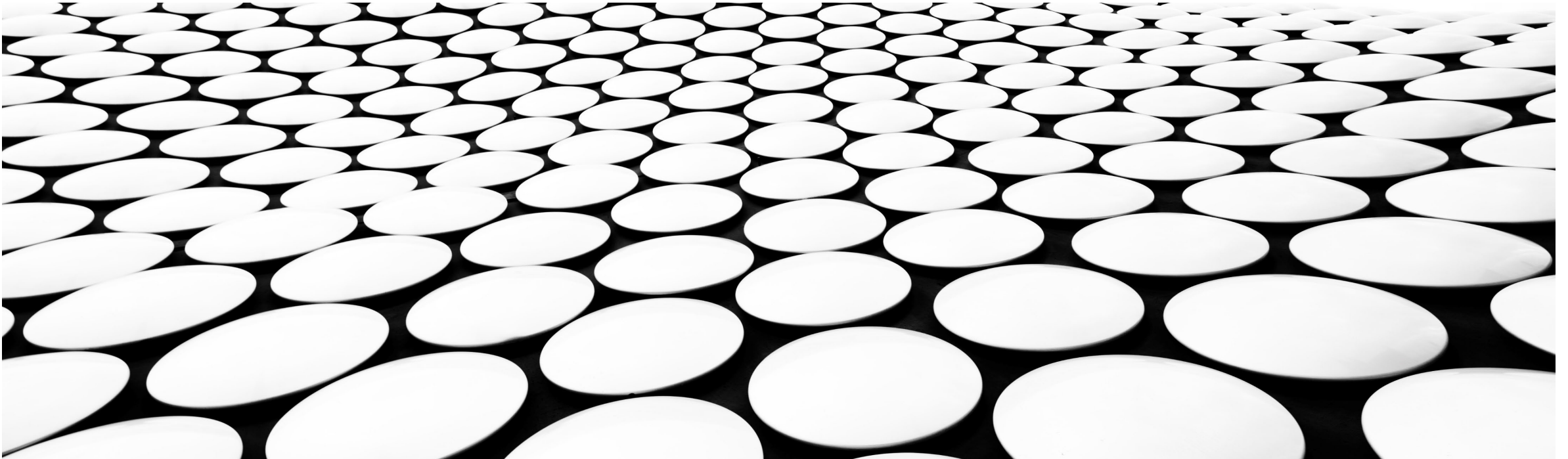
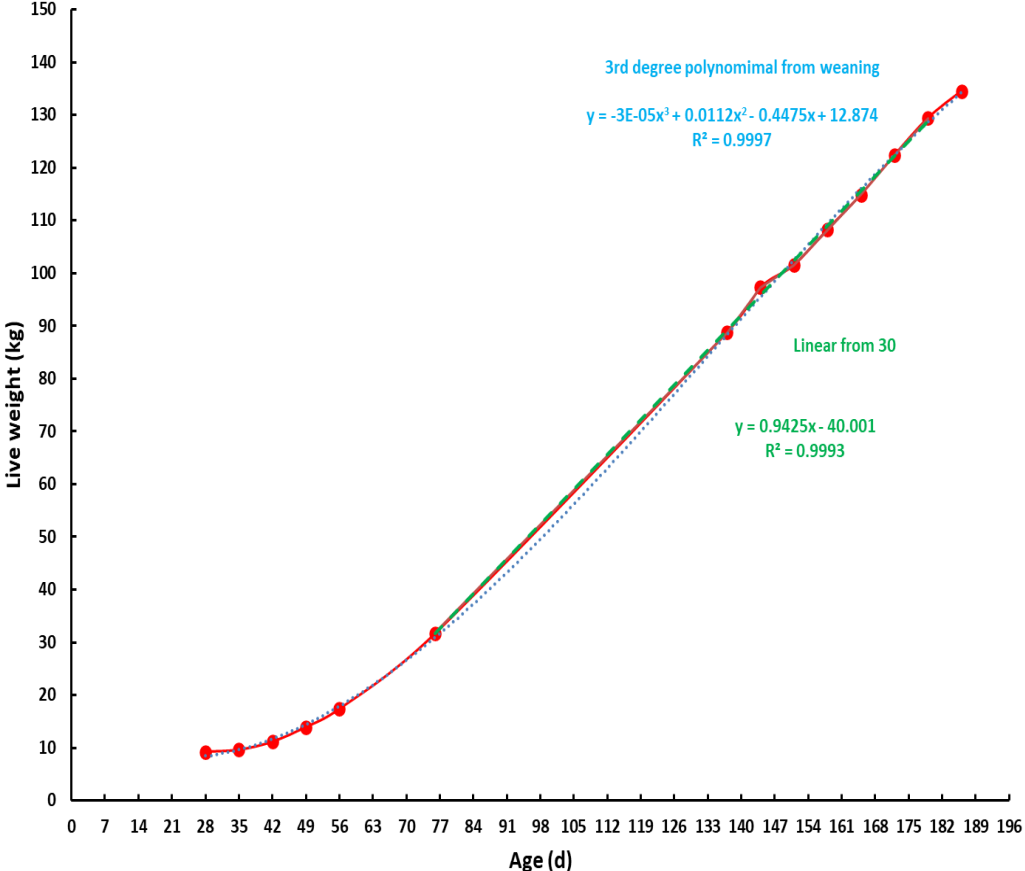

RECENT ADVANCES IN THE NUTRITION AND MANAGEMENT OF NURSERY PIGS

ARE OUR EXPECTATIONS TOO LOW?



WEIGHT FOR AGE OF PIC FEMALES (2024)



THE VARIABILITY IS SCARY

- Two studies conducted recently by KSU under commercial conditions.
- Investigated effects of different fish meals in 42-day studies.
- In both cases P1 and P2 diets fed for 21 days and common diet after 21 days.
- Start weight was 5.2 kg in experiment 1 and 4.7 kg in experiment 2.

Experiment	#1	#2
Start weight (kg)	5.2	4.7
21-day weight (kg)	9.4	7.6
42-day weight (kg)	18.6	14.3
ADG 0-42 (g)	320	228
Gain: Feed 0-42	0.640	0.620

TWO MORE FROM KSU

- Two studies as part of a PhD program on Ca and P
- First investigated effects of dietary P and 25OHD₃ on nursery pig performance and conducted at KSU under experimental conditions (5 pigs/pen). Study ran for 45 days.
- Second conducted at a commercial facility in New Horizon farms in Minnesota (26 pigs/pen) and investigated the effects of 1-25(OH)₂D₃ on nursery pig performance. Study ran for 42 days.
- First and second phase diets contained high level of ZnO in both studies.

RESULTS

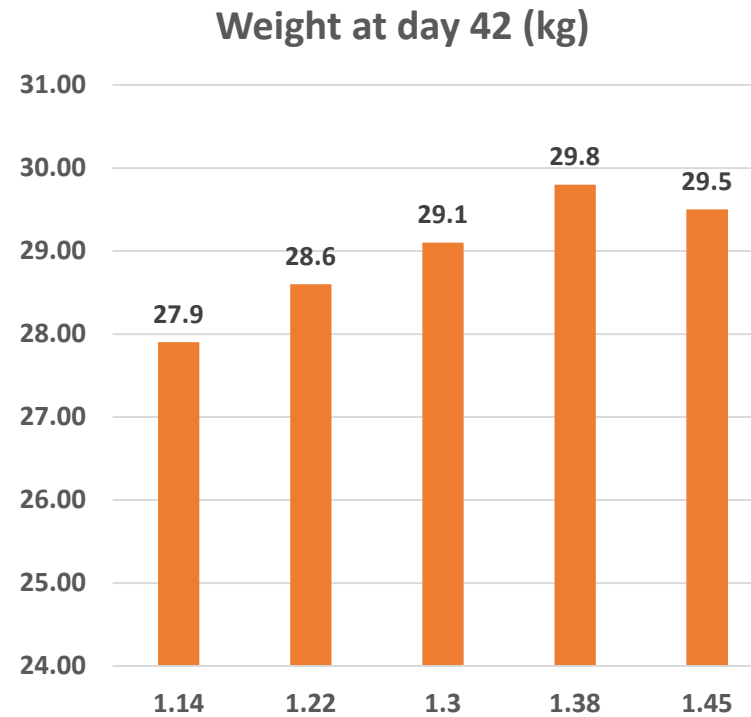
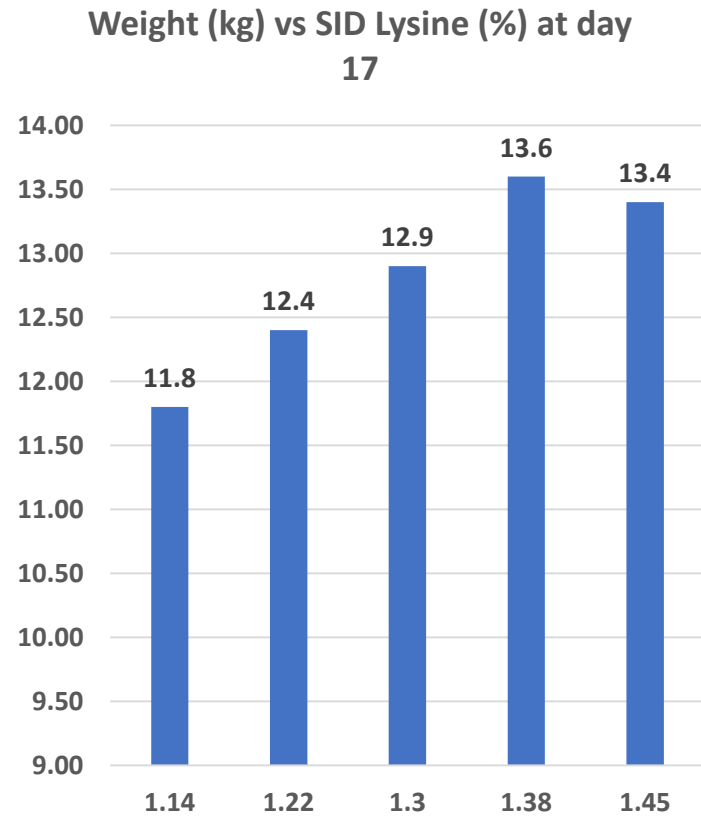
Experiment	#1	#2
Start weight (kg)	5.8	5.5
Day 10 (kg)	7.5	5.8 (7 days)
Day 21 (kg)	12.4 (22 days)	10.2
Day 45 (kg)	27.8	20.1 (42 days)
ADG 0-10 (g)	170	46
ADG 21 -42 (g)	768	459
Gain: Feed 0-10	0.897	0.654
Gain: Feed 21-42	0.654	0.660

Mortality and removals not reported in experiment #1 but was 15.5% in experiment#2

A RECENT STUDY BY HUBBARD – A BIT DIFFERENT

- ❑ A study to investigate the responses on nursery pigs to dietary SID lysine in diets with 10.5% NDF.
- ❑ Pigs started at 6.5 kg and were offered one of five diets ranging in SID lysine from 1.14% to 1.45%.
- ❑ Researchers would not tell us all the ingredients in the diet but it did contain 6.5% soy hulls and 6.5% sugar beet pulp.
- ❑ Diets offered for 17 days and followed by a common diet from 18 to 42 days.
- ❑ 2525 pigs involved 26/pen and 14 replicates/treatment
- ❑ 0.4% ZnO included in the diets fed to day 17
- ❑ SID Lysine levels (%): 1.14,1.22,1.30,1.36,1.45

LIVE WEIGHT AT 17 AND 42 DAYS AFTER WEANING



RESULTS

SID Lysine %	1.14	1.22	1.30	1.38	1.45	P =
0-17						
ADG (g)	312	346	377	415	408	<0.0001
G:F	.812	.857	.891	.910	.966	<0.0001
17-42						
ADG (g)	650	654	650	652	647	0.920
G:F	.699	.691	.684	.680	.676	<0.0001
0-42						
ADG (g)	510	527	537	554	548	<0.0001
G:F	.724	.729	.733	.736	.744	<0.0001

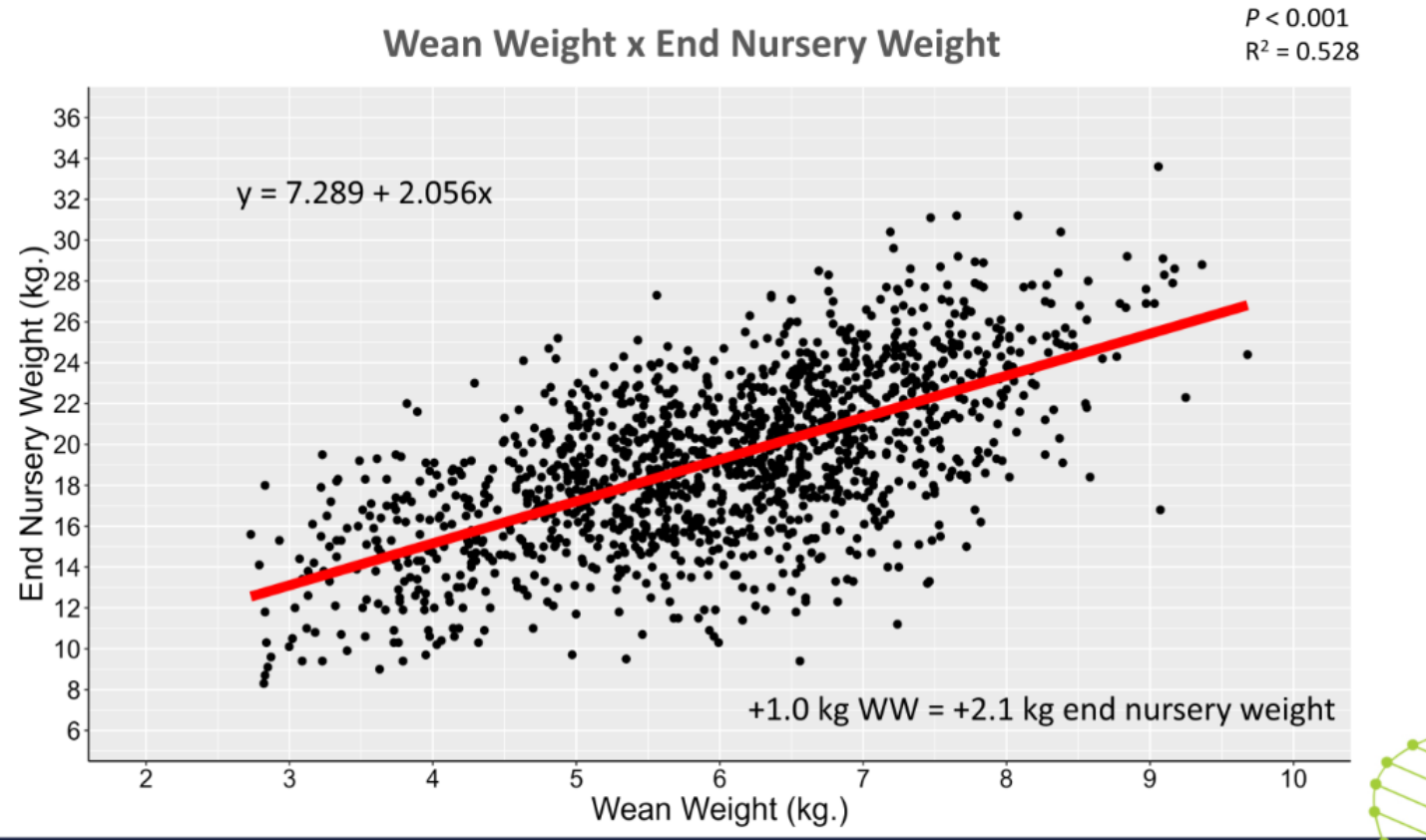
SO WHY SUCH BIG DIFFERENCES?

- Nursery entry weight
- Health of the piglets at weaning
- Stress prior to entering the nursery (like transport)
- Early diets
- Facility
- Other

SO WHY SUCH BIG DIFFERENCES?

- Nursery entry weight
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LINK BETWEEN WEANING WEIGHT AND NURSERY EXIT WEIGHT



EFFECT ON GAIN TO FEED



PERFORMANCE OF PRRS AFFECTED NURSERY PIGS

- ❑ Study in the USA in 2024
- ❑ 3028 pigs weaned at 21 days of age and confirmed positive for PRRS (sow herd broke with PRRS)
- ❑ Allocated across three treatments with three phase diet (0-2 ,2-4 and 4-6 weeks), First phase diet 17.6% CP and SID Lysine -1.2%.

Day post wean	Weight (kg)	ADG (g)	Gain: Feed
0	6.18		
14	9.13	200	794
28	14.0	350	666
42	27.8	663	647
0-42	27.8	432	672

Morbidity and mortality – 9.0%

WHAT ABOUT PRESSURE ON ZnO AND MANAGING SCOUR AND INCREASING INTAKE?

- ❑ Two ingredients that do enhance intake and one that can reduce the incidence of diarrhoea.
 - High levels of ZnO
 - Spray dried plasma
- ❑ **Relatively New strategies**
 - Reducing dietary CP and even essential amino acid levels
 - Return to reducing the ABC-4 of first and second phase diets
 - Low dose forms of Zn and lower ABC - 4 diets
- ❑ **Brand new**
 - Proteases , iodine , arginine, MSG

LET'S LOOK AT LOWER SBM /CP DIETS

- ❑ Results of low CP diets on health (scour) are inconsistent – largely because there is often no serious scour
- ❑ Results for performance are inconsistent – getting amino acids and total N right

RECENT STUDY FROM SDSU

- Investigated effects of low medium and high SBM with or without an enzyme mix and an enzyme mix plus acidifier on performance to 21-and-42 days post weaning.
- Pigs weaned at 18 days and weighing 5.9 kg
- Two diet phases in the experimental period (0-7 and 7-21 days with common diet from 21-42 days).
- 240 pigs weaned at 18 days of age and allocated across five dietary treatments in each with 8 replicate pens and 6 pigs/pen.
- They measured the trypsin inhibitor level of the SBM used and for each diet.
- Dietary SBM levels used in phase 1 and phase 2 diets. Low (17 and 20%) ,Med (22 and 25%) ,high (30 and 35%). The high SBM diets supplemented with an enzyme mix and the same enzyme mix plus a mixture of acids made up treatments 4 and 5.
- CP levels of the diets (21.8 and 21.8%) ,(23 and 21.9%) and (25.8 and 25.9%)
- TIU mg/kg (2.48 and 3.14), (3.74 and 2.72) and (4.02 and 2.93).
- First and second phase diets formulated to contain 1.5% and 1.35% SID lysine respectively

RESULTS

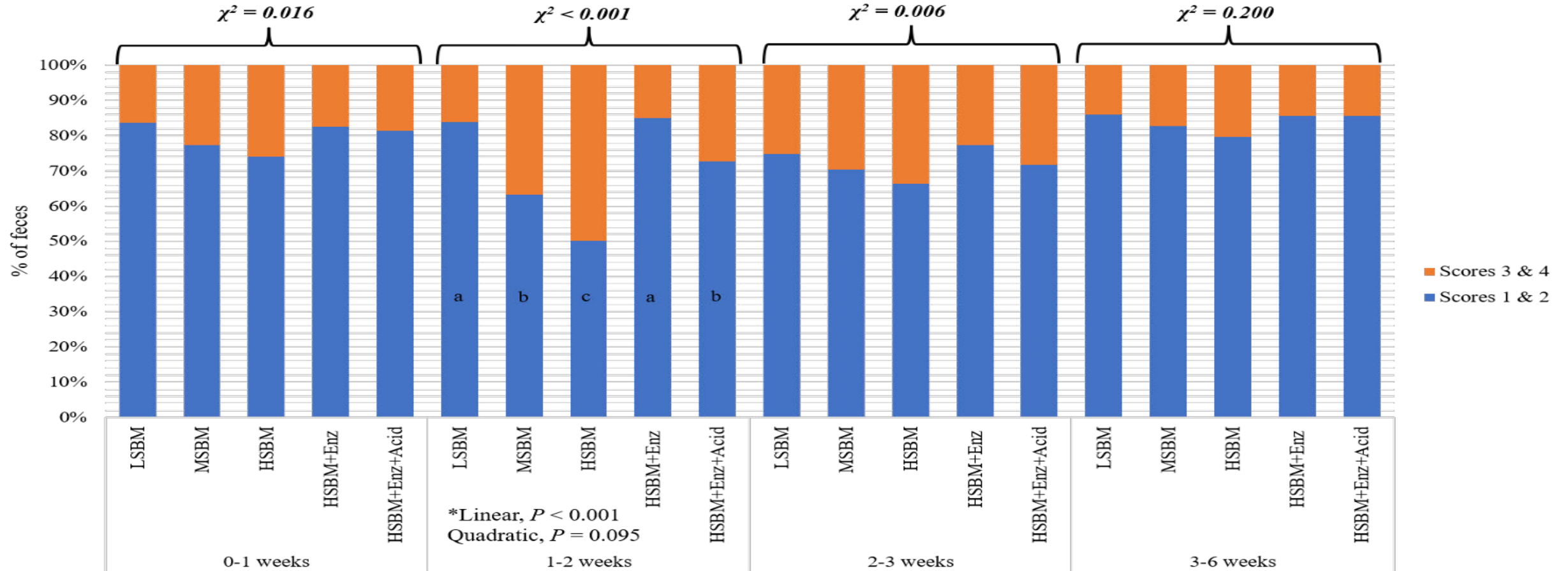
Treatment	Low SBM	Med SBM	High SBM	High +Enz	High +Enz +Acid	P =
Day 21 wt. (kg)	11.8	11.4	10.9	11.6	11.6	0.494
Day 42 Wt. (kg)	26.1	24.3	24.0	25.7	25.9	0.214
ADG (g) 0-21	280	259	237	267	267	0.100
ADFI 0-21 (g)	405 a	381 ab	340 b	368 ab	397 ab	0.027
G:F 0-21	0.69	0.67	0.70	0.73	0.67	0.200

EFFECTS ON AID OF ESSENTIAL AMINO ACIDS

Table 2.4. Effects of enzyme supplementation and acidifier on apparent ileal digestibility of amino acids in nursery pigs fed high SBM

Item	Dietary treatments					SEM	P-value
	Low SBM	Med SBM	High SBM	High SBM + Enzyme	High SBM + Enzyme + Acidifier		
Indispensable AA, %							
Arg	91.6 ^a	83.6 ^{ab}	72.8 ^b	82.0 ^{ab}	86.5 ^a	4.10	0.041
His	88.4 ^a	77.1 ^{abc}	66.1 ^c	74.6 ^{bc}	81.0 ^{ab}	4.66	0.030
Ile	86.8 ^a	75.2 ^a	54.0 ^b	71.3 ^{ab}	78.4 ^a	6.25	0.014
Leu	86.4 ^a	73.9 ^a	55.6 ^b	71.1 ^{ab}	78.8 ^a	6.14	0.020
Lys	91.4 ^a	83.1 ^{ab}	72.1 ^c	80.0 ^{bc}	85.3 ^{ab}	3.58	0.011
Met	92.0 ^a	84.5 ^{ab}	73.9 ^b	82.7 ^{ab}	88.2 ^a	3.57	0.016
Phe	91.4 ^a	77.7 ^{bc}	70.5 ^c	74.7 ^{bc}	85.7 ^{ab}	4.45	0.016
Thr	86.5 ^a	75.2 ^a	59.0 ^b	71.4 ^{ab}	78.4 ^a	5.26	0.015
Trp	91.9 ^a	84.2 ^{ab}	71.0 ^b	79.8 ^{ab}	86.4 ^a	4.58	0.038
Val	88.0 ^a	75.6 ^{abc}	60.6 ^c	71.9 ^{bc}	81.2 ^{ab}	5.39	0.016

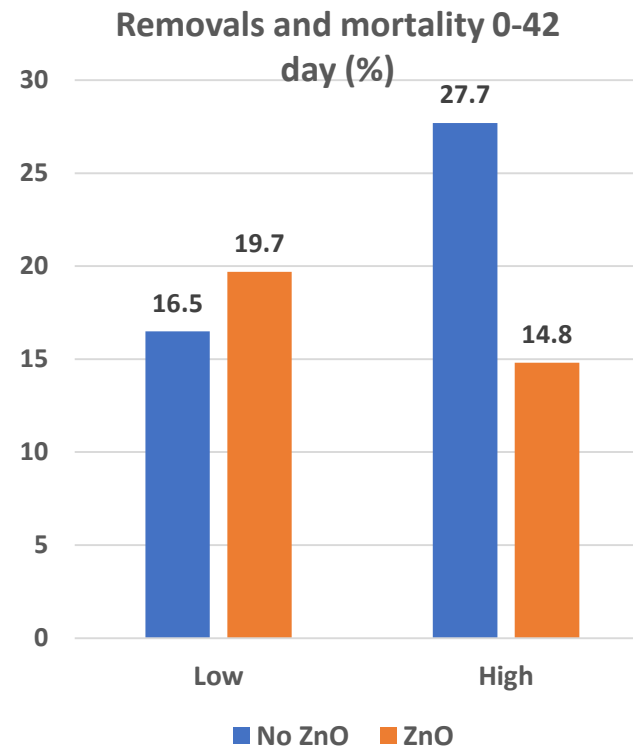
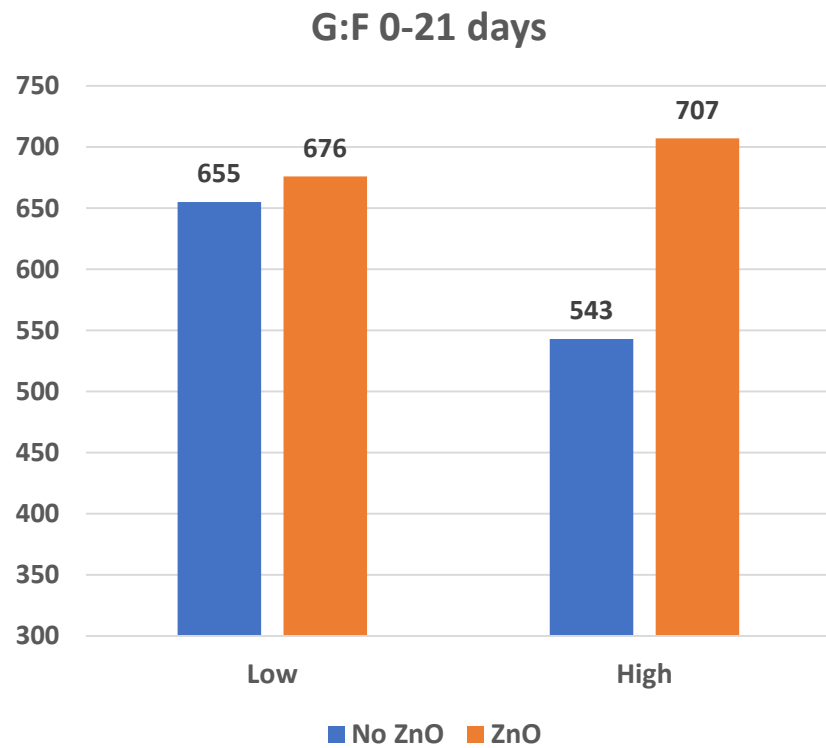
EFFECTS ON SCOUR



REDUCING THE ACID BINDING CAPACITY OF INITIAL DIETS

- ❑ Study conducted by KSU in commercial research facilities.
- ❑ Used 1057 pigs weaned at 21 days and 6.2 kg.
- ❑ Four diet treatments each with 12 replicate pens each with 22 pigs/pen.
- Used special Soy bean product and an acid and other to formulate low and high ABC-4 diets from 0-21 days and common diet from day 21 to day 42.
- ZnO was included or not at 0.3% and 0.28% in the first and second phase diets.
- So, a 2x2 factorial study – low and high ABC-4 and with or without ZnO
- P1 diets contained 19% SBM and 22.5% CP and no whey powder or speciality products other than 13% of the special soy protein (low ABC).
- P2 diet also simple (maybe too simple) with 23% CP , 23% SBM and 10.75% of the speciality soy protein

RESULTS FOR G:F 0-21 DAYS AND REMOVALS AND MORTALITY (0-42 DAYS)



PROTECTED ZnO ALTERNATIVE

- Study conducted in Colombia
 - 480 pigs weaned at 26 days of age
 - Allocated across four diet treatments and three diet phases to 61 days of age
 - Phases 1: 26-32 days of age. 2: 33-45 days of age , 3: 45 – 61 days of age
 - Four diet treatments all without antibiotics.
1. Free ZnO at 3000 and 1500 ppm in phases 1 and 2 and 150 ppm in P3.
 2. Protected ZnO at 400 ppm in all phases
 3. Protected ZnO at 600 ppm in all three phases
 4. Protected ZnO at 800 ppm in all three phases

RESULTS

Treatment	High ZnO	PZn400	PZn600	PZn800	P =
Weight @61 days of age (kg)	25.5	25.4	25.4	25.5	NS
Feed conversion ratio	1.63 b	1.57 ab	1.49 ab	1.44 a	<0.10
Feed cost savings \$/kg gain (%)	Zero	2.5	6.5	9.8	<0.01
Faecal Zn (%)	1.2	0.3	0.3	0.3	0.001

Product used widely in nursery diets in Australia at 1 kg/tonne (400 ppm Zn)
Has no adverse effect on palpability and Zn released across the whole GIT
Zn excretion reduced by 75% across treatments

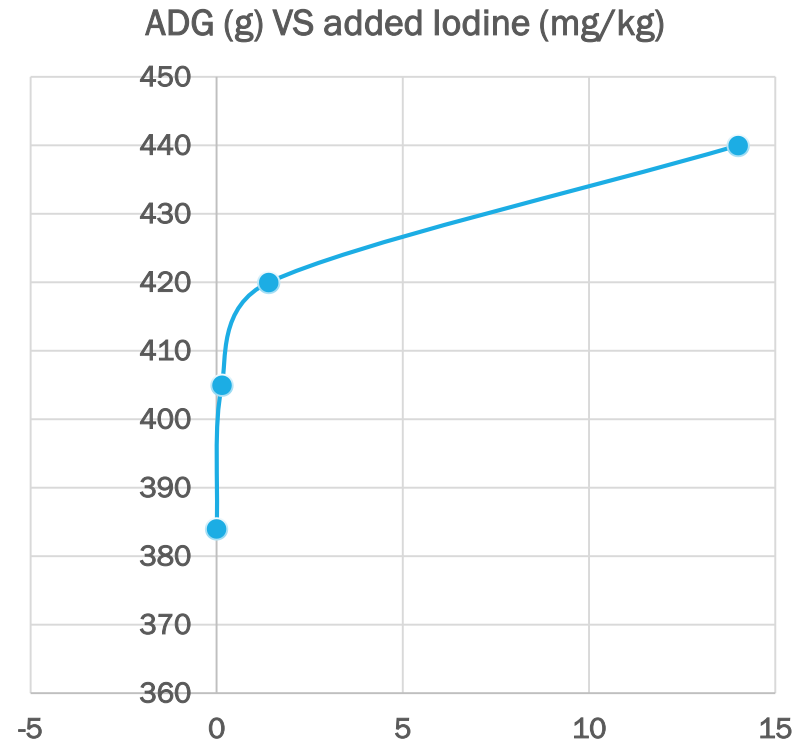
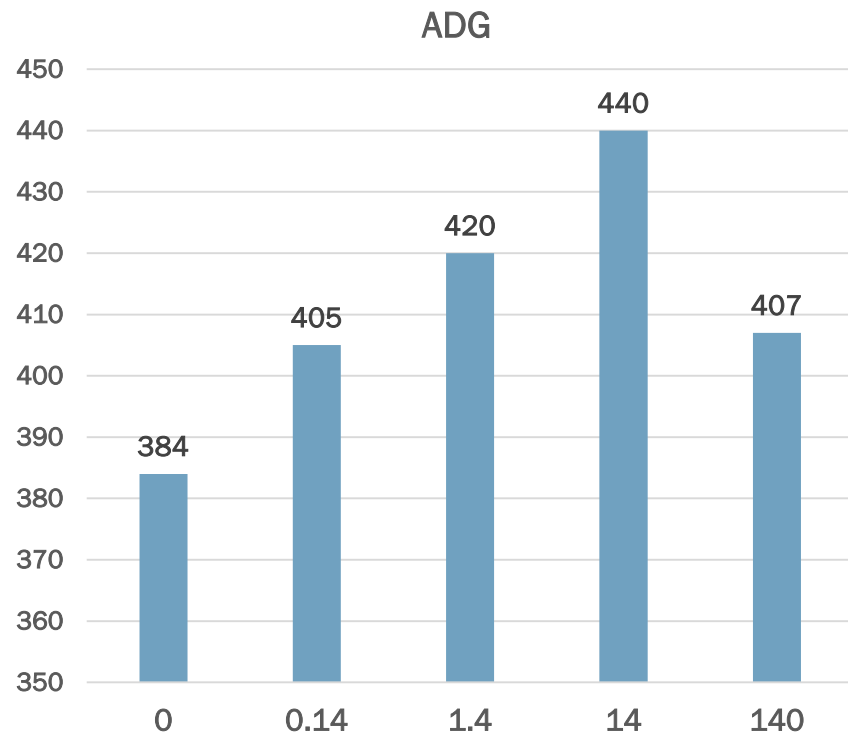
NOW FOR OTHER POSSIBLE “SOLUTIONS”

- Iodine
- Arginine
- Protease
- MSG

IODINE AND NURSERY PIG PERFORMANCE

- ❑ Iodine is needed for thyroid function and general metabolism
- ❑ Rarely considered with NRC (2012) recommendation for added I at 0.14 mg/kg
- ❑ Study investigated 5 added levels: 0 ,0.14 ,1.4, 14 and 140 mg/kg (0-1000 NRC)
 - Nine replicate pens each with 4 pigs weaned at 21 days and 5.4kg
 - Three diet phases: 0-10 ,11-21 and 22-35
 - Measured plasma T4 and T4 to T3 ratio at day 35

EFFECTS ON GROWTH RATE



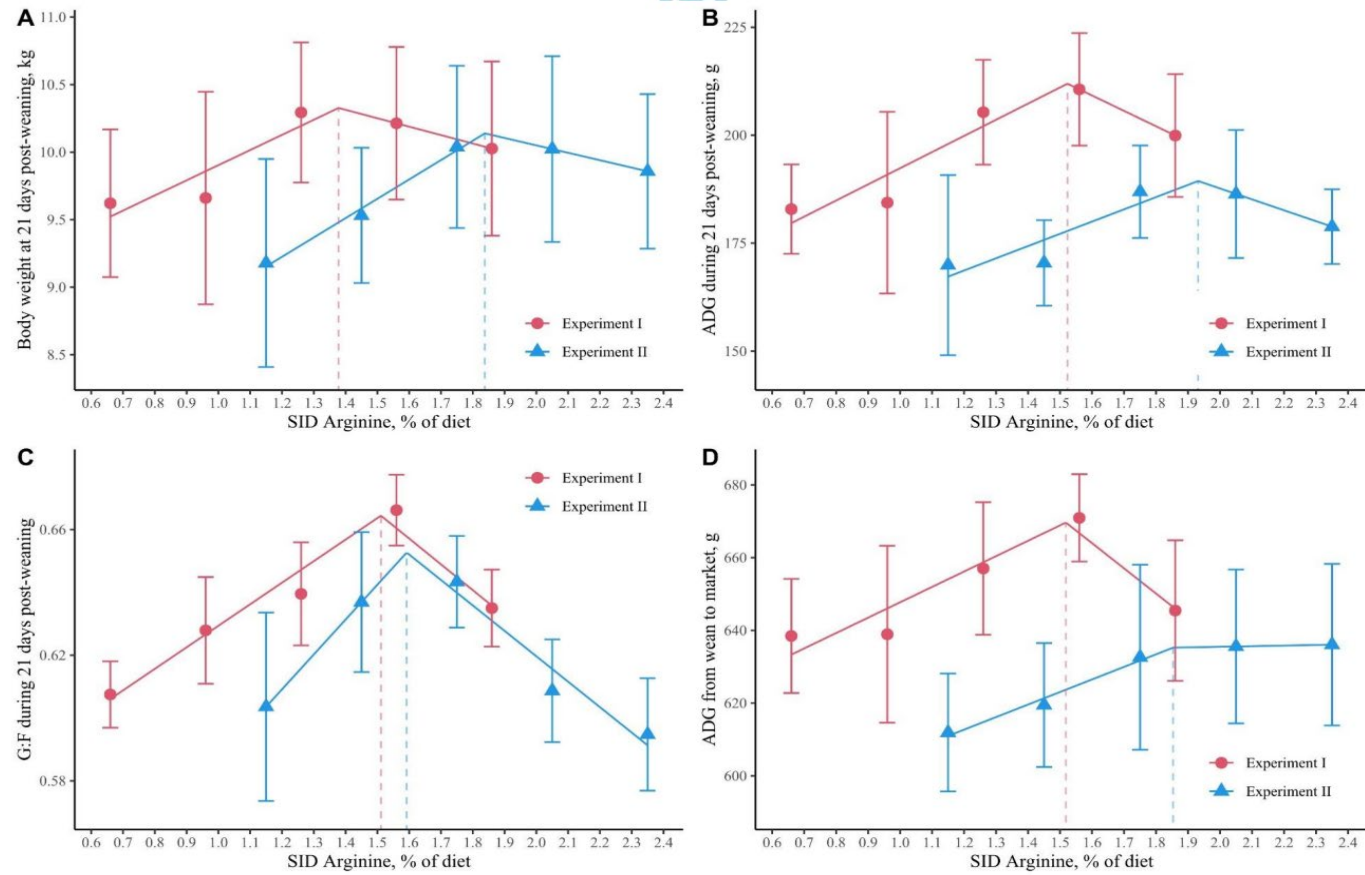
ITS ALL ABOUT ARGININE

□ Study conducted by SDSU

- Two experiments looking at effects of arginine on performance wean – 21 days and common diet 22-42 days. Taken through to sale.
- Pigs weaned at 20 days and 5.4 kg
- First with lower level of SBM (9%) and lower CP (16%) 25% and 18% dried whey in P1 and P2 diets. Five levels of SID Arginine 0.66% (NRC) to 1.86%. Nine replicate pens/treatment each with 5 pigs
- Second –more commercial: SBM (26%) and CP (21%) dried whey at 15% and 8% in P1 and P2 diets. Five levels of SID Arginine 1.15% to 2.35%. Eight replicate pens/treatment each with 5 pigs.
- SID lysine @ 1.50% and 1.35% in first (0-7) and second (8-21) phase diets in both experiments

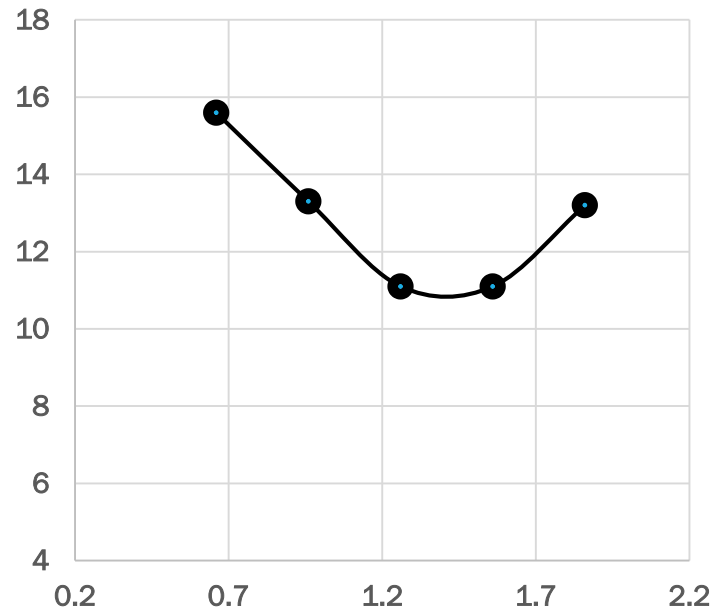
PERFORMANCE TO DAY 21 AND OVERALL

Figure 1

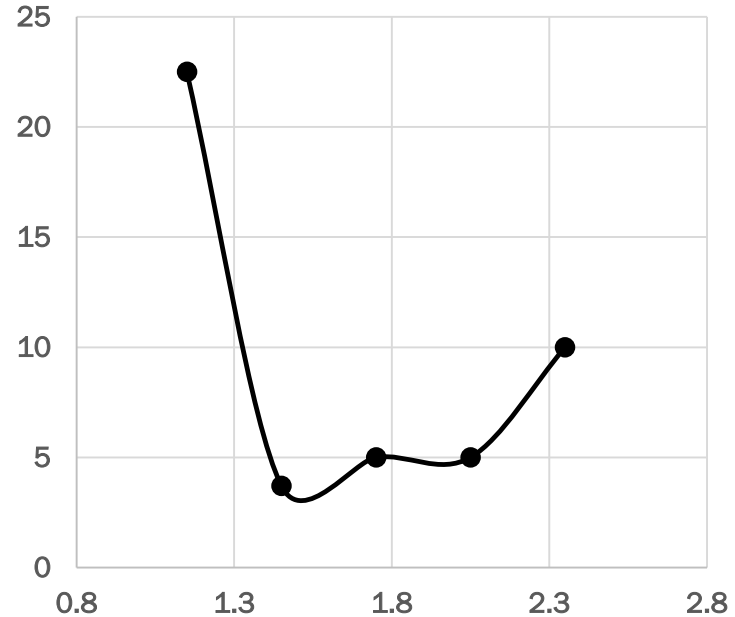


PIGS WHICH LOST WEIGHT IN WEEK 1 VS SID ARGININE (%)

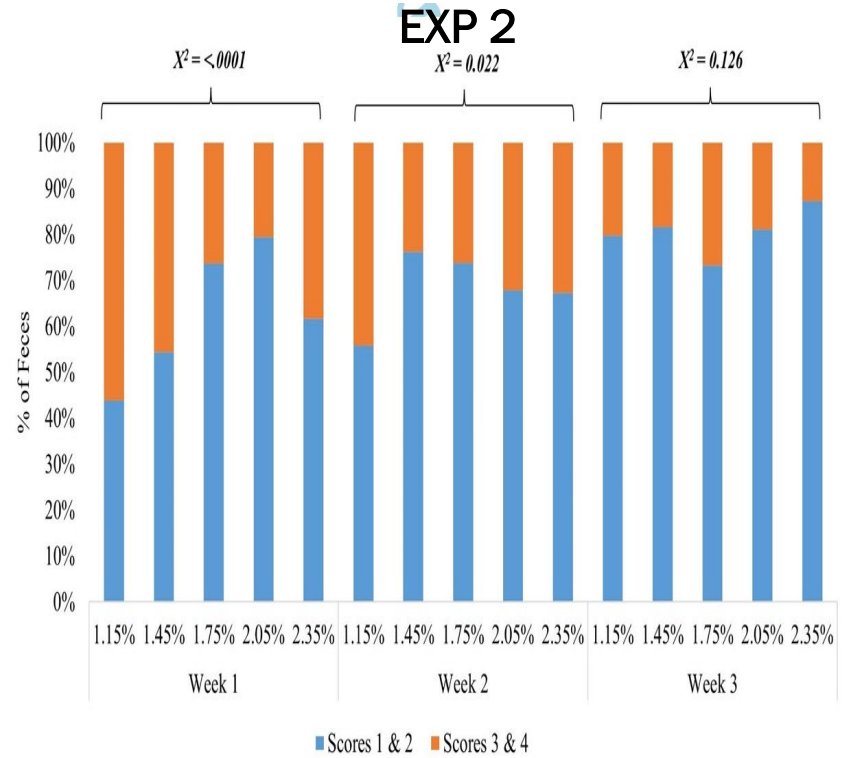
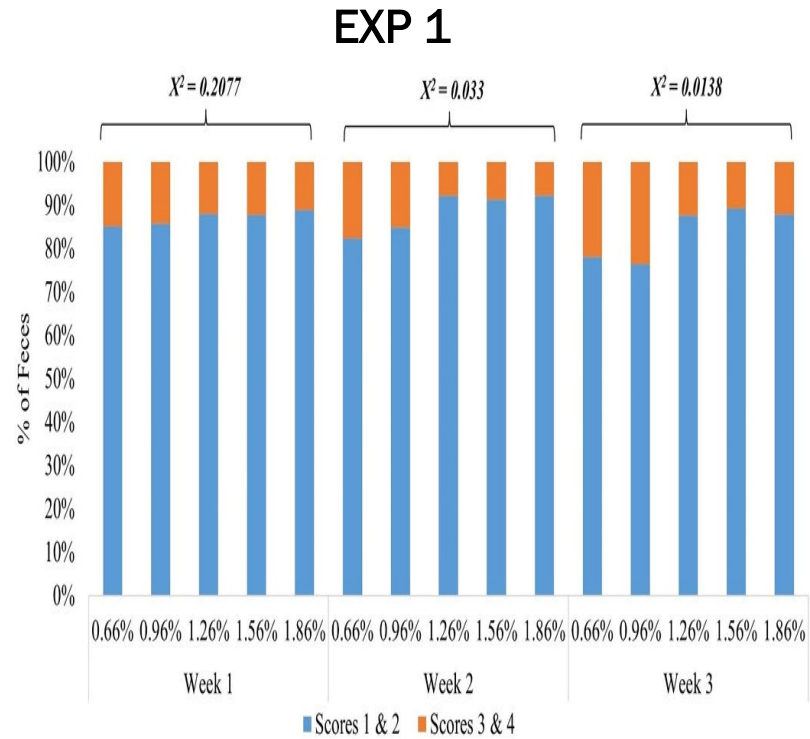
% pigs which lost weight in week 1
Experiment 1



% pigs which lost weight in week 1
Experiment 2



FAECAL SCORES IN EXPERIMENTS 1 AND 2





IMPLICATIONS

- ❑ These researchers may have tripped over a functional amino acid**
- ❑ Increasing evidence that SID arginine to SID lysine ratio in first and second phase weaner diets at 0.85-1.0**
- ❑ NRC (2012) 0.45:1**
- ❑ Effects on increased growth in most cases seem to be feed intake driven**
- ❑ Possible that diets used in Experiment 2 were inappropriate**



PROTEASE – SOME CANADIAN RESULTS

- Probably the most effective additive for nursery diets after ZnO.
- Briefly discuss two Canadian studies – one in 2016 and the other in 2024

WEANER STUDY - 2016

- Duration 14 days
- Positive control diet: Standard with 22% SBM and 5% whey powder and 3% fish meal
- Negative control diet: 31% SBM and no whey powder or fish meal
- Otherwise, similar nutrient contents
- Pigs weaned at 21 days and 10 replicate pens/treatment.
- Four doses of Jefe protease supplemented to the negative control diet
 - ❖ Zero , 100 ,200 and 300 g/tonne
 - ❖ Diets were all pelleted

RESULTS 0-14 DAYS

ITEM	Positive Control	Negative Control	NC +100 mg/kg Pro	NC +200 mg/kg Pro	NC + 300 mg/kg Pro	P =
ADG (g)	285 ab	258 c	274 b	293 a	292 a	<0.05
ADFI (g)	330 b	312 c	327 b	343 a	345 a	< 0.05
Villus height (um)	345 b	317 c	328 b	350 a	342 a	<0.05
Protein digestibility (%)	87.2 ab	80.2 c	84.0 b	88.0 a	87.0 a	<0.05
Incidence of diarrhoea (%)	1.79 a	3.37 b	2.34 a	1.84 a	1.91 a	<0.05

IMPLICATIONS

- ❑ The protease enables diet CP to be reduced without loss of performance
- ❑ Potential to reduce feed cost
- ❑ Will reduce incidence and severity of diarrhoea
- ❑ Will enhance GIT integrity
- ❑ The perfect additive for nursery diets

INCREASING WEIGHT AT WEANING

- ❑ Increase age at weaning – we all know this
- ❑ Recent evidence that 3% fish oil in sow diet in late gestation and lactation increases birth weight and weight at weaning – warrants validation
- ❑ Higher energy diets for lactating P1 and P2 sows and smart feed systems to increase sow intake in lactation
- ❑ Some past evidence that offering suckling pigs flavoured water in lactation stimulates creep intake and increases weaning weight and intake in first week after weaning – happy to follow up if you want
- ❑ Might be time to revisit creep feeding – take it more seriously



Study with 30 multiparous sows

Three treatments over 29-day lactation

Control

Control plus 1% MSG

Control plus 2% MSG

Sows all started lactation with 9 piglets

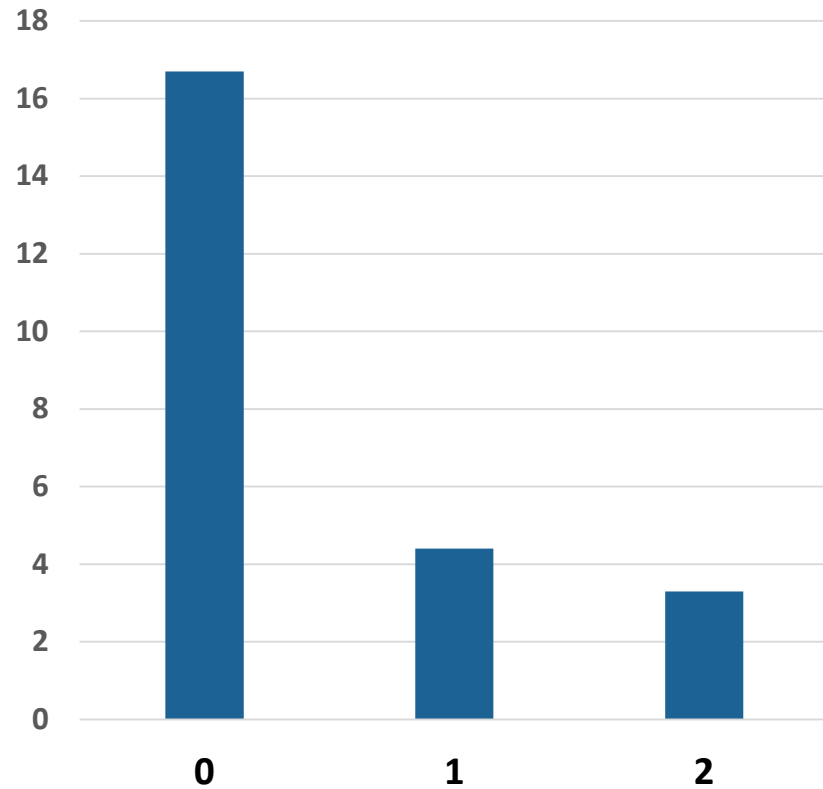


**PERFORMANCE
IN LACTATION**

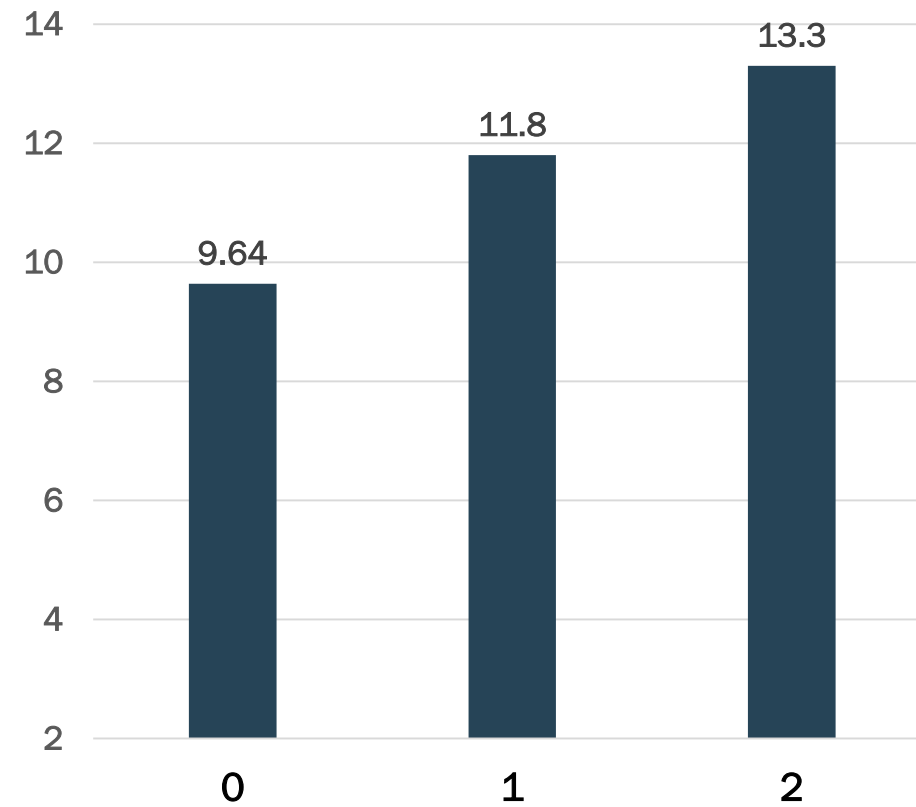
Dietary MSG (%)	Control (0)	1.0	2.0	P =
Sow weight loss (kg)	21.3	17.3	13.4	NS
PWM (%)	16.7	4.4	3.3	0.001
Weaning weight (kg)	9.6	11.8	13.3	0.001
Piglet ADG (g)	285	361	405	0.001
Litter weight gain (kg/d)	2.28	3.35	3.65	0.001

PREWEANING MORTALITY AND WEAN WEIGHT

PWM (%) Vs Dietary MSG (%)



Wean Wt. (kg) vs Dietary MSG (%)

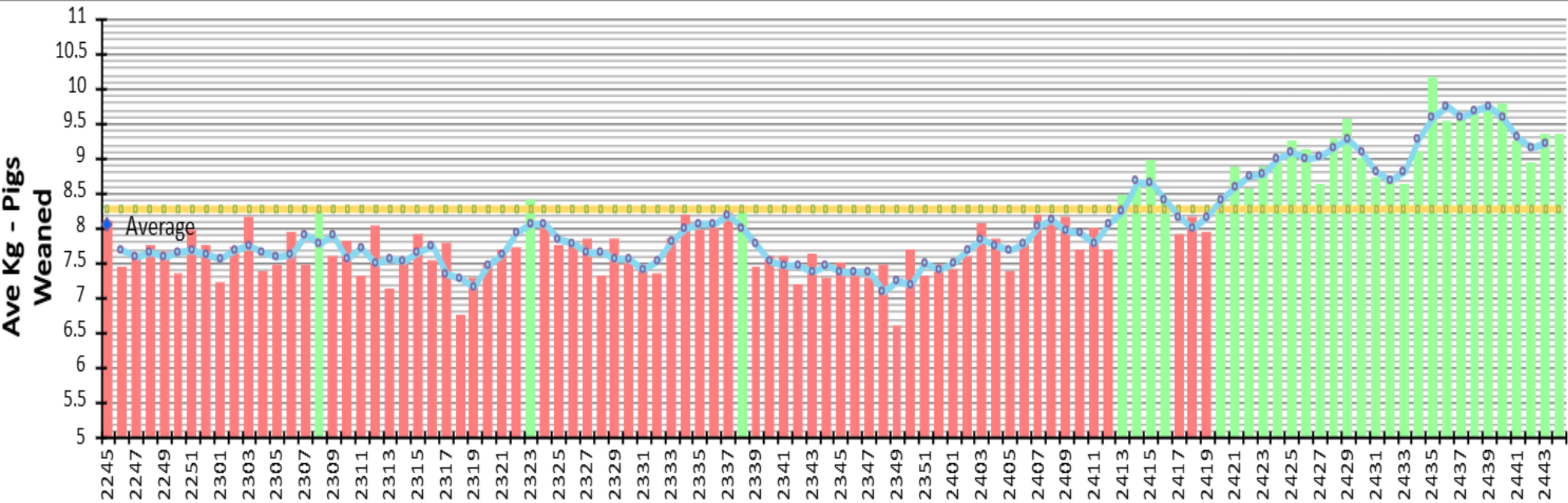




THE MECHANISM

- High intake of glutamate reduces use of other amino acids as energy source by the portal drained viscera.
- Markedly increases the nutrient content of milk.
- Small increase in sow feed intake

IMPACT OF MORE CREEP ON WEANING WEIGHT



STRATEGIES THAT MIGHT WORK

- ❑ Pay more attention to creep feeding
- ❑ Reduce CP and SBM levels in phase 1 and 2 diets
- ❑ Include higher levels of dried whey in both diets and even SDP in the first diet – don't skimp
- ❑ Higher levels of ZnO if permitted
- ❑ Otherwise, reduce ABC-4 to 250-300 Meq. And include a low dose Zn product
- ❑ Include protease in both diets – happy to discuss further if required
- ❑ Increase dietary Iodine (5-10 mg/kg)
- ❑ Try increasing arginine in the diets for challenged /problem nurseries
- ❑ Try MSG in lactation diet