



Practical experience with rye in pig feeding in Canada

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RYE-INTRODUCTION

- Rye is a member of the grass family Gramineae
- Most rye is grown as winter rye
- Second to wheat among the grains commonly used in the production of bread
- Used for rye whiskies production –Crown Royal, Gibson's
- Rye is a hardy crop with good frost and drought resistance and can be grown in more sandy soils with lower fertility



RYE-PRODUCTION (X 1000 MT)

Grains	Rye	Corn	Wheat	Barley	Rye USA
2015	226	13 680	27 647	8 257	291
2016	436	13 889	32 140	8 839	338
2017	342	14 095	29 884	7 891	251
2018	235	13 900	31 800	8 400	212
2019	400	15 400	34 500	9 800	

Source: Index Mundi

RYE HYBRID-NUTRIENT VALUE

Nutrient	Rye*	Wheat	Barley	Corn
Protein %	10,7	13,0	11,0	7,8
Lysine SID %	0,27	0,29	0,31	0,19
Fat %	2,10	2,30	2,30	3,40
Crude fiber %	2,40	2,60	4,60	2,30
Total Phos %	0,27	0,33	0,30	0,24
ME kcal/kg	3170	3250	3000	3350
NE kcal/kg	2465	2470	2310	2625

* 3 samples analyzed CTL and NIR March-June 2019

NEW HYBRID RYE- KWS

New Hybrid Rye variety – KWS Germany – FP Genetic

- Better yield (+ 30 %),
- lower height and faster pollination
- Reduced risk of contamination with ergot

IMPACT OF HYBRID RYE IN FINISHER

- Trial done at the with a large swine integrator in Canada in thei finisher R&D barn
- October 2016 to February 2017
- 48 pens total with 22 pigs/pen – total 1056 pigs
- 3 feeds treatment with 16 experimental units/treatment
- One single side 3 spaces wet/dry feeder per pen
- 7.3 square feet/pig at entry
- 16 weeks finisher period
- First pull 4-5 pigs/pen at week 13 and barn dump at week 16

IMPACT OF HYBRID RYE IN FINISHER

- 5 phases feed program – pelleted feed
- Pen weight done at entry, week 3, 6 , 9, 13 (first pull) and week 16 (shipping)
- Daily feed data per pen from Gestal XM feed system
- Carcass grading data for back fat and loin depth on all pigs
- Complete carcass evaluation for meat quality on 96 pigs selected at week 16 (32 pigs/treatment group)

FEED BUDGET AND % OF RYE

Diet phases	kg/pig	Control	Medium	High
Phase 1	36	0,0 %	10,0 %	20,0 %
Phase 2	36	0,0 %	15,0 %	30,0 %
Phase 3	48	0,0 %	20,0 %	40,0 %
Phase 4	72	0,0 %	25,0 %	50,0 %*
Phase 5	+/- 90	0,0 %	25,0 %	50,0 %*
	280			

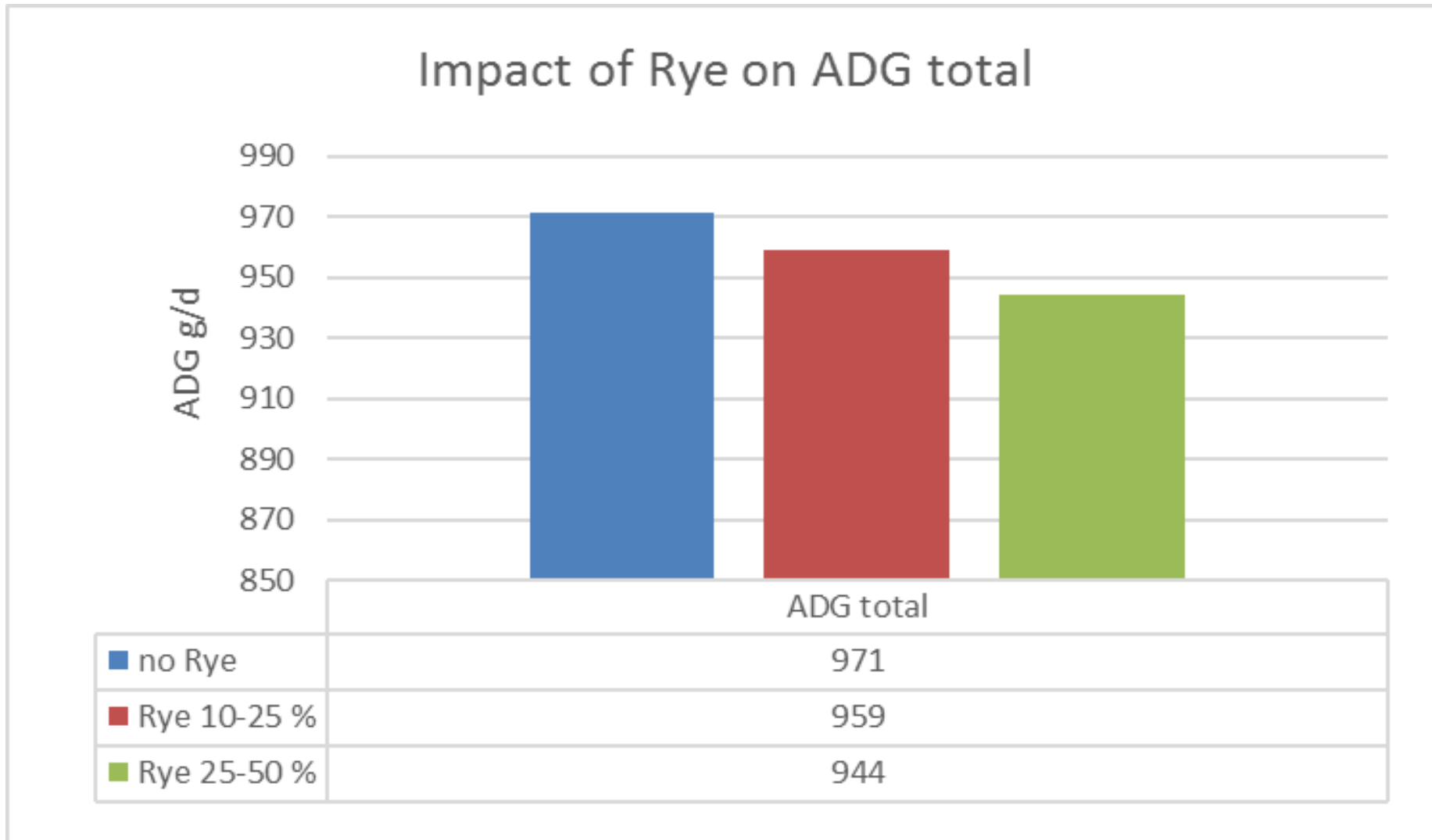
* Xylanase 40 000 G added at 100 g/ton

DIETS NUTRIENT SPECIFICATIONS

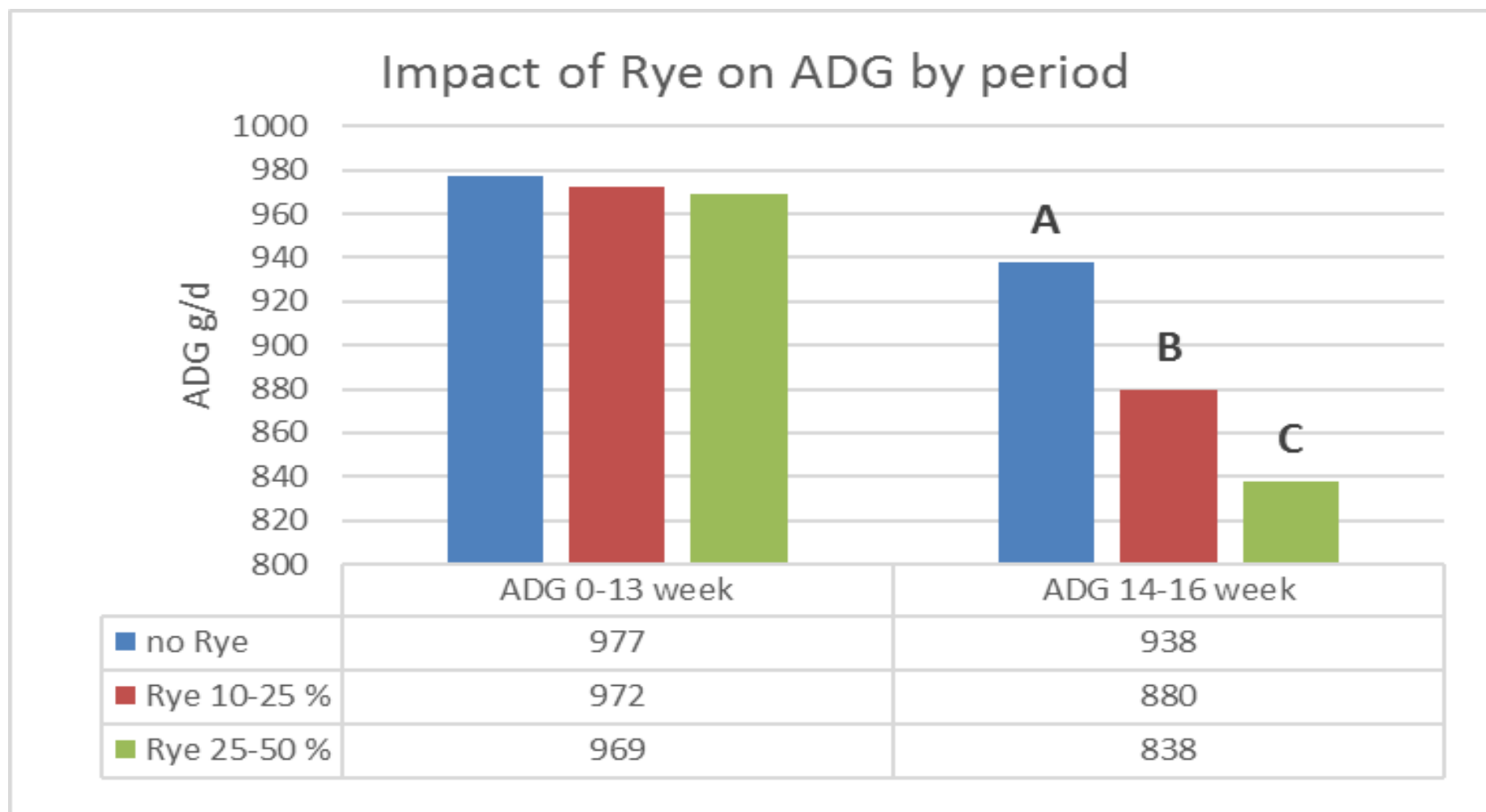
	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5
Protein %	18,40	16,30	14,50	13,40	13,10
Lysine SID %	1,04	0,92	0,82	0,72	0,65
NE kcal/kg	2475	2475	2425	2400	2400
Lys SID/NE	4,20	3,70	3,38	3,00	2,71
Calcium %	0,64	0,56	0,52	0,48	0,46
Av.Phos %	0,32	0,28	0,26	0,24	0,23

FORMULA PHASE 4 FINISHER

	Control	Medium	High
Corn	472,3	340,0	153,5
Wheat	150,0	150,0	150,0
Barley	235,9	79,90	-
Rye	-	250,0	500,0
Corn DDGS	73,2	116,5	122,3
Soybean meal	45,1	40,5	48,2
Oil	-	-	3,1
Lysine	4,50	4,50	4,20
Methionine	0,10	0,10	0,20
Threonine	1,10	1,00	1,00
Tryptophane	0,40	0,30	0,10
VTM	1,00	1,00	1,00
Others	16,4	16,2	16,4

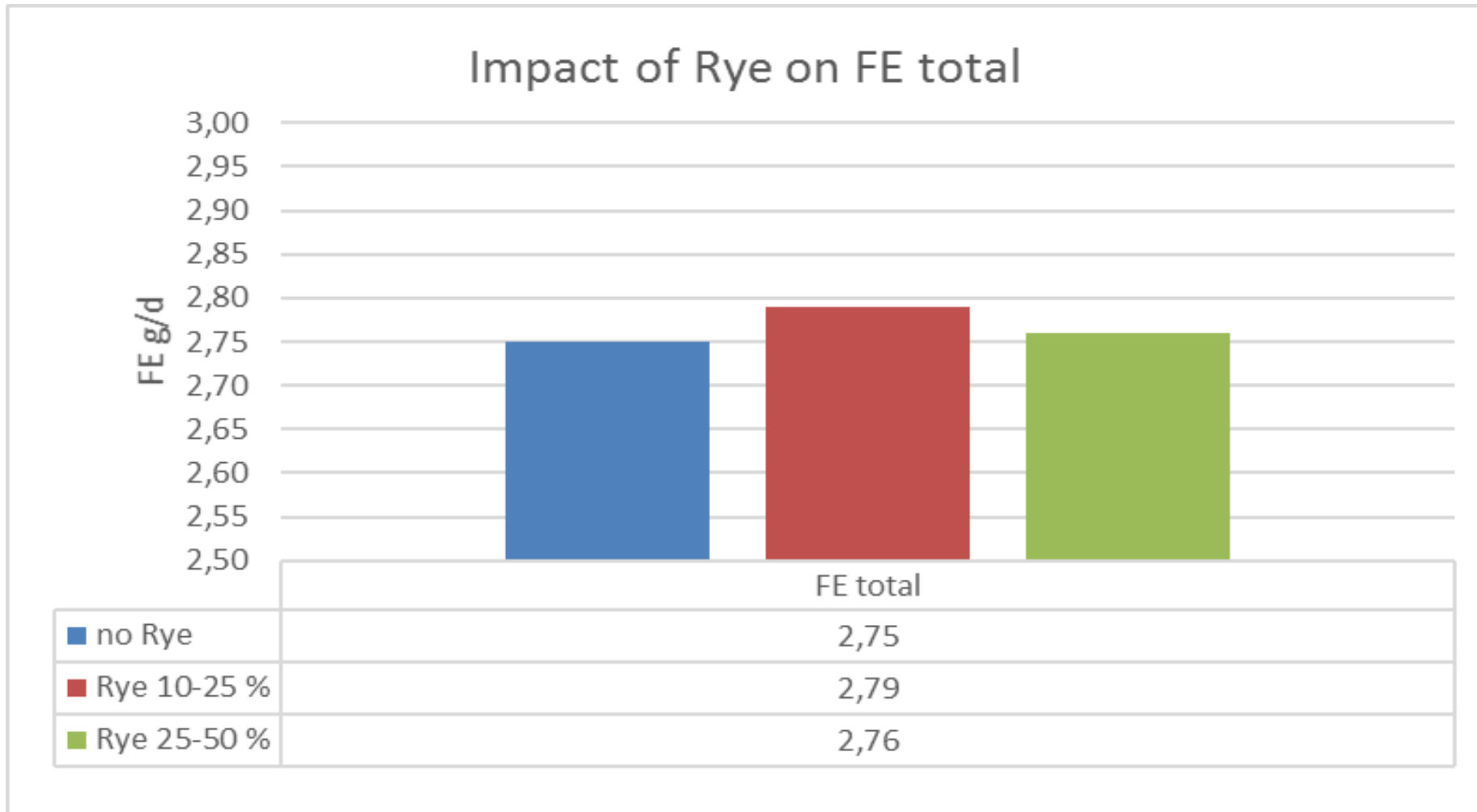


ADG total P value 0.20

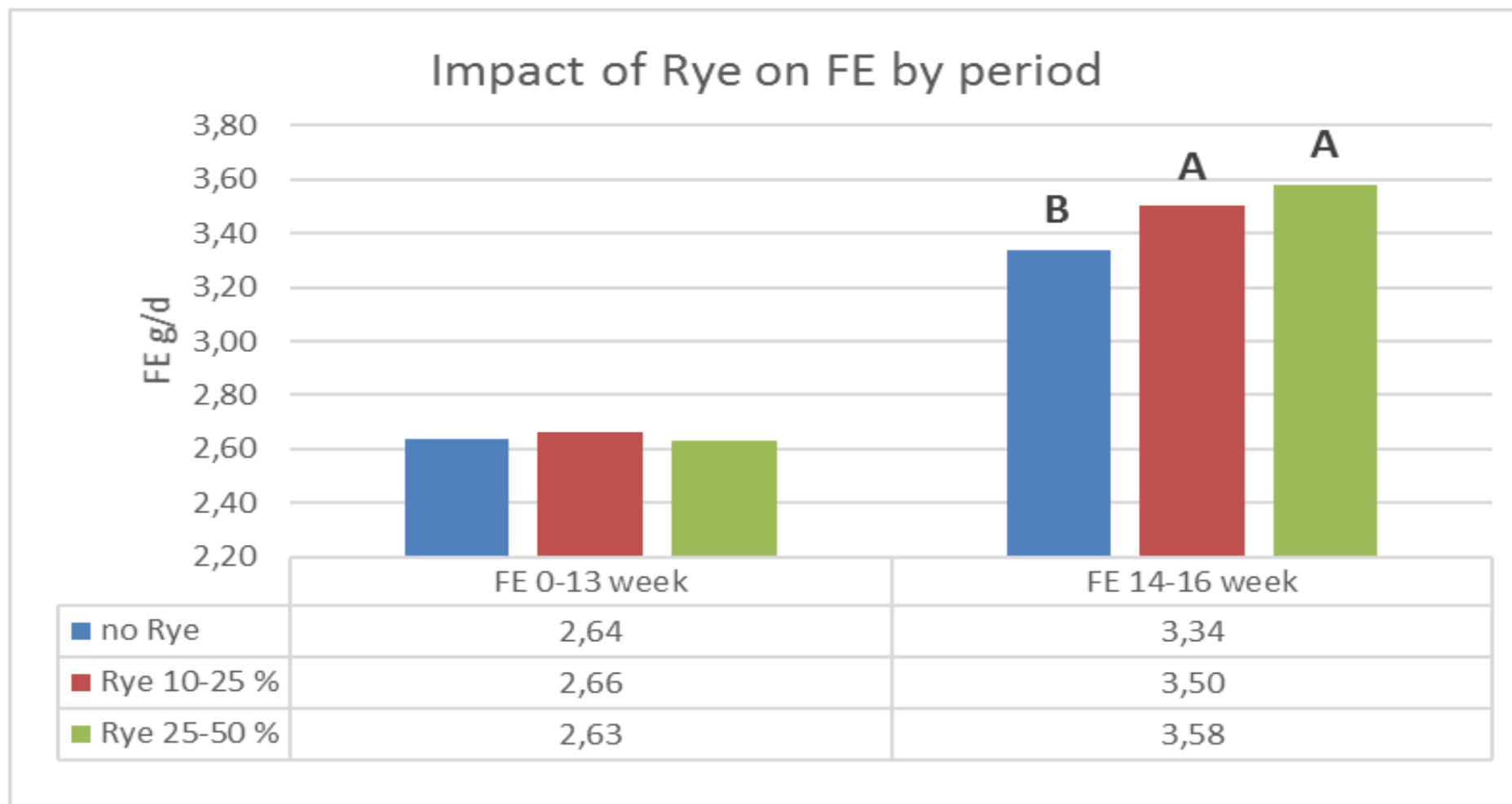


ADG 0-13 weeks P value NS

ADG 14-16 weeks P value <0.001

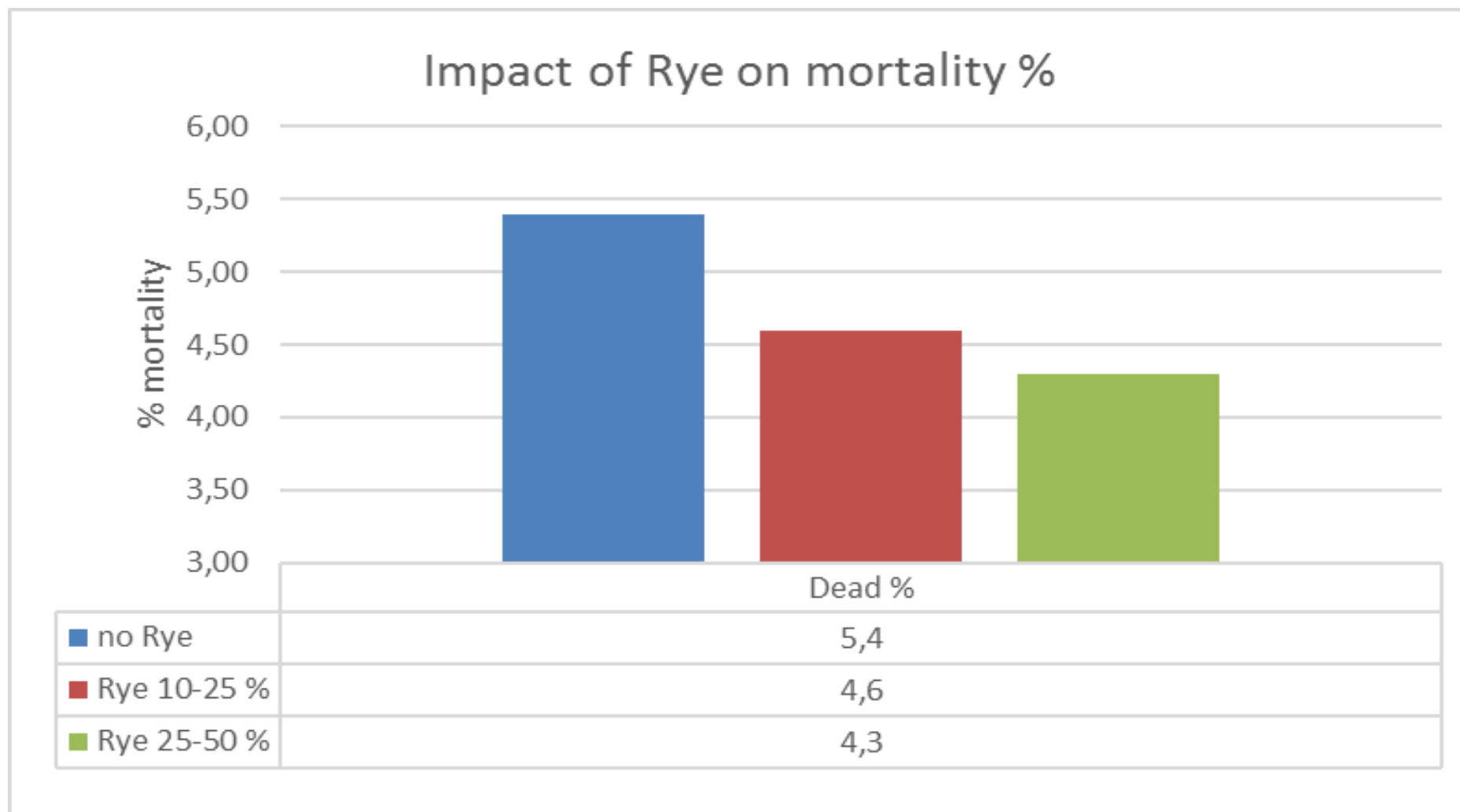


FE total P value NS



FE 0-13 weeks p value NS

FE 14-16 weeks p value <0.05



Mortality (dead/pull) P value 0,77

HYBRID RYE TRIAL-CARCASS/MEAT QUALITY

	A – NO RYE	B – MODERATE RYE	C – HIGH RYE	P-VALUE
Dress weight (kg)	110,49	108,91	108,06	0,2022
Dressing yield (%)	81,12	80,98	81,18	0,6474
Fat (mm)	16,99	16,58	16,32	0,0848
Loin (mm)	66,17	65,63	65,51	0,2869
Primal yield %	70,29	69,55	70,31	0,0890
pH	5,54	5,57	5,57	0,5783
Loin fat IV	70,37	70,52	71,16	0,4087
Drip loss %	1,90	1,89	1,93	0,9900
NPPC loin colour	3,71	3,97	3,83	0,3494

HYBRID RYE TRIAL-CARCASS/MEAT QUALITY

- We observed no impact on carcass and meat quality traits
- Rye can be a good alternative to wheat and barley for improving fat quality and firmness
- Lower IVP value vs wheat and barley

HYBRID RYE FINISHER TRIAL DISCUSSIONS

- Performance were very similar until week 13 of the trial
- We observed a drop in performance with reduced ADG and increase in FE for the pigs on rye diet after week 13
- Corresponds to feed production **with new batch of rye**
- Ran out of rye early January
- 90 tons bought and tested before the trial started, but part of the rye was likely dumped into the wheat bin at entry, so ended-up to be out product before the end of the trial

HYBRID RYE FINISHER TRIAL DISCUSSIONS

- High ergot contamination for rye bought early January
- First batch of rye tested at 800 ppb ergot alkaloids - OK
- Second lot of rye tested at 4980 ppb!!!!
- Phase 5 - Control 50 ppb
- Phase 5 - 25 % rye 921 ppb analyzed vs 1245 ppb expected
- Phase 5 - 50 % rye 1558 ppb analyzed vs 2490 ppb expected
- Look like the higher level of ergot in the feed starting at week 13 has affected pig performance
- Or could it also be attributed to increased viscosity and lower rate of passage when feeding the high rye diet?

HYBRID RYE FINISHER TRIAL DISCUSSIONS

- 25% rye can easily be incorporated into finishing feeds
- Level of 40-50% can also be considered
- Pay attention to the ergot level – target for use in finisher diets → 0.08 % maximum (on a weight basis)
- Need to better understand potential impact on feed intake with higher rye and increased viscosity
- High level of fructane (4x more vs wheat) – gut health benefit, ↑ butyric acid
- Rye has been used in commercial finisher diet from June 2017 to August 2018 at one of their feed mill

IMPACT OF HYBRID RYE IN NURSERY

- Trial done with a large swine integrator in Canada in their nursery R&D barn
- Trial started in March 2018
- 48 pens total with 24 pigs/pen – total 1152 pigs
- 3 feeds treatment with 16 experimental units/treatment
- One single side 5 spaces dry feeder per pen
- 3.0 square feet/pig at entry
- 47 days trial period

IMPACT OF HYBRID RYE IN NURSERY

- 4 phases feed program
- Pen weight done at entry and then weekly with last week being 5 days period
- Daily feed intake data measured by using a feed cart of load cell
- Scour index monitored daily with an evaluation score notation from 0 to 5, zero being no scour and 5 being very watery scour
- Individual weight done at entry and at the end to measure weight variation

FEED BUDGET AND % OF RYE

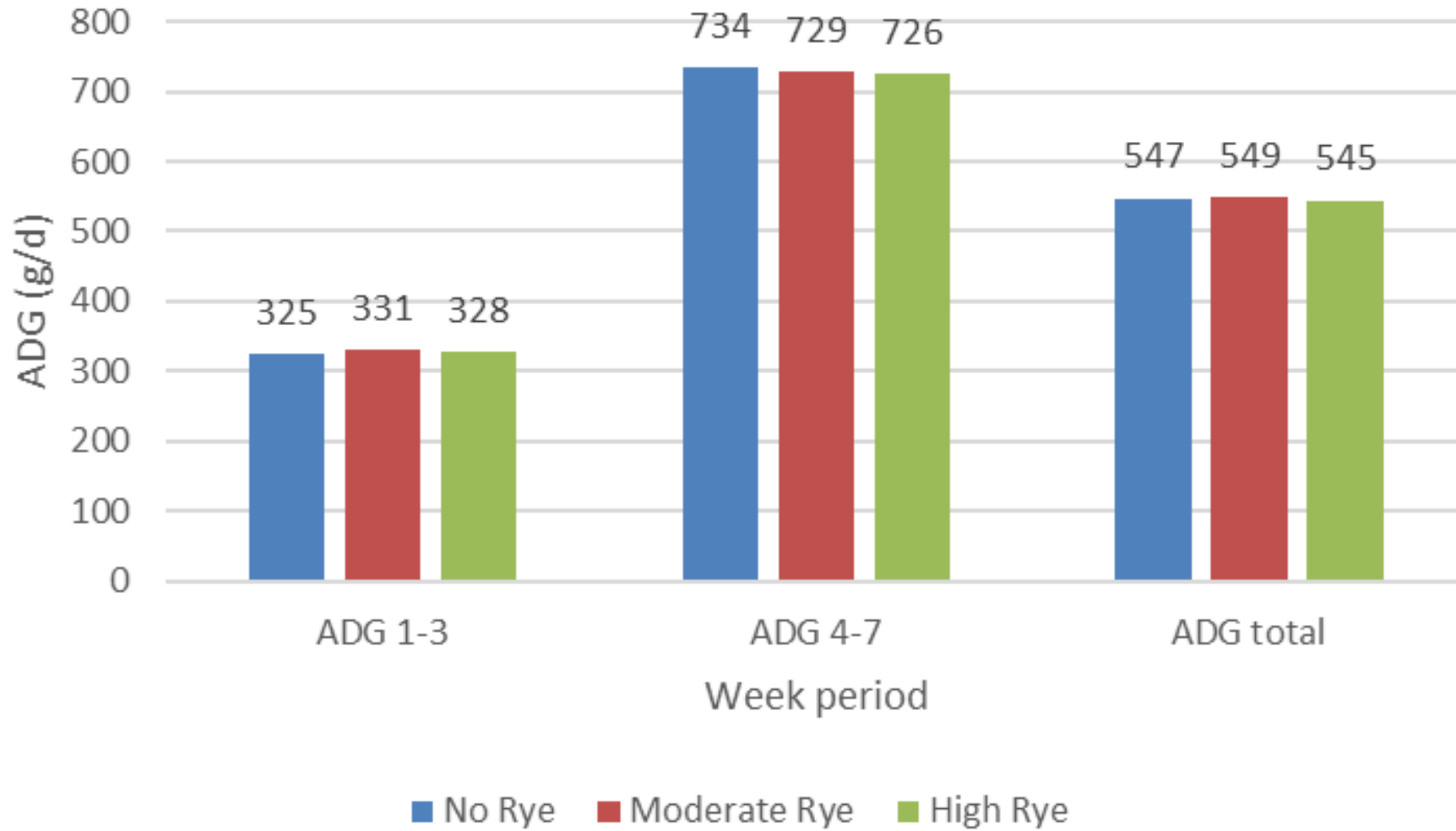
Diet phases	kg/pig	Control	Medium	High
Phase 1	2.0	0,0 %		
Phase 2	5.0	0,0 %		
Phase 3	12.0	0,0 %	10,0 %	20,0 %
Phase 4	20.0	0,0 %	20,0 %	40,0 %
	39.0			

Xylanase 40 000 G added at 100 g/ton in all diets for all treatment group

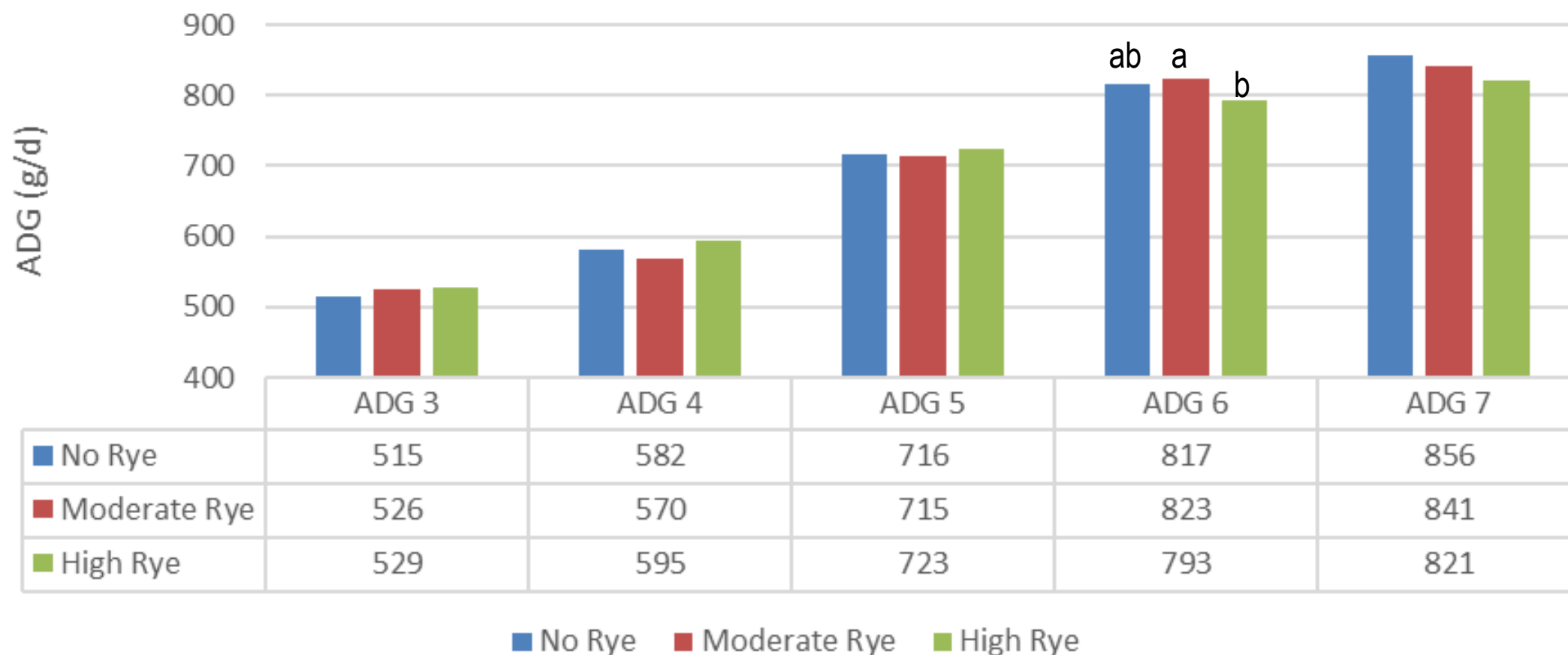
DIETS NUTRIENT SPECIFICATIONS

	Phase 1	Phase 2	Phase 3	Phase 4
Protein %	20,8	20,2	20,2 - 20,5	19,2 - 19,9
Lysine SID %	1,34	1,25	1,20	1,11
NE kcal/kg	2475	2375	2400	2450
Lys SID/NE	5,43	5,26	5,00	4,55
Crude fat %	5,72	5,23	4,96-5,21	4,80-5,30
Crude fiber %	3,00	3,48	3,50-3,57	2,74-2,88
Calcium %	0,65	0,65	0,65	0,70
Av.Phos %	0,50	0,45	0,40	0,35

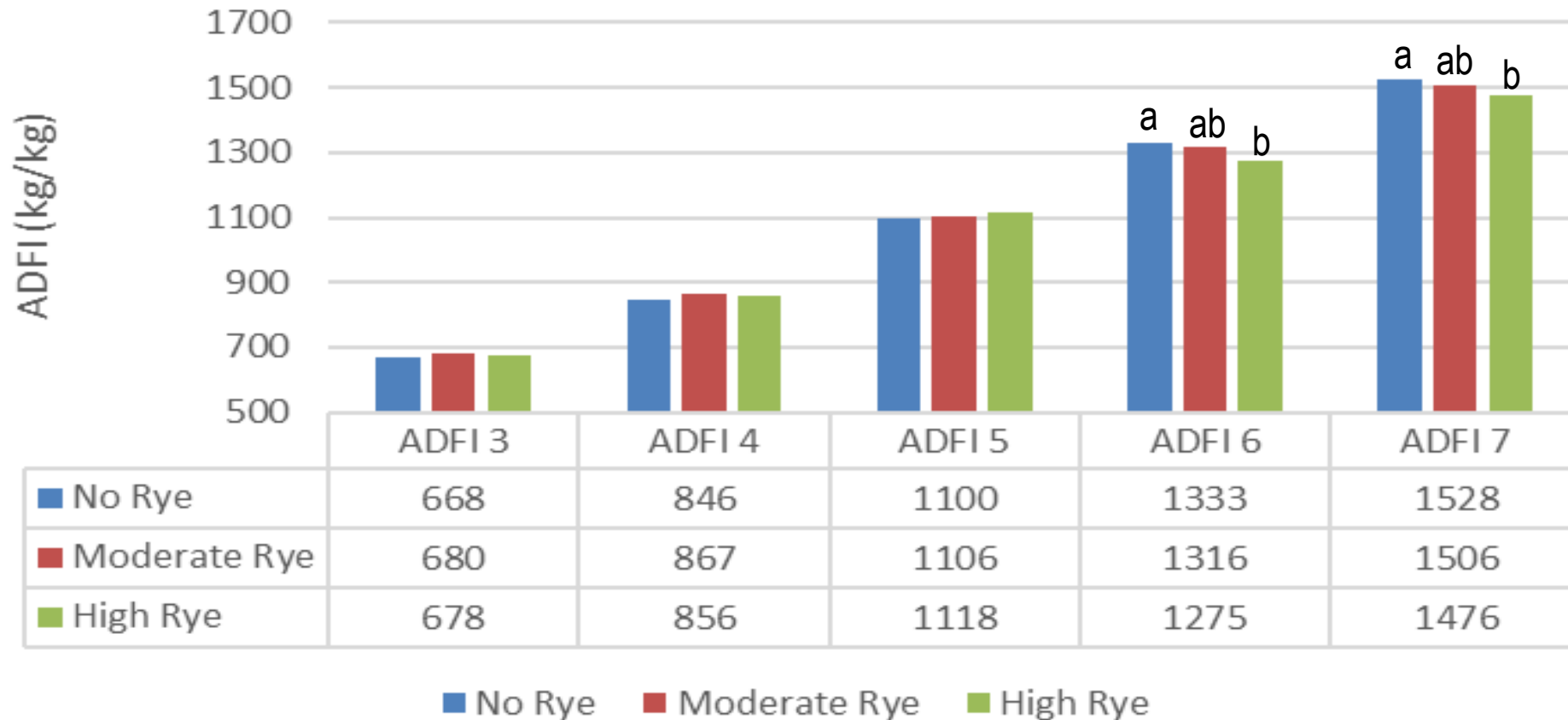
Impact of Rye on ADG

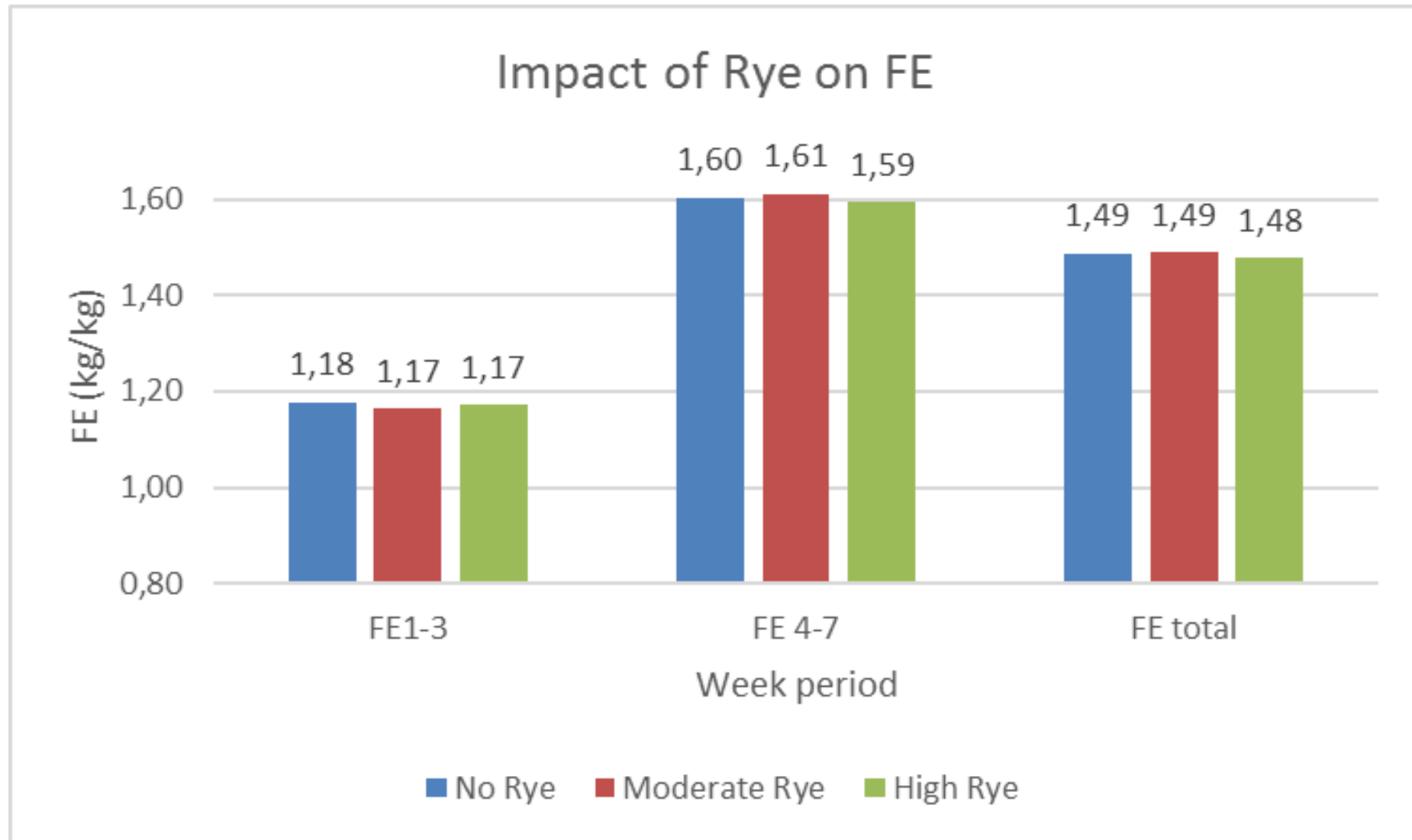


Impact of Rye on weekly ADG

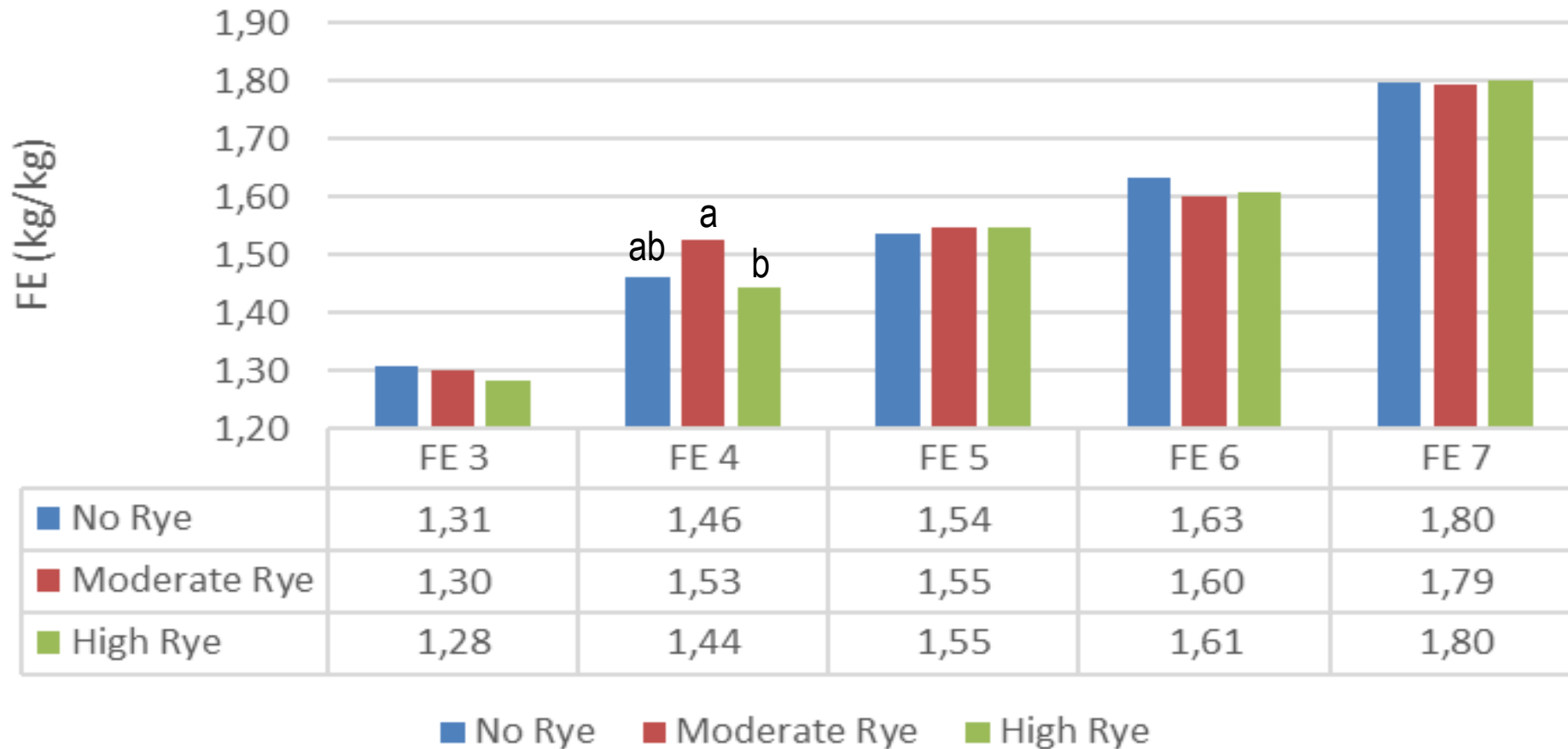


Impact of Rye on weekly ADFI

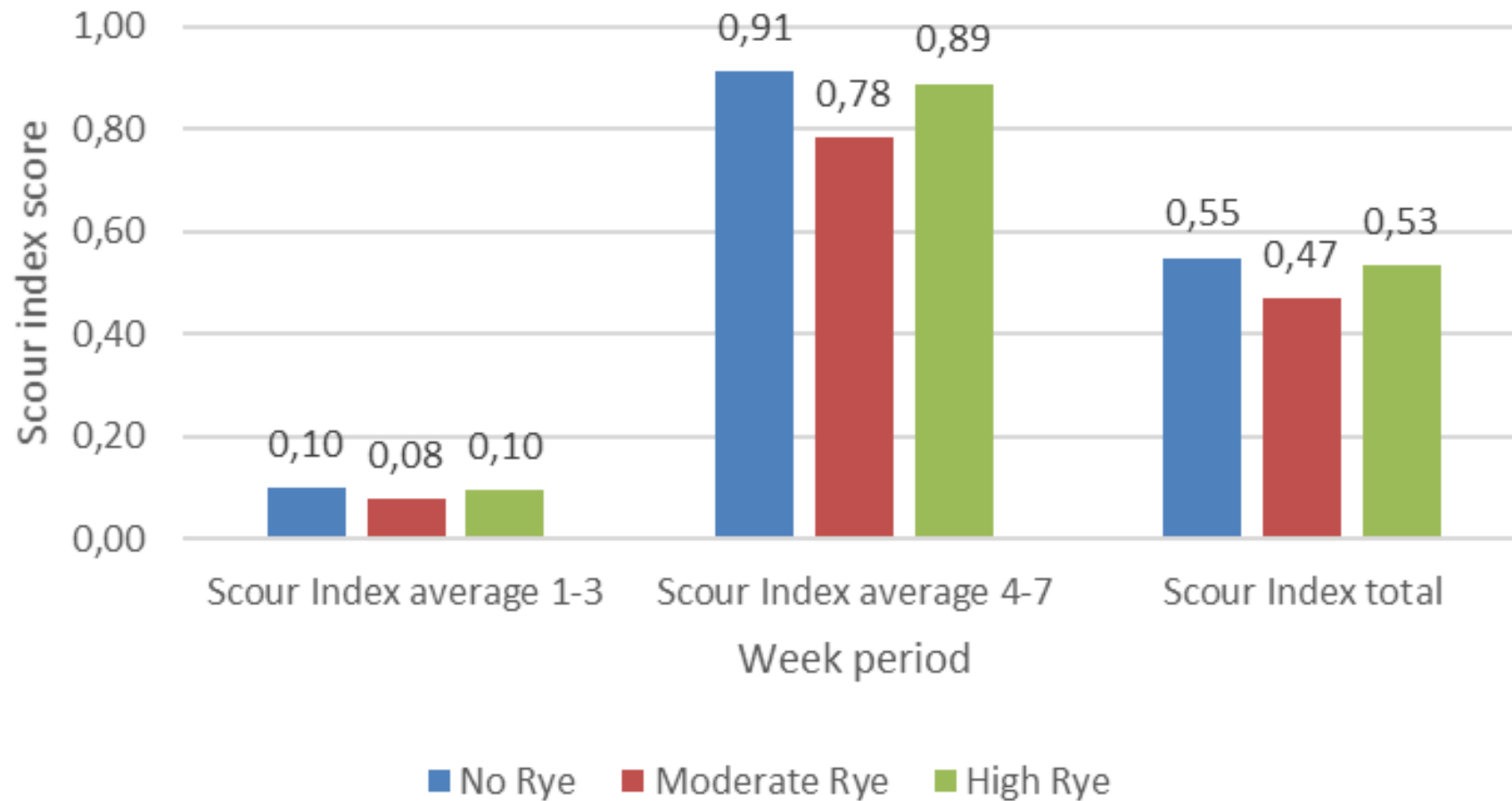


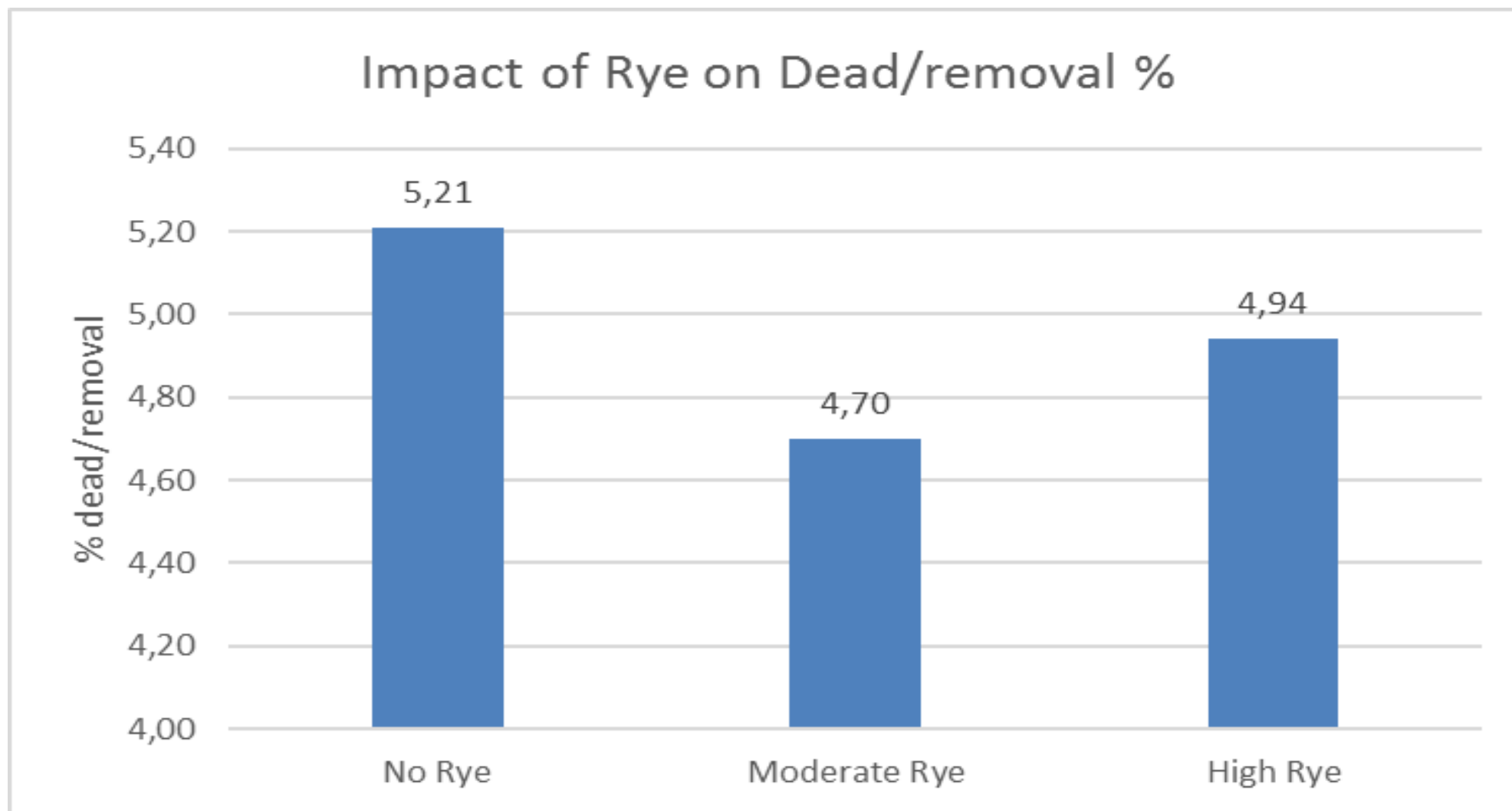


Impact of Rye on weekly FE



Impact of Rye on Scour index





ERGOT ANALYSIS

Diet	No Rye	Medium Rye		High Rye	
	Analyzed	Analyzed	Objective	Analyzed	Objective
Phase 3	< 5 ppb	160 ppb	126 ppb	519 ppb	252 ppb
Phase 4	< 5 ppb	235 ppb	252 ppb	475 ppb	504 ppb
Average		198 ppb	189 ppb	497 ppb	378 ppb

Rye sample : 1261 ppb ergot.

DON, Zearalenone level very low/under DL

Objective : Calculated by using % rye inclusion rate x 1261 ppb

Analysis done by Actlab in Ontario

HYBRID RYE NURSERY TRIAL DISCUSSIONS

- No difference in growth performance and feed efficiency for the overall trial period
- We observed a reduction in feed intake in the last 2 period of the trial (week 6 and 7), which led to drop in ADG in week 6 and a numerical reduction in ADG in week 7, but not statistically significant ($p = 0.1723$)
- Is this an impact of the ergot level in the rye diet or the too high rye level?
- Or an impact of higher viscosity due to NSP?
- Not impact on week 3, 4 and 5 when introducing rye in the diet, so not likely to be a rye impact on palatability at least
- More likely to be an impact of the moderate ergot contamination and build-up over time or NSP content/viscosity

HYBRID RYE NURSERY TRIAL DISCUSSIONS

- 10-20 % rye can easily be incorporated into nursery diet from 12 to 30 kg
- Level up to 40 % can be considered
- Pay attention to the ergot level – target for use in nursery diets → 0.04 to 0.05 % maximum (on a weight basis) for the Rye or < 200-250 ppb in the final feed
- Inclusion level need to be adjusted base on potential contamination with ergot in the rye

ERGOT CONTAMINATION

- As with any other toxins, no clear cut threshold level for ergot in swine diet
- Report that >1 ppm ergot alkaloids impacted growth on weaned pig (35 days to 63 days of age)
- 2 ppm → 3.0 % reduction in ADG
- 5 ppm → 15.0 % reduction in ADG
- 10 ppm → 24 % reduction in ADG
- CFIA max tolerance level 4-6 ppm ??????

Other reference

- Low – 0.5 ppm
- Moderate– 1.0 ppm
- High – 2.0 ppm

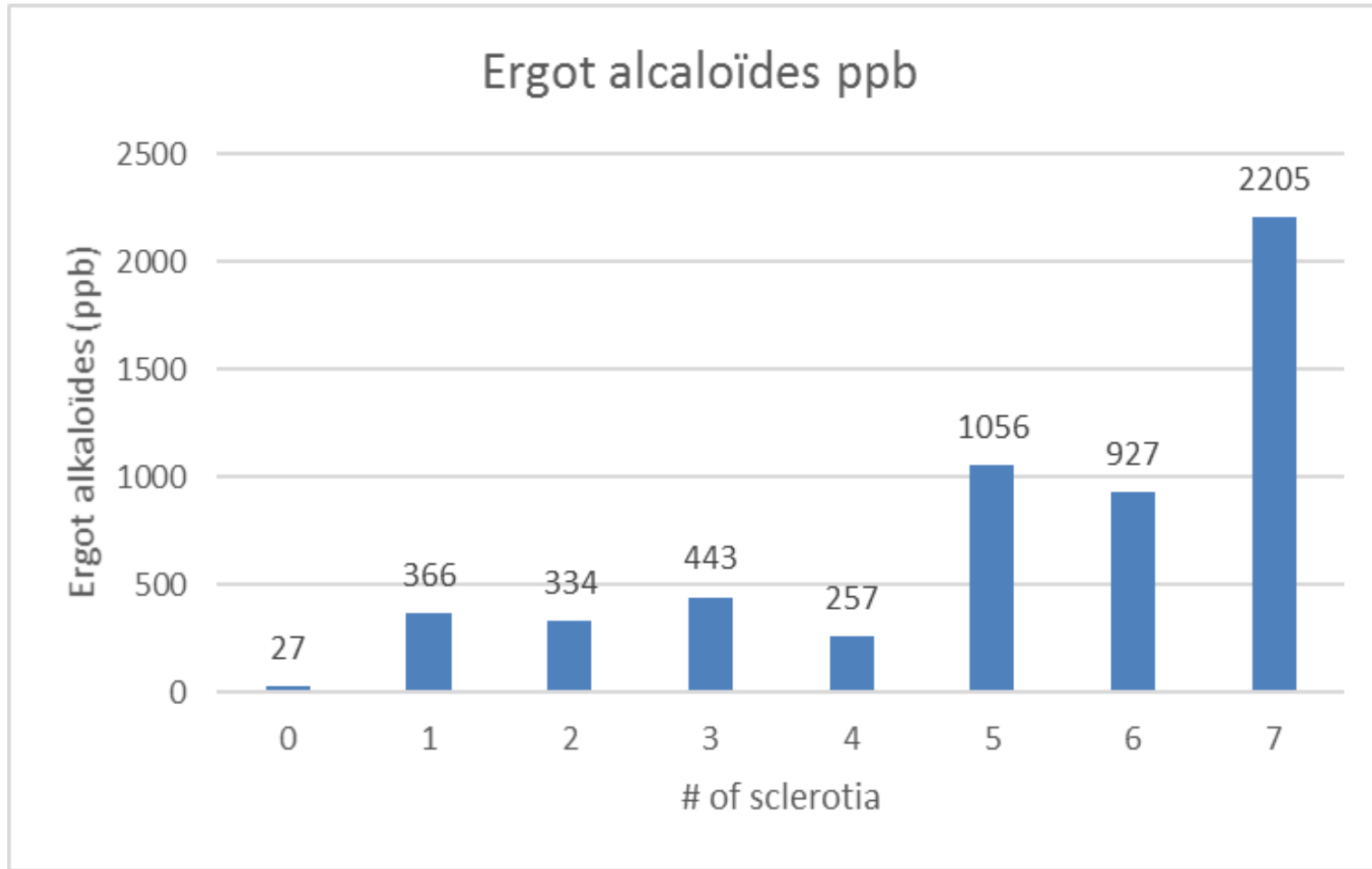


ERGOT CONTAMINATION

- ACT lab analysis on 6 ergot alcalöides
- Ergocomine, Ergocristine, Ergocryptine, Ergometrine, Ergosine, Ergotamine
- Sum of all 6 give the total ergot alkaloids



ERGOT ANALYSIS VS # SCLEROTIA



Analysis at PDS lab
sclerotia in 0.5 liter of grains
Average of 200 ppb/sclerotia
0.04 % in weight = about 5 sclerotia
0.04 % in weight = about 1000 ppb

ERGOT CONTAMINATION

- Recommended Quality Assurance SOP for Ergot
- 0.5 liter and count the # of sclerotia trying to assess count on complete sclerotia kernel
- Sow/Nursery : max 0.04 % on weight basis which should represent 1000 ppb
- Finisher : max 0.08 % on weight basis which should represent 2000 ppb
- Maximum inclusion rate adjusted base on risk of contamination
- Sow and Nursery finish feed : target max 0.20 ppm
 - 200 kg/t max on 1000 ppb product
- Finisher : target max 0.50 ppm
 - 250 kg/t max of 2000 ppb product

USE OF RYE

- Rye used in finisher diet at one large feed mill from June 2017 to August 2018
– 2100 ton/month on average
- Average rye price 200 \$/t (180 to 240 \$/t range)
- Average corn, wheat, barley price were respectively 185 \$, 232 \$, 210 \$ per ton
- Rye vs wheat : 86,3 %
- Rye vs corn : 108.0 %
- Rye vs barley : 95.2 %
- Average inclusion rate was 12 % in the finisher diet
- Average saving 1-3 \$/t

USE OF RYE

- Had no issue with performance
- Average particle size on the rye was 350-375 microns
- Corn 250-300 microns and wheat/barley 325-375 microns

RYE INTEREST PRICE

Interest price Hybrid Rye KWS								
		Low NE	High NE					
Relative rye price vs	Corn	103,5%	94,0%					
	Wheat	98,6%	95,0%					
	Barley	109,0%						
Corn price \$/t	180,00 \$	190,00 \$	200,00 \$	210,00 \$	220,00 \$	230,00 \$	240,00 \$	250,00 \$
Interest price Rye \$/t Low NE	186,30 \$	196,65 \$	207,00 \$	217,35 \$	227,70 \$	238,05 \$	248,40 \$	258,75 \$
Interest price Rye \$/t High NE	169,20 \$	178,60 \$	188,00 \$	197,40 \$	206,80 \$	216,20 \$	225,60 \$	235,00 \$
Wheat price \$/t	190,00 \$	200,00 \$	210,00 \$	220,00 \$	230,00 \$	240,00 \$	250,00 \$	260,00 \$
Interest price Rye \$/t Low NE	187,34 \$	197,20 \$	207,06 \$	216,92 \$	226,78 \$	236,64 \$	246,50 \$	256,36 \$
Interest price Rye \$/t High NE	180,50 \$	190,00 \$	199,50 \$	209,00 \$	218,50 \$	228,00 \$	237,50 \$	247,00 \$
Barley price \$/t	170,00 \$	180,00 \$	190,00 \$	200,00 \$	210,00 \$	220,00 \$	230,00 \$	240,00 \$
Interest price Rye \$/t Low/High NE	185,30 \$	196,20 \$	207,10 \$	218,00 \$	228,90 \$	239,80 \$	250,70 \$	261,60 \$
Interest price is the price at which the Rye will start to compete with the reference ingredient and start to pull-in								

QUESTIONS ?

