

Nonruminant Nutrition: Enzyme Supplementation and By-Products in Swine Diets

568 Chemical composition, phytate phosphorus release during steeping and feeding value of corn steep water for pigs. S. J. Niven^{*1}, O. A. Izquierdo², C. Zhu¹, D. Columbus¹, and C. F. M. de Lange¹, ¹University of Guelph, Ontario, Canada, ²Corn Products International, Westchester, IL.

Corn steep water (CSW) is a co-product of the wet milling industry and may be used as a liquid feed ingredient for pigs. Samples of CSW (n=3) were analyzed to have a pH of 4.3 45% DM and contain, within DM, 50% crude protein, 2% lysine, 18.0% ash, 5% potassium, 3.3% phosphorus (P), 1.5% magnesium, 0.5% crude fat and 20% lactic acid. The high lactic acid content may reduce pathogen load and stimulate gut development in pigs. In a performance study (4 pens of 8 pigs per treatment; 63 to 105 kg BW), pigs were fed with a computer controlled liquid feeding system, and corn and soybean meal based diets that contained 0, 5 or 10% CSW on a dry matter basis. Growth rate (1.10, 1.17, 1.06 kg/d; SE 0.03) and gain:feed (2.46, 2.30, 2.45; SE 0.05; 88% DM basis) were not influenced (P>0.10) by dietary treatment. In corn condensed distillers' solubles (CDS) most P is phytate-bound. In an attempt to release phytate-bound P, 200 ml samples of CSW were steeped with a commercially available phytase (Natuphos) at 4 inclusion levels (125, 250, 500 and 750 FTU kg⁻¹ DM), at two temperatures (40°C and 50°C), and with 3 replicates per treatment combination. The samples were continuously agitated. Release of phytate P was measured as the appearance of soluble P at 0, 3, 6, 12, 24, 48 and 96 h after adding phytase. At 0 h, CDS contained 6 gP kg⁻¹ DM (SE 0.11) soluble P and 30.7 gP kg⁻¹ DM (SE 0.43) total P. Rate of phytate P release was increased (P<0.05) with both temperature and phytase inclusion level. At 50°C and with 750 FTU kg⁻¹ appearance of soluble P was maximized at 27.17 gP kg⁻¹ DM (SE 0.28) of total P after 24 h. For all treatment combinations, there was no further increase (P>0.10) in soluble P after 48h of steeping. These studies indicate that CSW can be an effective feed ingredient for pigs and can supply significant amounts of available P.

Key Words: Corn steep water, Phytase, Pig

569 Addition of phytase and xylanase to wheat-based diets fed to growing pigs using growth performance and nutrient balance as response criteria. O. A. Olukosi^{*1}, J. S. Sands², and O. Adeola¹, ¹Purdue University, West Lafayette, ²Danisco Animal Nutrition, Marlborough, UK.

The study was designed to investigate the response of growing pigs to xylanase and phytase when used in a wheat-based diet. The wheat-based diet also contained wheat middlings and canola meal. The experiment consisted of a 6-wk growth trial and 14-d nutrient balance. One-hundred fifty pigs weighing 23 kg were used for the 6-wk growth trial. The pigs were blocked by weight and gender and assigned to 5 dietary treatments in a randomized complete block design. The treatments were a positive control (PC); negative control (NC) diet marginally deficient in phosphorus (P) and metabolizable energy (ME);

NC plus phytase added at 500 FTU/kg; NC plus xylanase added at 4,000 U/kg; and NC plus phytase and xylanase added at 500 and 4,000 units/kg, respectively. Nutrient balance study was conducted using 24-kg pigs in metabolism cages that allowed total but separate collection of urine and feces. Final weight and daily gain were higher in the PC than NC (P < 0.05); there were no effects of enzyme addition on these response criteria. Feed intake and gain:feed were not significantly different in all the treatments. Addition of phytase alone or in combination with xylanase improved (P < 0.05) P digestibility. Metabolizable energy was higher (P < 0.05) in the PC compared with NC, but there were no effects of the addition of the enzymes on ME. Phosphorus excretion was highest (P < 0.01) in the PC and lowest (P < 0.05) in the diet with combination of phytase and xylanase. Combination of the two enzymes improved P retention (P < 0.01) above the NC diet to a level similar to the PC. In conclusion, the combination of phytase and xylanase was efficient in reducing excretion and increasing P retention in growing pigs fed wheat-based diet.

Key Words: Xylanase, Phytase, Retention

570 Effects of xylanase and wheat middlings in diets for finishing pigs. C. Feoli^{*}, J. D. Hancock, C. R. Monge, C. L. Jones, and C. W. Starkey, Kansas State University, Manhattan.

A total of 312 finishing pigs (avg initial BW of 64.5 kg) was used in a 62-d experiment to determine the effects of xylanase and wheat middlings on growth performance and carcass characteristics. Treatments were a corn-soybean meal-based diet without and with 826 mg/kg xylanase product (to supply none and 2,313 units of xylanase activity per kg of diet) and wheat middlings (none, 15%, and 30%) arranged as a 2 x 3 factorial. The pigs were sorted by sex and ancestry and blocked by BW with 13 pigs/pen and four pens/treatment. Feed and water were consumed on an ad libitum basis until the pigs were killed (avg BW of 121 kg) at a commercial slaughter facility. Overall, there were no interactions among xylanase addition and concentration of wheat middlings for ADG, ADFI, G:F, dressing percentage, last-rib backfat thickness, or percentage carcass lean (P > 0.26). As for the main effects, addition of xylanase did not change overall growth performance or carcass measurements (P > 0.16). As concentration of wheat middlings was increased from none to 30%, there were linear decreases in overall ADG (P < 0.003), G:F (P < 0.002), dressing percentage (P < 0.002), and last-rib backfat thickness (P < 0.06) while percentage carcass lean increased (P < 0.03). However, the effects on carcass fatness and lean percentage disappeared (P > 0.71) when hot carcass weight was used as a covariate. In conclusion, increasing the concentration of wheat middlings in diets for finishing pigs reduced rate and efficiency of gain and addition of xylanase did not prevent these effects.

Table 1.

Item	Without xylanase			With xylanase			SE
	0	15	30	0	15	30	
ADG, kg	0.944	0.918	0.885	0.951	0.916	0.893	0.038
ADFI, kg	2.87	2.96	2.91	2.97	2.96	3.01	0.14
G:F	0.329	0.310	0.304	0.320	0.309	0.297	0.016
Hot carcass weight, kg	91.5	89.9	86.9	91.5	89.6	88.1	1.6
Adjusted dressing percentage	74.5	74.3	73.3	74.4	74.1	73.6	0.3
Adjusted back fat, mm	21.3	21.0	21.3	22.0	20.8	22.3	2.6
Adjusted lean percentage	53.3	53.3	53.3	53.0	53.4	52.8	1.1

Key Words: Pig, Wheat middlings, Xylanase

571 Toxicity of Fusarium mycotoxins and detoxification by mycotoxin degrading enzymes. G. Schatzmayr^{*1}, U. Hofstetter¹, and C. Yeong-Hsiang², ¹BIOMIN GmbH, Herzogenburg, Austria, ²National I-Lan University, I-Lan, Taiwan.

Deoxynivalenol (DON) and zearalenone (ZON) are the most frequently occurring mycotoxins in the United States (US), Canada and Central Europe. They are produced by *Fusarium* species on a great variety of commodities. Amongst all animal species pigs are most affected by the uptake of these fungal toxins. The aim of this study was to test the synergistic effects of deoxynivalenol (DON) and zearalenone (ZON) on performance parameters, blood biochemistry and immune parameters of pigs. Further the effect of Mycofix[®]Plus (MP), a product based on mycotoxin degrading enzymes, was investigated in this experiment. A total of 48 weaning pigs were allocated to four treatments including control, toxin (DON and ZON), toxin + MP (DON, ZON, and MP), and MP alone for a 6 wk challenge trial. The concentration of DON (1mg/kg) and ZON (0.25mg/kg) were below the recommended tolerance levels for swine diets in the US. After 6-wk the growth performance parameters of the toxin group (BW = 26.2kg; ADG = 412g) were significantly ($P \leq 0.05$) affected by DON and ZON (control group; BW = 29.08kg; ADG = 495g). The addition of MP (0.15%) neutralized the negative impact of the mycotoxins on BW (29.1kg) and ADG (476g). The addition of MP alone did not show any improvement in comparison to the control group. Besides performance parameters also serum biochemistry parameters, alveolar macrophages activity, antibody titers for pseudorabies (PR) vaccine and cytokines secretion profile were significantly impaired ($P \leq 0.05$) by the combination of DON and ZON. The addition of MP counteracted the detrimental effect on aspartate aminotransferase and alleviated the negative influence of the mycotoxins on chemotaxis and phagocytosis. Some improvement (not significantly different) of the PR vaccination response was also noted when MP was added to the toxin containing diet. This study showed that mycotoxin concentrations below the recommended tolerance levels in the United States and Canada occurring together in animal diets can lead to significant economic losses and the addition of MP is useful in alleviating toxic effects.

Key Words: Mycotoxin, Deactivation, Enzymatic degradation

572 Energy and phosphorus digestibility in high-protein distillers dried grain with solubles fed to growing pigs. M. R. Widmer^{*1}, M. L. Gibson², L. M. McGinnis¹, C. Pedersen¹, and H. H. Stein¹, ¹South Dakota State University, Brookings, ²Dakota Gold Marketing, Sioux Falls, SD.

Two experiments were conducted to measure the digestibility of energy and phosphorus in a new co-product from the ethanol industry. This product is produced by de-hulling and de-germing corn before it enters the fermentation process. The resulting distillers grain with solubles (DDGS) contains approximately 38% CP and 0.40% P. In Exp. 1, six growing pigs were placed in metabolism cages and fed a corn-based diet (97.6% corn) and a corn-DDGS based diet (50% corn, 47.7% DDGS). The DE and ME were measured for each diet and the DE and ME were then calculated for DDGS by subtracting the contribution of corn to the energy in the corn-DDGS diet. Results of this experiment showed that the DE and ME in high-protein DDGS is 4,763 and 4,476 kcal per kg DM, respectively. These values are greater ($P \leq 0.001$) than the DE and ME in corn (4,056 and 3,972 kcal per kg DM, respectively). Experiment 2 was conducted to measure the apparent total tract digestibility (ATTD) of Ca and P and the true total tract digestibility (TTTD) of P in high-protein DDGS. A P-free diet based on gelatin, cornstarch, and sugar, and a DDGS-based diet containing DDGS (60.0%), cornstarch, and sugar were formulated. Each diet was fed to eight growing pigs during one 14-d period with total collections of urine and fecal matter during the last five d of the period. The ATTD and the retention of Ca and P were calculated for the diet containing DDGS and the endogenous loss of P was estimated from the pigs fed the P-free diet. Results of this experiment showed that the ATTD for Ca and P in high-protein DDGS are 75.0 and 59.6%, respectively and the retention of Ca and P are 52.6 and 58.9%, respectively. The endogenous loss of P was estimated at 211 ± 0.04 mg per kg DMI. By correcting the ATTD of P for the endogenous loss, the TTTD of P was calculated at 69.3%. It is concluded that high-protein DDGS has a high digestibility of energy, Ca, and P and it is expected that this feed ingredient will have a greater value than conventional DDGS when fed to pigs.

Key Words: Digestibility, High-protein DDGS, Pigs

573 Effects of replacing corn with triticale in diets for nursery and finishing pigs. C. R. Monge^{*}, J. D. Hancock, T. L. Gugle, and C. Feoli, Kansas State University, Manhattan.

Two experiments were conducted to determine the effects of replacing corn (none, 33.3%, 66.7%, and 100%) with triticale on growth performance and nutrient digestibility in pigs. For the 34-d nursery experiment, 168 weaning pigs (avg initial BW of 6.7 kg) were sorted by sex, weight, and ancestry, and allotted to pens. The control diet had 27, 40, and 61% corn for d 0 to 7, 7 to 21, and 21 to 34, respectively. On d 24, fecal samples were collected and feed (0.25% chromic oxide used as an indigestible marker) and feces were analyzed for DM, N, and GE. Overall, ADG (cubic effect, $P < 0.08$) and G:F (linear effect, $P < 0.01$) were increased by 4% as replacement of corn with triticale was increased from none to 100%. Digestibility of DM, N, and GE were not affected by increasing the concentration of triticale in the diet ($P > 0.18$). For the finishing experiment, 184 pigs (avg initial BW of 59 kg) were sorted and allotted to pens as in the nursery experiment. The control diet had 70 and 81% corn for d 0 to 40 and 40 to 59, respectively. On d 46, fecal samples were collected and feed and feces were analyzed as in Exp. 1. Overall, ADG (linear effect, $P < 0.02$) and ADFI (linear effect, $P < 0.05$) were decreased by 6% as replacement

of corn with triticale was increased from none to 100%. However, G:F and digestibility of nutrients were not affected ($P > 0.16$) by concentration of triticale in the diet. In conclusion, replacing corn with triticale improved growth performance in nursery pigs but reduced ADFI and, thus, ADG in finishing pigs.

Table 1.

Item	Triticale, %				SE
	None	33.3	66.7	100	
Nursery Exp					
ADG, g	528	555	534	549	9
ADFI, g	707	728	696	709	14
G:F, g/kg	747	762	767	774	7
DM dig, %	82.2	82.5	83.3	82.9	0.9
N dig, %	77.9	76.7	79.3	77.3	1.3
Finishing Exp					
ADG, g	1.08	1.07	1.02	1.03	0.02
ADFI, g	3.03	3.09	2.93	2.86	0.13
G:F, g/kg	356	346	348	360	13
DM dig, %	84.3	81.4	82.2	82.0	1.3
N dig, %	79.4	76.0	77.8	77.5	2.0

Key Words: Pig, Triticale, Growth

574 Impact of a varying number of random out-of-feed events on grow-finish pig performance. M. Brumm^{*1}, S. Colgan¹, and K. Bruns², ¹University of Nebraska, Concord, ²South Dakota State University, Brookings.

Two hundred forty barrows (initial wt 18.1 kg) were used to evaluate the effect of repeated out-of-feed (OOF) on performance to slaughter. There were 15 pigs (0.69m²/pig), one bowl drinker, and one 2-hole feeder per pen in a fully slatted, naturally ventilated wean-to-finish facility. There were 4 pens per treatment and OOF treatments applied on random days every 2 weeks were 1) never OOF (0x), 2) OOF 1 time (1x), 3) OOF 2 times (2x), and 4) OOF 3 times (3x). Out-of-feed was accomplished by closing the feed delivery mechanism on the feeder from 1200 hr to 0800 hr. Diets were corn-soybean meal based in meal form with a mean particle size of 933 microns and 1.8 SD. At the end of the 112 day trial, there was a quadratic ($P=0.097$) impact of treatment on final weight (117.0, 117.6, 117.5 and 113.8 kg for the 0x, 1x, 2x and 3x treatments respectively). This contrasted with the linear ($P=0.014$) effect on BW on day 56 (64.7, 64.3, 63.3 and 59.9 kg) and linear ($P=0.003$) decrease in daily gain for the 0-56 d period (0.838, 0.826, 0.803 and 0.753 kg/d) for the 0x, 1x, 2x and 3x treatments respectively. However there was no effect ($P>0.1$) of treatments on daily gain for the 56-112 d period. For the entire 112-d trial, there was linear reduction ($P=0.03$) in daily gain due to increasing numbers of OOF events (0.887, 0.888, 0.883, 0.857 kg/d for the 0x, 1x, 2x, and 3x treatments, respectively). There was a linear ($P<0.05$) reduction in ADFI for increasing number of OOF events for every 2 wk period for the first 8 wk and no difference ($P>0.1$) in ADFI for any treatment for any 2 wk period during the second 8 wk. There was no effect ($P>0.1$) of treatment on feed conversion for any time period measured. These results suggest that pigs adjust to repeated, random OOF events. The penalty for repeated OOF events is an initial reduction in ADG and ADFI which was clearly not compensated for later in the growth process by pigs on the 3x treatment. However, pigs on the 1x treatment compensated for the missed feed events, while pigs on the 2x treatment

appeared to be on the edge of being able to compensate completely for OOF events.

Key Words: Pigs, Feed availability, Welfare

575 Effects of flaxseed and carbohydrase enzyme supplementation on growth performance, plasma urea nitrogen and nutrient digestibility in piglets. E. Kiarie^{*}, B. A. Slominiski, and C. M. Nyachoti, University of Manitoba, Winnipeg, Canada.

The effect of including flaxseed in starter diets with or without carbohydrase enzyme supplementation was investigated in a 28 d study involving 96 weaned pigs (6.1 kg initial BW). The diets were based on wheat, barley, pea, soybean and canola meals with 0% or 12% flaxseed and fed alone or supplemented with multi-carbohydrase enzyme (0.05%) containing cellulase, pectinase, mannanase, xylanase, glucanase and galactanase activities. Diets were formulated to similar CP and lysine levels and flaxseed was added by proportionately reducing other feedstuffs to balance for CP and energy. Each diet was assigned to 6 replicate pens (each with 4 pigs) in a completely randomized design. Pigs were weighed and bled weekly to determine plasma urea nitrogen (PUN). Fresh fecal samples were collected from each pen on d 28 and at the end of the study 1 pig per pen was killed to sample ileal digesta. Treatments effect on performance was only evident in wk 3 when ADG in flaxseed diets was lower (268 vs. 353 g/d; $P<0.01$) than in non-flaxseed diets. There was a tendency ($P=0.08$) for flaxseed and carbohydrase to interact in G:F in wk 3 such that in absence of enzyme flaxseed diets resulted in lower G:F ($P<0.01$) compared to non-flaxseed diets, however, no difference ($P>0.15$) was observed between the two diets in presence of enzyme. Flaxseed diets increased PUN in wk 3 (4.95 vs. 3.92 mmol/L; $P<0.05$), ileal viscosity (3.4 vs. 1.5; $P<0.01$) and reduced ileal apparent digestibility of ($P<0.01$) of DM, N and non-starch polysaccharides (NSP) compared to non-flaxseed diets. Compared with unsupplemented diets, enzyme supplemented diets resulted in higher ileal DM digestibility (53 vs. 46 %; $P<0.05$). Compared with all other diets, flaxseed diet without enzyme supplementation reduced ($P<0.05$) fecal DM digestibility. Results suggest that the depressive effect of flaxseed on performance and nutrient utilization in nursery pigs fed wheat-barley diets can be minimized by carbohydrase enzyme supplementation.

Key Words: Flaxseed, Multi-carbohydrase enzyme, Piglet performance

576 Flaxseed and carbohydrase enzyme supplementation affects gut microbial populations and activities in nursery pigs. E. Kiarie^{*}, C. M. Nyachoti, B. A. Slominiski, and G. Blank, University of Manitoba, Winnipeg, Canada.

The effects of flaxseed and carbohydrase enzyme supplementation on ileal microbial populations, organic acids as well as ileal and fecal ammonia in nursery pigs were investigated in a 28 d trial. Ninety-six pigs (17±1 d, 6.1kg BW) were weaned and based on BW; four pigs were housed per pen with six pens per diet. The diets were based on wheat, barley, pea, soybean and canola meals with 0% or 12% flaxseed and fed alone or supplemented with multi-carbohydrase enzyme (0.05%) containing cellulase, pectinase, mannanase, xylanase, glucanase and galactanase activities. Fresh fecal samples were collected from each pen on d 28, and at the end of the study, 1 pig per pen was killed to sample ileal digesta. Microbial populations and organic acid contents were analyzed in ileal digesta samples only. Ammonia content in samples was measured as ammonia-N. There tended ($P=0.10$) to

be an interaction between flaxseed and enzyme for ileal *Lactobacilli* concentrations; in absence of flaxseed, enzyme tended to increase ileal *Lactobacilli* concentrations compared to unsupplemented diets. Flaxseed diets reduced ileal anaerobic spore formers (2.6 vs. 3.1 log₁₀ CFU/g; *P*0.05), lactic acid (1115 vs. 2354 μmol/L; *P*<0.01) and total organic acids (2220 vs. 4133 μmol/L; *P*<0.01) compared to non-flaxseed diets, however, ileal pH was not affected by dietary treatments. Enzyme supplementation tended to increase (*P*=0.10) ileal lactic acid and total organic acids compared to non-enzyme diets.

Inclusion of enzyme blend in non-flaxseed diets resulted in reduced (*P*=0.06) ileal ammonia content. Flaxseed diets had a lower fecal pH (6.4 vs. 6.8; *P*<0.01) and tended to have lower fecal ammonia content (32.4 vs. 40.4 mg/L; *P*=0.07) than non-flaxseed diets. Results suggest that flaxseed suppressed ileal microbial numbers and organic acids concentration while enzyme supplementation increased organic acids and tended to increase *Lactobacilli* concentration.

Key Words: Flaxseed, Multi-carbohydrase enzyme, Ileal microbial activities

Physiology and Endocrinology: Reproductive Physiology

577 Effect of decreasing the interval from GnRH to PGF_{2A} and lengthening proestrus on reproductive performance in GnRH-CIDR-PGF_{2A} synchronization programs. L. A. Helsler^{*1}, G. A. Bridges¹, D. E. Grum¹, M. L. Mussard¹, C. L. Gasser², D. M. Lantz¹, and M. L. Day¹, ¹The Ohio State University, Columbus, ²Southern Utah University, Cedar City.

We have previously reported similar reproductive performance in GnRH-based programs when the interval from the initial GnRH injection to CIDR withdrawal and PGF_{2α} (PGF) was reduced from 7 to 5 d and two PGF doses were given 12 h apart. In order to determine the efficacy of a single PGF injection at CIDR withdrawal in a 5 d program, two experiments were conducted to compare reproductive performance between a 7 d (7SS) or 5 d (5SS) Select Synch + CIDR program. Lactating beef cows (n = 137; Expt 1) and yearling heifers (n = 159; Expt 2) received the 7SS or 5SS program with a single PGF. In cows, estrus response was greater (*P* < 0.05) in the 7SS (98.5%) than 5SS (89.9%) treatment. Treatment by status (cyclic, anestrus; *P* < 0.05) and age (2 yr-old, mature; *P* < 0.05) interactions implied that cyclic and mature cows benefited from the 7SS treatment, whereas the 5SS treatment favored the anestrus and 2 yr-old cows. In heifers (Expt 2), estrus response (92.5%) and pregnancy rates (59.7%) were similar between treatments. In a third experiment (n = 216; Expt 3), reproductive performance was compared for a 7 (7CO) and 5 (5CO) d CO-Synch + CIDR program in postpartum cows. Based upon results of Expt 1, two injections of PGF, 12 h apart, were used. In the 7CO treatment, timed AI, concurrent with GnRH, was performed at 60 h after the initial PGF, whereas this interval (proestrus) was extended to 72 h in the 5CO treatment. Timed-AI pregnancy rate was greater (*P* < 0.05) in the 5CO (80.0%) than 7CO (66.7%) treatment. In conclusion, it is questionable if decreasing the Select-Synch program to 5 d is advantageous in either cows or heifers if a single PGF is administered. Conversely, the modified CO-Synch + CIDR program increased timed-AI pregnancy rates in postpartum beef cows. The relative contributions of the shorter GnRH to PGF interval and the longer duration of proestrus to enhance fertility warrants further investigation.

Key Words: Beef cattle, CIDR, Synchronization

578 Effects of PES during in vitro culture of bovine embryos on pregnancy rates. M. Barcelo-Fimbres^{*}, Z. Brink, and G. E. Seidel Jr, Colorado State University, Fort Collins.

Phenazine ethosulfate (PES) is an electron acceptor that oxidizes NADPH to NADP, which increases flux of glucose through the pentose phosphate pathway and decreases lipid accumulation in embryos (Reprod. Fert. Dev. 17:218). The aim of this experiment was to evaluate the effects of PES, days post estrus of the recipient at

embryo transfer (synchrony), and embryo transfer grade (ET grade) on pregnancy rates. Oocytes were collected from slaughterhouse ovaries, matured, fertilized, and the resulting embryos cultured in vitro by standard procedures in a chemically defined medium (J. Anim. Sci. 78:152). Day 0 of culture was 18±2h after the onset of IVF. From 2.5 to 6.5 d of culture, half of the eight cell embryos were exposed to 0.3 μM PES, and the rest were controls. Day 7 PES or control blastocysts of good quality, were transferred nonsurgically (ET) to synchronized recipients. Only recipients in estrus 6 to 7.5 d earlier, with a detectable corpus luteum were used. The ET grades were: 1, good; 2, some cow movement; and 3, problematic (much cow movement and/or bloody transfer gun). Pregnancies were evaluated at 35 and 105 d post estrus by ultrasonography, by detecting an amniotic vesicle or live fetus. Use of PES during in vitro culture had no effect on pregnancy rates compared to control at 35 or 105 d (*p*>0.1) (Table 1). There was a significant effect of synchrony on pregnancy rates; (*p*<.05) (Table 1). ET grade 1 was superior to grades 2 and 3 (*p*<0.05) (Table 1). There was no interaction among treatments (*p*>0.1). Use of PES during in vitro culture did not affect pregnancy rates nor conceptus losses between d 35 and 105 of pregnancy, and 7 to 7.5 d recipients and grade1 ET were superior.

Table 1. Pregnancy rates after transfer of in vitro-produced embryos (%)

Pregnancy day	Treat-ment	Treat-ment	Syn-chrony	Syn-chrony	ET grade	ET grade	ET grade
	Control (n=35)	PES (n=38)	6-6.5 (n=38)	7-7.5 (n=35)	1 (n=40)	2 (n=20)	3 (n=13)
35	37	40	29 ^c	49 ^d	53 ^a	30 ^b	8 ^b
105	26	24	15 ^a	34 ^b	38 ^a	15 ^b	0 ^b

a,b,c,d Values with different superscripts within treatments in the same row differ (^{a,b} *P*<0.05; ^{c,d} *P*<0.06) by Fisher's exact test.

Key Words: *In vitro* produced embryos, Phenazine ethosulfate, Embryo transfer

579 Influence of a CIDR insert after a fixed-time AI on pregnancy rates and return to estrus of nonpregnant cows. K. N. Thielen¹, J. E. Larson^{*1}, B. J. Lovaas², D. J. Kesler³, J. S. Stevenson⁴, T. T. Marston⁴, and G. C. Lamb², ¹University of Minnesota, St. Paul, ²University of Minnesota, Grand Rapids, ³University of Illinois, Urbana, ⁴Kansas State University, Manhattan.

We determined whether resynchronization of an ovulatory estrus could be accomplished in nonpregnant cows without compromising