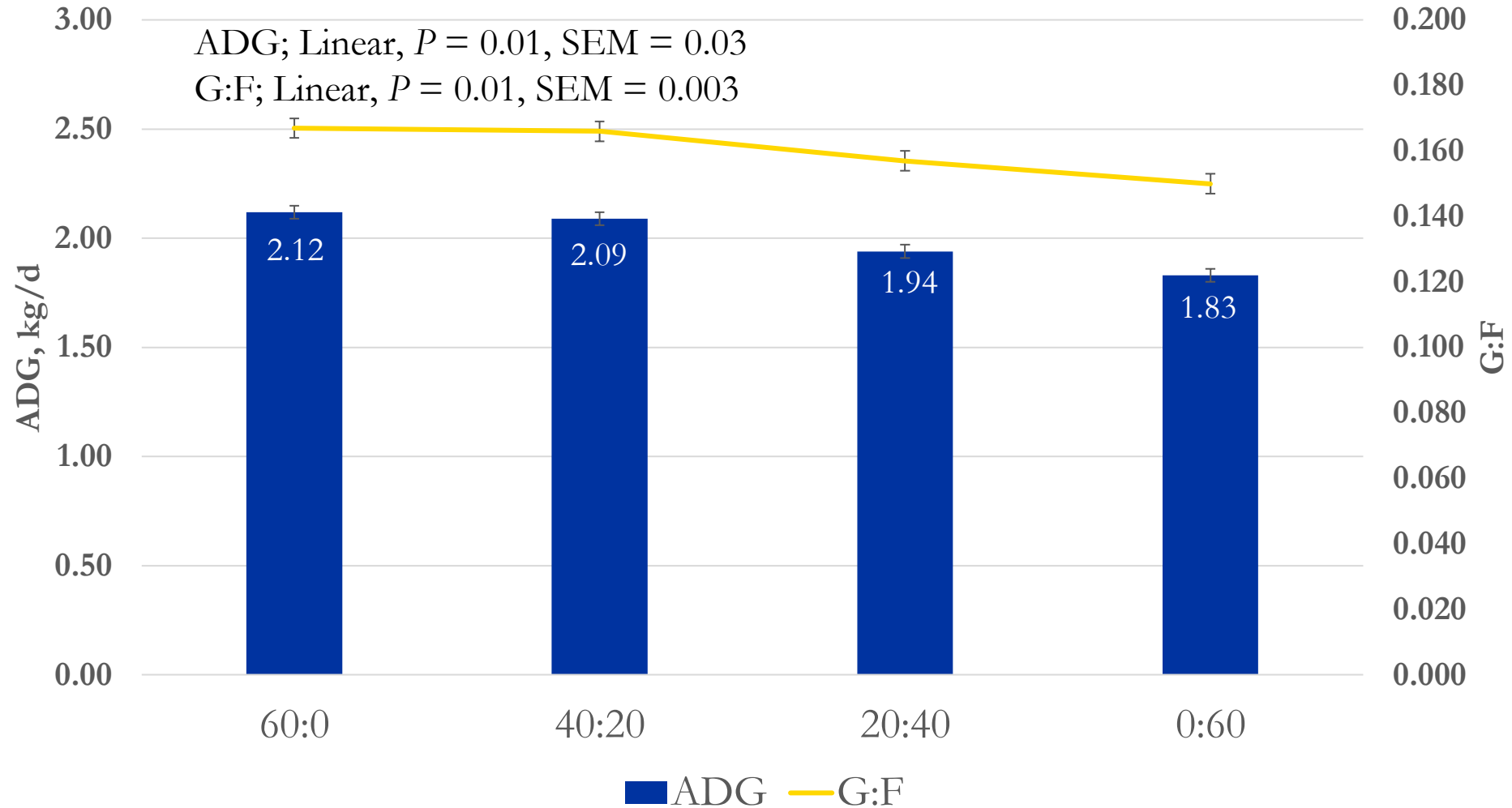
ADG AND G:F (D 1 TO D 19)



RYE INCLUSION AFFECTED DMI



CARCASS ADJ ADG AND G:F (CUMULATIVE)



CARCASS CHARACTERISTICS

Item	60:0	40:20	20:40	0:60	SEM	0 vs Rye	L	Q
Carcass Adj Final BW, kg	650	648	632	620	4.9	0.01	0.01	0.32
HCW, kg	406	405	395	388	3.0	0.01	0.01	0.33
Dressing percent, %	60.10	59.12	58.42	58.56	0.221	0.01	0.01	0.02
LM area, cm ²	83.3	84.6	82.1	80.8	1.00	0.52	0.04	0.22
Marbling score	474	478	485	445	11.3	0.74	0.14	0.07
Backfat, cm	1.30	1.30	1.30	1.24	0.036	0.78	0.46	0.55
USDA YG	3.40	3.32	3.37	3.32	0.063	0.43	0.54	0.85
EBF, %	30.29	30.19	30.43	29.78	0.253	0.59	0.27	0.29
Adj Final BW, kg	599	599	581	580	4.5	0.02	0.02	0.99



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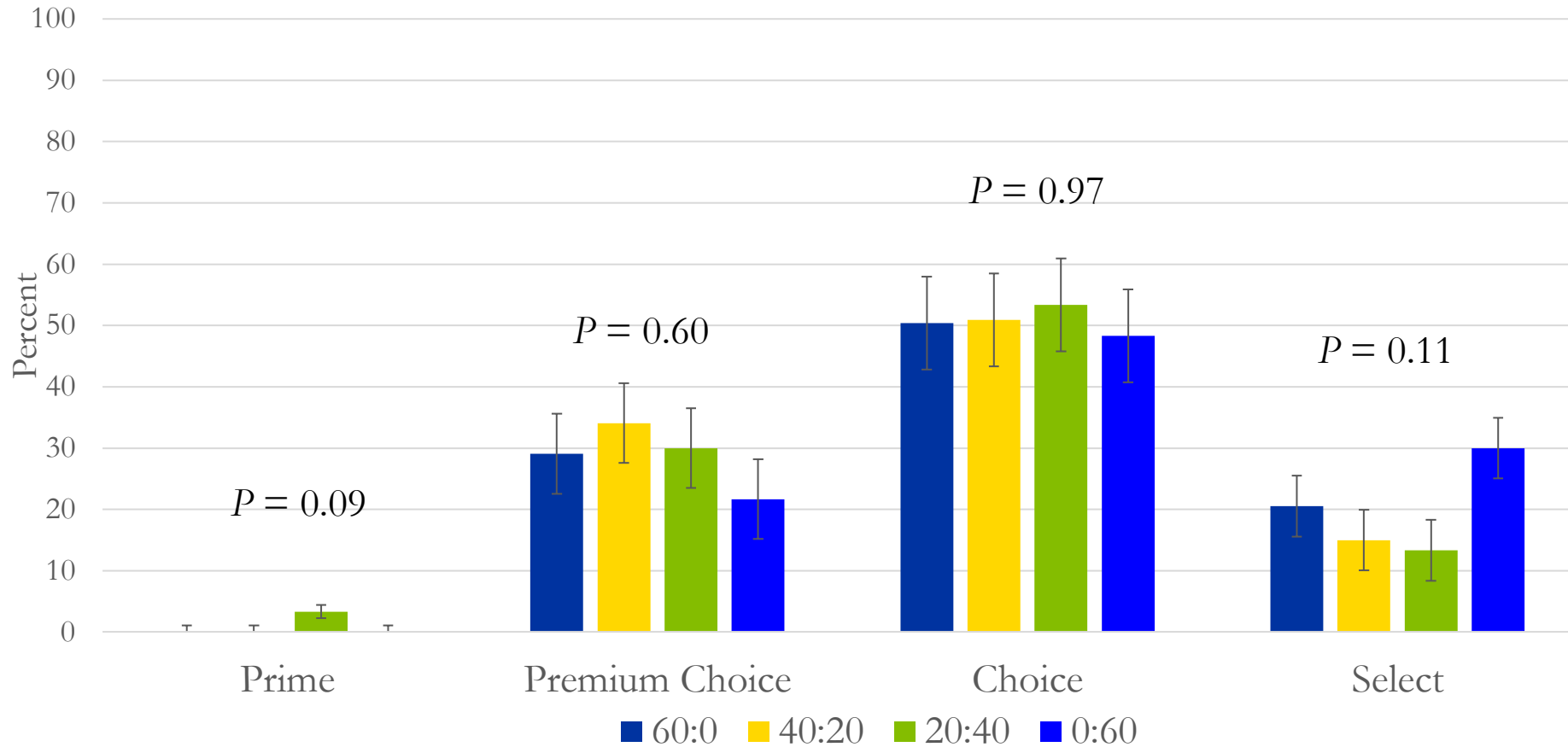


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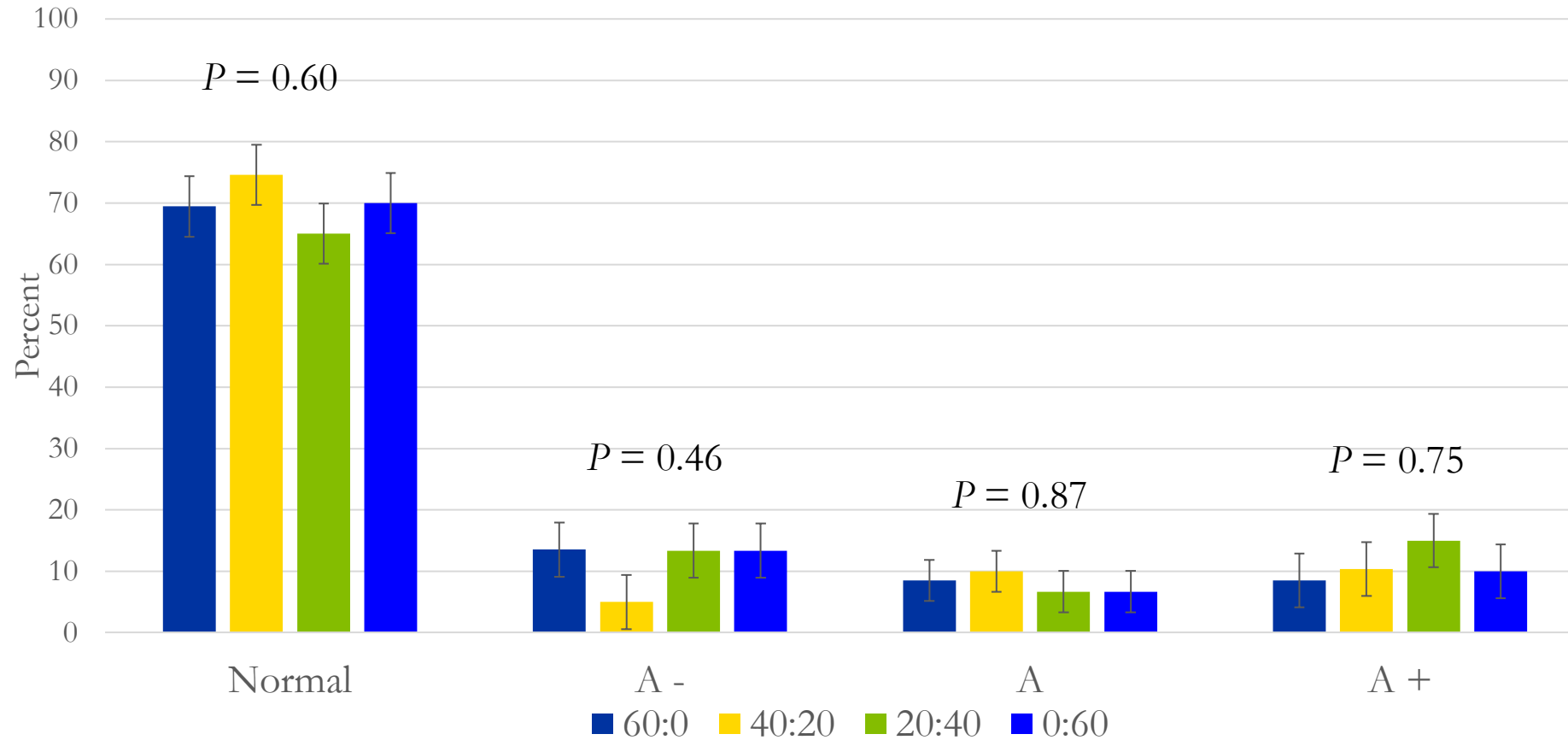
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Adj Final BW, kg (28% EBF)	599	599	581	580	4.5	0.02	0.02	0.99



RYE INCLUSION AND QG DISTRIBUTION



RYE INCLUSION AND LIVER SCORES



NET ENERGY VALUES & ASSOCIATIVE EFFECTS

	40:20	20:40	0:60
NE m, Mcal/kg	2.08	1.93	1.90
NE g, Mcal/kg	1.41	1.28	1.25
Associative Effect, ADG	3.7%	1.0%	
Associative Effect, G:F	3.1%	0.6%	

Associative effect = (Observed – Expected)/Expected



NE VALUE COMPARISON (AT FULL REPLACEMENT)

	NE m, Mcal/kg	NE g, Mcal/kg
Current Experiment	1.90	1.25
Published values		
NASEM, 2016	1.97	1.32
Preston, 2016	1.90	1.23



UNPROCESSED RYE

BUCKHAUS, ET AL., 2021

- Yearling heifers
 - 91 DOF, 60% DRC or 60% unprocessed rye
- Lesser cumulative ADG and poorer F:G
 - Rye tended ($P = 0.08$) to have 7% greater intake
 - NE value estimated to be 21.4% less than corn and 9% less than processed rye



SYSTEM EFFECT OF ADDING RYE

- Assume a 1200 acre Midwestern farm
 - Corn-soybean vs. Corn-Soybean-Rye
 - Rotation effect at Beresford: +20 bushels corn/acre

	Two-crop	Three-Crop
Corn Yield, bushels	108,000	80,000
Soybean Yield, bushels	30,000	20,000
Rye Yield, bushels	NA	46,000
Total bushels of feed grain	108,000	126,000 16.7%
Corn:Rye production		1.73



CONCLUSIONS

- Rye can be successfully fed to finishing cattle.
- Increased inclusions of rye depressed DMI after 48 days on feed and decreased ADG and G:F when measured over the entire feeding period.
- Estimated NEm and NEg values agreed closely with published estimates at approximately 84% that of DRC.
- Additional research needed to determine reasons for decreased DMI and performance.



ACKNOWLEDGEMENTS

- KWS Cereals USA, LLC
 - Financial Support
 - In-kind contributions of rye grain
- Southeast Research Farm
 - Mr. Scott Bird, cattle feeding, care & management

