

Nonruminant Nutrition: Diet and health

188 Effects of n-6/n-3 fatty acid ratios in young pig diets on performance and immune function. T. A. Meyer*, M. D. Lindemann, S. T. Franklin, M. L. Vickers, H. J. Monegue, and G. L. Cromwell, *University of Kentucky, Lexington, KY.*

Weanling pigs (n=36, 24 d of age, and 6.6 kg BW) were used in a 7-wk experiment to evaluate the effects of three dietary n-6/n-3 fatty acid ratios (n6/n3) on performance and immune function. Three diets contained either 5% menhaden oil, corn oil, or a combination resulting in n6/n3 ratios of 0.8, 6.7, and 39.8, and 1.0, 7.4, and 43.5 for the 4-wk nursery and 3-wk grower phases, respectively. Diets contained 1.22 and 0.95% lysine for the nursery and grower, respectively, and other nutrients met or exceeded NRC (1998) requirement estimates. Pigs were allotted two per pen minimizing weight and age differences across pens within a block. Pig weights and feed intake were recorded weekly. Colormetric lymphocyte proliferation assays were performed prior to and 4 wk after treatment allotment. Plate conditions were 1×10^6 cells/ml, with 6.8% autologous serum, 16, 32, and 64 $\mu\text{g/ml}$ for concanavalin A and 1, 5, and 25 $\mu\text{g/ml}$ for pokeweed mitogen (PWM). Additionally, a primary and secondary killed H1N1 influenza A vaccination was administered after 2 and 5 wk with serum specific antibody analyzed at Wk 2, 5, and 7. ADG and ADFI (0.58 and 1.04 kg, respectively) did not differ ($P > 0.10$) among dietary treatments. However, a linear tendency ($P < 0.07$) in F/G occurred with increasing n6/n3 (1.79, 1.76, and 1.83, respectively). No lymphocyte proliferation differences among treatments occurred ($P > 0.10$) in response to either mitogen. However, lymphocyte proliferation decreased ($P < 0.01$) from Wk 0 to Wk 4 in cultures stimulated with 1 (1.30 and 1.17, respectively) and 5 (1.34 and 1.17, respectively) $\mu\text{g/ml}$ PWM. Only the secondary vaccination produced detectable antibody to the influenza vaccine with no differences ($P > 0.10$) among dietary treatments. The dietary n6/n3 did not influence ADG, ADFI, lymphocyte proliferation, or humoral immune response but tended to improve F/G with declining n6/n3 in the diet.

Key Words: Pigs, Fatty acids, Immunity

189 Inclusion of oat hulls in diets for piglets based on native or cooked cereals. E. Lopez¹, M. A. Latorre¹, D. G. Valencia¹, R. Lazaro¹, and G. G. Mateos^{*1}, ¹*Universidad Politécnic de Madrid. Spain.*

A trial was conducted to study the influence of main cereal (50% rice vs 50% corn), heat-processing of the cereal portion of the diet (native vs cooked at $97 \pm 2^\circ\text{C}$ for 45 min), and inclusion of cooked oat hulls (0 vs 2%) on nutrient digestibility and productive performance of young pigs weaned at 21 d of age. Each treatment was replicated six times (five piglets penned together) and the trial lasted 35 d. The experimental diets were formulated to have similar nutritive value and were supplied in meal form. They contained 12% full-fat soybeans, 5 to 8% fish meal, and 20% milk products but no antibiotics were included. Apparent faecal nutrient digestibility was determined at 33, 43, and 49 d of age using 0.5% celite as additional indigestible marker. From 21 to 49 d of age piglets fed rice ate 20.5% more feed ($P < 0.001$), grew 19.1% faster ($P < 0.001$), tended to have less incidence of diarrhoea ($P = 0.12$), and had similar feed conversion than piglets fed corn. The improvements in feed intake and daily gains observed were maintained at 56 d of age. Cooking the cereal portion of the diet did not affect piglet performance at any age. From 35 to 49 d of age, the inclusion of 2% oat hulls in the diet reduced feed intake ($P < 0.05$) and tended to improve feed conversion ($P < 0.10$) but no significant effects were detected at 56 d of age. Digestibility of organic matter and gross energy did not differ markedly with age but was higher for rice than for corn diets. Nitrogen retention, however, was not affected by main cereal of the diet. Also, oat hull inclusion tended to reduce nutrient digestibility ($P < 0.10$) but heat processing of the cereal did not have any effect. It is concluded that the use of rice in substitution of corn improves nutrient digestibility and piglet performance and that the inclusion of moderate amount of oat hulls does not impair productivity and in fact might improve feed conversion in early stages of piglet life.

Key Words: Oat hulls, Piglet performance, Cooked cereals

190 Oat hulls in diets for young pigs based on cooked rice or corn without antibiotics. F. Martín¹, M. A. Latorre¹, J. M. Gonzalez-Alvarado¹, R. Lazaro^{*1}, and G. G. Mateos¹, ¹*Universidad Politcnica de Madrid. Spain.*

A trial was conducted to investigate the influence of cereal source (53% of cooked and rolled corn vs cooked rice) and inclusion of cooked oat hulls (0, 2, and 4%) on productive performance, apparent faecal nutrient digestibility of nutrients, and incidence of diarrhoea in piglets weaned at 20 d of age. Each treatment was replicated eight times (five piglets penned together) and the trial lasted 34 d. From 20 to 41 d of age, piglets were fed their respective experimental diets that included 13% full-fat soybeans, 8% fish meal, and 15% milk products without terrestrial animal proteins or antibiotics. The corn and rice used were cooked at $97 \pm 2^\circ\text{C}$ for 45 min (Amandus Kahl). From 41 to 54 d of age, all piglets received a common starter diet based on corn, barley, and soybean meal. Digestibility of nutrients was determined at 27 and 37 d of age using 0.5% celite as additional indigestible marker. From 21 to 41 d of age, piglets fed rice ate 15.0% more feed ($P < 0.01$) and grew 12.3% faster ($P < 0.05$) but had similar feed conversion than piglets fed corn. Most of the improvement in productive performance observed with rice feeding at 41 d were maintained at the end of the trial (659 and 623 g/d for feed intake; $P < 0.01$, and 447 and 418 g/d for daily gains; $P < 0.01$, for rice and corn diets, respectively). In general, digestibility of nutrients (organic matter, gross energy, NDF, and ether extract) increased with age and was higher for rice than for corn diets but nitrogen retention was not affected by main cereal used. Increasing the level of oat hulls in the diet did not affect performance or nutrient digestibility but reduced the incidence of diarrhoea from 21 to 41 d of age ($P < 0.05$). We conclude that cooked rice is an ingredient of choice in feeds for young pigs. Also, the use of moderate amounts of oat hulls might help to reduce the incidence of diarrhoea without impairing nutrient digestibility or piglet performance.

Key Words: Cooked cereals, Oat hulls, Piglet performance

191 Rice vs wheat feeding and protein level of the diet on performance of piglets from 10 to 16 kg BW. J. Bonet¹, J. Coma¹, M. Cortés², P. Medel², and G.G. Mateos^{*3}, ¹*Vall Companys Group, Spain*, ²*Imasde Agropecuaria, S.L., Spain*, ³*Universidad Politécnic de Madrid, Spain.*

The use of feeds without antibiotics has resulted in an increase in the incidence of diarrhoea in piglets. Two possibilities to improve productivity are the inclusion of more digestible cereals and the reduction in the protein content of the diet. Two trials were conducted to evaluate the influence of cereal (cooked wheat vs cooked rice) and protein level of the diet (LP, 15.5%; HP, 21%) on performance of piglets from 46 to 63 d of age. The origin of the piglets was a farm with high (trial 1) or low (trial 2) health status. In each trial 416 piglets weaned at 21 d and distributed in the replicates at 25 d were used. Each treatment (2 x 2 factorial) had four replicates of 25 piglets. All diets contained 2.5 Mcal NE/kg and 1.38% total lysine and were based on soybean meal, soy oil, and 60 to 74% cooked cereal. Data were analyzed by GLM procedure of SAS using body weight at 25 d post weaning as a covariate. In trial 1 piglets fed rice diets ate more (588 vs 513 g/d; $P < 0.01$), grew faster (400 vs 339 g/d; $P < 0.01$), and had better feed conversion (1.47 vs 1.55 g/g; $P < 0.05$) than piglets fed wheat diets. Piglets fed HP diets ate more (569 vs 532 g/d; $P < 0.01$), grew faster (413 vs 326 g/d; $P < 0.01$), and had better feed conversion (1.37 vs 1.65 g/g; $P < 0.01$) than piglets fed LP diets. In trial 2, piglets fed rice grew faster (349 vs 317 g/d; $P < 0.01$) than piglets fed wheat, but no differences were observed for feed conversion. Also, piglets fed HP diets grew faster (379 vs 286 g/d; $P < 0.01$) and had better feed conversion (1.37 vs 1.60 g/g; $P < 0.01$) than piglets fed LP diets. An interaction cereal x protein level of the diet was observed for productive traits in both trials: the beneficial effects of HP diets were more evident in piglets fed wheat than in piglets fed rice ($P < 0.01$). We concluded that rice could be used advantageously in diets for piglets. Also, the use of 21% CP instead of 15.5% CP is recommended in diets for piglets of this age.

Key Words: Piglet performance, Cooked cereals, Protein level

192 Impact of spray-dried bovine serum on mortality and performance of turkeys challenged with *Pasteurella multocida*. J. M. Campbell^{*1}, J. D. Quigley¹, L. E. Russell¹, and L. A. Koehn², ¹APC, Inc., Ames, IA, ²ARKO Laboratories, Ltd., Jewell, IA.

Nicholas turkey poults (n = 80; 1 d of age) were allotted to a 2 x 2 factorial design. Treatments consisted of 1) challenge or no challenge and 2) Innavax[®] (INX; spray-dried bovine serum) treated water or untreated water. Tap water was mixed with 0 or 1.30, 0.65, 0.325, and 1.30% (wt/wt) INX on d 0-7, 8-14, 15-21, and 22-49, respectively. Water was mixed daily and provided ad libitum. Poults were fed commercial turkey starter and grower feed ad libitum. Poults were challenged on d 35 by swabbing the tonsils with 3.0 x 10⁸ cfu of *Pasteurella multocida* Type III. Intake (feed and water), BW gain, feed efficiency and mortality were determined. Consumption of INX (d 0 to 7) increased ADG (P < 0.03), water intake (P < 0.10), and feed efficiency (P < 0.10); while total BW gain and feed intake were unaffected (P > 0.10) by treatment. No treatment differences (P > 0.10) were noted in ADG, total BW gain, feed or water intake, and feed efficiency from d 0 to 35. After the challenge (d 35), INX did not impact (P > 0.10) ADG, water or feed intake; while INX increased total BW gain (P < 0.10) and gain/feed (P < 0.003). Innavax improved (P < 0.03) survival (d 35 to 49) of challenged poults (94.1% survival) compared to challenged poults consuming untreated water (63.2% survival). These data suggest that the addition of INX to drinking water systems will increase ADG, water intake, and feed efficiency of poults the first week post placement. Furthermore, addition of INX to drinking water reduces mortality in turkeys exposed to *Pasteurella multocida*.

Key Words: Turkeys, Serum, *Pasteurella multocida*

193 Effects of different levels of spray dried egg and lactose on the performance of weaned pigs. C. M. Shao^{*1}, B. G. Harmon², and M. A. Latour², ¹Wellhope Agri-Tech Co., Beijing China, ²Purdue University, West Lafayette, IN.

Spray Dried Egg (SDE) is an alternative source of immuno-globulin in phase 1 diets for weaned pigs. Three trials were conducted to study the effects of feeding SDE to pigs weaned at less than 18 days of age. In the first two trials, SDE was fed at 0 or 5% in diets containing a constant level of ME, lysine, methionine/cystine, threonine and tryptophan. Diets contained a constant amount of dried whey, poultry by-product meal (trial 1), meat and bone meal (trial 2) and fish meal. In the first trial, 168 pigs and in trial 2, 140 pigs were weaned at 14 to 18 days of age, blocked by weight, and randomly allotted to treatment in 10 day trials. Daily gain (ADG) was significantly greater in pigs receiving 5% SDE (243 g/day vs. 204 g/day in trial 1 and 204 g/day vs. 181 g/day in trial 2, P<.05). Feed intake (FI) was significantly greater in pigs receiving 5% SDE (236 g/day vs. 204 g/day in trial 1 and 263 g/day vs. 253 g/day in trial 2). Feed efficiency (FE) was not different between treatments. In trial three, SDE and lactose were added at 1:3 ratios to provide 0, 5, and 10% of the mixture to a basal diet containing 5% whey in treatments 1, 2 and 3. Whey was omitted in fourth diet containing 15% of the combination, SDE/lactose. The trial was conducted for 14 days each in phase 1 and phase 2 with 160 pigs used in the study. In phase 2, diets contained either 5% dried whey or 5% SDE/lactose. During phase 1, ADG improved from diet 1 to 4 (60.4, 64.9, 79.9, and 79.0 g, respectively P<.05), when lactose and SDE levels were increased. FE was not different across treatments. There were no differences in gain or efficiency when the SDE/lactose combination was fed at 10% of the diet compared to 15% SDE/lactose and removal of dried whey from the diet. The 5 heavy weight replications had much greater ADG compared to the 3 light weight replications (70.8 vs. 40.9, 76.3 vs. 45.4, 94.0 vs. 84.4, 88.1 vs. 63.6 g, respectively). Performance was greatest in pigs receiving 10% of the SDE/lactose combination. The addition SDE alone or in combination with lactose improved the performance of weaned pigs.

Key Words: Spray-dried egg, Lactose, Pigs

194 Effect of the substitution of feed growth promoter by plant extracts on the performances of broilers. D. Eclache^{*1} and M. Besson², ¹GENUOL, ²PHODE, France.

The protection of the consumers imposes the reduction if not the suppression of numerous growth promoters in broiler feeds. The effect of incorporating a product based on natural plant extracts (Oléobotique[®];

OLEO, Phodé, France) on growth performance, was evaluated on yellow Ross broilers during the rearing period up to slaughter (39 days). The trial took place on a french research farm with high health status. Dietary treatments were: a positive control using the growth promoter avilamycine at 10 ppm (CON+); an OLEO group at 0.1% and a negative control without additives (CON-). Chicks (n=1500) were allotted to 5 pens per treatment with 100 chicks per pen (50 males, 50 females). During the fattening period, the growth rate was improved with OLEO compared to CON- (P<0.10, Table 1). There was no significant difference among the 3 diets for feed conversion rates during the 39-day period. In this trial, the supplementation of the feed with a plant extract allowed to obtain a significant increase in growth rate compared to the unsupplemented group and similar performance compared to the growth promoter group.

Table 1: Effect of a herbal extract product on the performance of broilers.

Period	Measure	CON+	CON-	OLEO	P-value
1-7 day	ADG, g/d	13.3 ^a	14.3 ^b	14.9 ^b	0.01
1-7 day	FCR	0.97 ^b	0.86 ^a	0.89 ^a	0.01
1-14 day	ADG	21.3 ^a	21.2 ^a	22.9 ^b	0.01
1-14 day	FCR	1.29	1.29	1.27	ns
1-27 day	ADG	40.0 ^a	40.0 ^a	42.1 ^b	0.01
1-27 day	FCR	1.58 ^b	1.56 ^{ab}	1.53 ^a	0.05
1-34 day	ADG	50.7 ^{ab}	49.5 ^a	51.4 ^b	0.10
1-34 day	FCR	1.60	1.62	1.62	ns
1-39 day	ADG	51.7 ^{ab}	50.3 ^a	51.9 ^b	0.10
1-39 day	FCR	1.78	1.79	1.80	ns

ns: non significant (P>.10). a,b: value with the same superscript did not differ (P>0.10).

Key Words: Broiler, Plant extract, Growth promoter

195 Bioefficacy of *B. coagulans* in broiler and piglet diets: a comparative study. E. Esteve¹, A. E. Espinel², C. Piñeiro³, J. Gasa⁴, M. Cortes⁵, and P. Medel^{*5}, ¹IRTA, Spain, ²Norel, Spain, ³PigCHAMP, Spain, ⁴UAB, Spain, ⁵Imasde Agropecuaria, Spain.

Two trials were performed to determine the efficacy of dietary supplementation with the probiotic *B. coagulans* CECT 5940 containing 10⁹ UFC/g on performance of both broilers and piglets. In Trial one (T1), 576 male chickens were used and there were four treatments, a control diet based on barley, corn and soya, and three levels of inclusion of the probiotic: 10, 100 and 1000 g/t. The experimental unit was a flat deck battery cage containing 12 chicks, and there were 12 reps per treatment. The experimental design was applied to a grower (0 to 21 d) and a finisher diet (21-42 d), both in mash form. In Trial two (T2), 300 piglets were used and there were three treatments, a control diet, and two levels of inclusion of the probiotic: 100 and 1000 g/t. The experimental unit was a pen containing 10 pigs, and there were 10 reps per treatment. The feeding program consisted of a Prestarter diet from weaning at 21 to 40 d, based on cooked corn, barley, soya and milk products and a Starter diet from 40 to 74 d, based on corn, barley, wheat and soya, being the experimental design applied to both pelleted diets. Both experiments were analyzed as a completely randomized block design by using the GLM procedure of SAS. In T1, feed efficiency was significantly improved by the probiotic inclusion from 21 to 42 d, and for the overall period (1.803, 1.786, 1.783 and 1.782 g/g for 0, 10, 100 and 1000 g/t of probiotic, respectively, P<.05). In T2, piglets fed the diet supplemented at the dose of 1000 g/t showed better feed conversion than remaining treatments, both in the Starter and in the overall period (1.51, 1.52 and 1.47 for 0, 100 and 1000 g/t of probiotic, respectively, P<.05). In conclusion i) the probiotic *B. coagulans* CECT 5940 improved feed conversion in both broilers and piglets, ii) the feed conversion improvement was found for the second and for the overall period in both trials.

Key Words: Probiotic *B. coagulans*, Piglets, Broilers

196 Effects of antibiotics and a heat-stable yeast product in diets for weaning pigs. N. Llanes*, J. D. Hancock, C. L. Jones, and C. W. Starkey, *Kansas State University, Manhattan.*

A total of 192 pigs (average initial BW of 6.8 kg and 21 d of age) were used in a 35-d experiment to determine the effects of a heat-stable yeast product on growth performance of nursery pigs fed diets without and with antibiotics. There were six pigs per pen and eight pens per treatment. Treatment diets were formulated to: 1.7% lysine, 0.9% Ca, and 0.8% P for d 0 to 7; 1.5% lysine, 0.8% Ca, and 0.7% P for d 7 to 21; and 1.3% lysine, 0.75% Ca, and 0.65% P for d 21 to 35. Treatments were arranged as a 2 x 2 factorial with main effects of antibiotic (without and with carbadox at 55 g/metric ton) and yeast (without and with 0.2% of the heat-stable yeast product). All diets had 3,000 mg/kg total Zn for d 0 to 7 and 250 mg/kg total Cu for d 7 to 35. For d 0 to 7 and 7 to 21, the diets were pelleted and for d 21 to 35, the diets were fed in meal form. Feed and water were consumed on an ad libitum basis throughout the experiment. Rate of gain was greater ($P < 0.01$) in pigs fed the antibiotic for d 0 to 21 and overall (d 0 to 35). Also, the antibiotic improved efficiency of gain for d 0 to 7 and 0 to 21 ($P < 0.04$). However, there were no effects of the yeast product on growth performance ($P > 0.15$) and there were no interactions among antibiotic and yeast additions in any phase of the experiment ($P > 0.08$). In conclusion, the antibiotic was effective as a non-specific growth promoter but the yeast product had minimal effect on growth performance of nursery-age pigs.

Item	P <				SE	AB	AB x	
	No AB/ No Yst	No AB/ Yst	AB/ No Yst	AB/ Yst			Yst	Yst
d 0 to 7								
ADG, g	324	330	339	347	15	ns	ns	ns
ADFI, g	284	318	294	295	11	ns	0.15	0.18
G/F, g/kg	1,141	1,038	1,153	1,176	35	0.04	ns	0.11
d 0 to 21								
ADG, g	420	419	453	462	10	0.002	ns	ns
ADFI, g	470	489	498	492	12	ns	ns	ns
G/F, g/kg	894	857	910	939	18	0.02	ns	0.08
d 0 to 35								
ADG, g	517	516	531	544	7	0.01	ns	ns
ADFI, g	679	696	702	714	10	0.06	ns	ns
G/F, g/kg	761	741	756	762	12	ns	ns	ns

Key Words: Pigs, Antibiotics, Yeast

197 Efficacy of Bio-Mos® in the nursery pig diet: A meta-analysis of the performance response. J. C. Miguel*, S. L. Rodriguez-Zas, and J. E. Pettigrew, *University of Illinois at Urbana-Champaign, Urbana, IL/USA.*

A meta-analysis of all available data was conducted to evaluate the efficacy of Bio-Mos® on immediate post-wean, nursery pig performance. Fifty five comparisons from 29 separate experiments and 21 research teams were utilized in the analysis. When Bio-Mos®, a mannan oligosaccharide product (Alltech Inc.), was supplemented in the nursery diet there was an overall improved response ($P < 0.01$) in growth rate (4.15%), feed intake (2.08%) and feed efficiency (-2.34%) compared to the performance of pigs fed a control diet. Several production factors were incorporated as independent variables into a statistical model with dependent variables of percentage response of growth measures to Bio-Mos®, to identify factors that affect the response to Bio-Mos®. The ADG response to Bio-Mos® was similar in publicly available data (5.44%) to that in the data from Alltech's files (3.34%), so all further analyses were done with the full data set. Growth rate of control pigs during the first 7 to 15 days after weaning was taken as an imperfect indicator of health. Pigs that grew more slowly during this period (less healthy pigs) responded more sharply ($P < 0.01$) to Bio-Mos® (data shown as early ADG, g/% response in overall ADG: $< 180/7.18\%$; $180-280/2.67\%$; $> 280/1.50\%$). The ADG response also suggests that Bio-Mos® is most effective during the first four weeks post weaning (6.68%) compared to dietary inclusion longer than four weeks (2.98%). In addition, the ADG response to Bio-Mos® is larger in pigs weaned at an early age of 17-18 d (6.25%) compared to those weaned at 20-21 d (4.72%) and 24-28 d (3.51%). The optimal concentration of Bio-Mos® in the nursery diet could not be determined. The ADG response to Bio-Mos® was similar in the presence (4.80%) or in the absence (4.87%) of antibiotics in the diet, with the response being

additive when Bio-Mos® was supplemented in combination with antibiotics. These data indicate that Bio-Mos® supplemented to the diet of nursery pigs can improve their growth performance.

Key Words: Mannan oligosaccharide, Nursery pigs, Performance

198 Use of fermented soybean meal in nursery diets. S. W. Kim, R. L. McPherson*, and F. Ji, *Texas Tech University.*

One hundred ninety two nursery pigs were weaned on d 19.2±0.2 and allotted into one of three dietary treatments: CON (control), FS3 (soybean meal fermented by *Aspergillus Orizae*, replacing 3% of normal soybean meal), and FS6 (replacing 6%). Fermented soybean meal contained live *Aspergillus Orizae* from the fermentation process. The CON contained 21% soybean meal and the FS3 and FS6 replaced soybean meal with fermented soybean meal by 3 and 6%, respectively. All diets contained 15% dried whey, 3% plasma protein, and 51% corn providing 1.43% lysine and 3.28 Mcal/kg ME. Each treatment had 8 replicates with 8 pigs per pen-replicate. Pigs were fed the experimental diets for 4 wk. Weight and feed intake of pigs were measured weekly. Diarrhea score was measured daily during the first 14 d. Pigs fed the FS3 tended to grow faster ($P = 0.062$) than pigs fed the CON during the wk-1. There was no difference in feed intake of pigs among the treatments during the wk-1. Gain/feed of pigs fed the FS3 and FS6 was greater ($P < 0.05$) than that of pigs fed the CON during the wk-1. During the wk-2 and -3, pigs fed the FS3 and FS6 had a greater ($P < 0.05$) gain/feed than pigs fed the CON whereas there was no difference in ADG of pigs among the treatments. Pigs fed the CON had a greater ($P < 0.05$) feed intake than pigs fed the FS3 and FS6 during the wk-2. During the wk-1 to -3, pigs fed the CON had a greater ($P < 0.05$) feed intake than pigs fed the FS6 whereas ADG of pigs was the same among the treatments. Pigs fed the FS3 and FS6 had a greater ($P < 0.01$) gain/feed than pigs fed the CON during the same period. During the wk-4, there was no difference in gain/feed, ADG and feed intake among the treatments. During the entire experimental period (wk-1 to -4), pigs fed the FS3 and FS6 had a greater ($P < 0.01$) gain/feed than pigs fed the CON. However, there was no difference in ADG and feed intake of pigs among the treatments during the entire experimental period. Pigs fed the CON had a higher ($P < 0.05$) incidence of diarrhea than pigs fed the FS3 during the wk-1 whereas there was no difference during wk-2. In conclusion, the use of fermented soybean meal with *Aspergillus Orizae* replacing conventional soybean meal up to 6% in nursery diets can improve growth performance and reduce the incidence of diarrhea.

Key Words: Nursery pigs, Growth, Fermented soybean meal

199 Use of probiotics and fermented soybean meal in lactation diets. J. Fei* and S. W. Kim, *Texas Tech University.*

Forty primiparous lactating sows and the litters were used to determine the effect of dietary supplementation of probiotics and fermented soybean meal on lactation performance. Primiparous sows were moved to individual farrowing crate on d 105 of gestation and allotted to one of four dietary treatments: CON (control), PA (probiotics-A containing *Aspergillus Orizae*, supplemented 0.2%), PB (probiotics-B containing *Aspergillus Orizae* and *Bacillus Sp*, supplemented 0.2%), and FS (fermented soybean meal by *Aspergillus Orizae*, replacing 2% of normal soybean meal) based on their body weight on d 105 of gestation. Fermented soybean meal contained live *Aspergillus Orizae* from the fermentation process. Sows received the experimental diets from d 105 of gestation until the weaning on d 21 of lactation. All lactation diets contained 17.5% CP (0.94% lysine) and 3.28 ME Mcal/kg. Sows were fed 2 kg/day until farrowing and fed ad libitum during lactation. Litter size was set to 10 pigs within 48 h postpartum (10.3±0.4). Weight and backfat of sows and weight of litters were measured weekly until weaning. Feed intake of sows was measured daily. All the litters were weaned on d 21 of lactation and sows were returned to gestation stalls. Numbers of days return to estrus were measured. Voluntary feed intake of sows did not differ among the treatments (5.64±0.19 kg/d). Weight gain of nursing pigs from the FS sows tended to be higher than that from the PA sows ($P = 0.061$). However, there was no difference in weight gain of nursing pigs between the CON and other treatment groups. Weight loss of the FS sows (6.7 kg) during the 21-d lactation was lower ($P < 0.05$) than that of the CON sows (16.6 kg). Weight loss of the PA and PB sows did not differ from that of the CON sows. Greatest difference ($P < 0.05$) in weight loss between the FS sows and the CON sows happened during the third week of lactation. Changes in backfat thickness of sows among the

treatments were not different during the lactation. The numbers of days return to estrus of sows among the treatments were not different. This study indicates that the use of fermented soybean meal with *Aspergillus Orizae* in lactation diet improved the performance of primiparous sows

Physiology: Estrous synchronization

200 A comparison of the MGA[®] Select and 7-11 Synch protocols to synchronize estrus in postpartum beef cows. J. E. Stegner*, F. N. Kojima, M. R. Ellersieck, M. F. Smith, and D. J. Patterson, *University of Missouri*.

This experiment compared progestin-GnRH-PGF_{2α}(PG) based protocols for estrus synchronization in postpartum beef cows. Cows were assigned by age, body condition score (BCS), and days postpartum (dpp) to one of two treatments. The MGA[®] Select treated cows (T1; n=109) were fed melengestrol acetate (MGA; 0.5mg·hd⁻¹·d⁻¹) for 14 d, injected with GnRH (100 μg i.m. Cystorelin) 12 d after MGA withdrawal, and PG (25 mg i.m. Lutalyse) 7 d after GnRH. The 7-11 Synch treated cows (T2; n=111) received MGA for 7 d, PG on day 7 of MGA, GnRH 4 d after PG, and PG 7 d after GnRH. Mean BCS (4.7 ± 0.1, T1; 4.7 ± 0.1, T2) and dpp (41 ± 1, T1; 41 ± 1, T2) did not differ (P > 0.1) between treatments. Blood samples were collected 8 d and 1 d prior to MGA to determine pretreatment cyclicity [progesterone, P₄ > 1ng/mL; 10/109 (9%), T1; 12/111 (11%), T2; P > 0.1] and again on the day of PG to predict treatment response [81/109 (74%), T1; 84/111 (76%), T2; P > 0.1]. Serum concentrations of P₄ at PG differed (P < 0.01) between treatments [3.3 (T1) vs. 1.7 (T2) ng/mL]. Heat Watch[®] was utilized for 7 d after PG to detect estrus and AI was performed 12 h after the onset of estrus. Estrous response was similar (P > 0.1) between treatments [100/109 (92%), T1; 101/111 (91%), T2]. The mean interval to estrus (65 ± 2 h, T1; 52 ± 2 h, T2) and synchrony of estrus (analyzed by ratio of variance, F-test) differed (P < 0.01) between treatments. Synchronized conception and pregnancy rates [61/100 (61%), 61/109 (56%), T1; 71/101 (70%), 71/111 (64%), T2] and final pregnancy rate [97/109 (89%), T1; 98/111 (88%), T2] did not differ (P > 0.2) between treatments. This study demonstrates that estrous response and fertility are similar among cows assigned to the MGA[®] Select or 7-11 Synch protocols. Synchrony of estrus, however, may be improved following treatment with the 7-11 Synch protocol. These data will be used to facilitate methods of fixed-time AI in beef cattle. (Supported by grants from Select Sires, Inc., and USDA-NRI 2000-02163.)

Key Words: Estrus synchronization, Progestin, GnRH

201 A comparison of two fixed-time AI programs for postpartum beef cows. F. N. Kojima*, J. E. Stegner, J. F. Bader, D.J. Schafer, R. L. Eakins, M. F. Smith, and D. J. Patterson, *University of Missouri*.

The objective of this study was to compare two fixed-time AI protocols for postpartum beef cows. Cows at two locations (location 1, n = 113; location 2, n = 95) were stratified by age, days postpartum (dpp), and body condition score (BCS), and randomly assigned to one of two fixed-time AI protocols. The two treatments included: 1) 7-11 Synch (n = 103: cows were fed melengestrol acetate [MGA; 0.5mg·hd⁻¹·d⁻¹] for 7 d followed by prostaglandin F_{2α} [PG; 25 mg i.m. Lutalyse] on d 7 of MGA, GnRH [100 μg i.m. Cystorelin] on d 11, and PG on d 18, with fixed-time AI 60 h after the last PG and GnRH at AI); and 2) CO-Synch plus EAZI-BREEDTM CIDR (CIDR: n = 105: GnRH was administered at the time of CIDR insertion [CIDR was in place for 7 d], PG was administered at the time of CIDR removal, with fixed-time AI 48 h after PG and GnRH at AI). One AI sire was used for all inseminations. Pregnancy rate to fixed-time AI was determined by ultrasonography between 50 and 60 d after AI. Quantitative data were analyzed by ANOVA and qualitative data were compared by Chi-square and logistic regression analyses. There were no differences attributed to location for any of the variables considered in the analyses. Results were, therefore, pooled for the respective treatments. Mean age (5.8 ± 0.2 vs. 5.8 ± 0.2), dpp (50.3 ± 1.7 vs. 51.5 ± 1.7), and BCS (5.6 ± 0.1 vs. 5.6 ± 0.1) were not different (P > 0.10) between the 7-11 Synch and CO-Synch plus CIDR groups. Pregnancy rate to fixed-time AI did not differ (P > 0.10) between the 7-11 Synch (65/103, 63 %) and CO-Synch plus CIDR (58/105, 55 %) groups. These data indicate that the 7-11 Synch and CO-Synch plus CIDR protocols provide significant opportunity to AI cows at a fixed time with resulting high fertility, eliminating the need to detect

by decreasing body weight loss during lactation whereas the use of probiotics was not beneficial.

Key Words: Lactating sows, Probiotics, Fermented soybean meal

estrus. Duration of treatment and cost of these protocols provide flexibility for beef producers in choosing the protocol that matches a specific management scenario. (Supported by USDA-NRI 2000-02163)

Key Words: Beef Cows, Estrus Synchronization, Fixed-time AI

202 Effects of CIDR in the Ovsynch protocol on AI pregnancy rate in crossbred beef cows. H. K. Baitis*¹, A. Garcia¹, W. D. Whittier¹, and J. M. DeJarnette², ¹*Virginia Polytechnic Institute and State University, Blacksburg, VA/United States*, ²*Select Sires, Inc., Plain City, OH/United States*.

Failure of the follicle to respond to the first GnRH injection in a synchronization protocol results in premature estrus (PE) in 8-10% of treated animals. The objective of this experiment was to determine if the addition of an intravaginal progesterone-releasing insert (CIDR) to the Ovsynch protocol would alter AI reproductive performance in postpartum beef cattle. Crossbred beef cows were subjected to synchronization of estrus and ovulation. Cows were managed in a typical commercial cow/calf operation at three locations in Virginia. A total of 379 mature beef cows were randomly allotted to receive either 50μg GnRH (Cystorelin, Abbott Laboratories) on d 0, PGF_{2α} on d 7 (25 mg dinoprost), 100μg GnRH on d 9 (OV; n=188) or 50μg GnRH and CIDR on d 0, PGF_{2α} on d 7 with CIDR removal, 100μg GnRH on d 9 (CIDR; n=190). Estrous activity was monitored with both Kamar (Kamar, Inc., Steamboat Springs, CO) and visual detection methods. Cows that exhibited PE were bred 12-16 h after estrus. All cows not detected in estrus were bred AI at 12-16 h after PGF_{2α}. Pregnancy was diagnosed via trans-rectal ultrasonography 35-40 d post insemination. Data were analyzed using the Proc GLM (SAS) procedures. A higher pregnancy rate (P<0.05) was obtained in cows receiving a CIDR device (66%) compared with OV treatment alone (52%). Pregnancy rate to AI was not affected (P>0.05) by location, inseminator, or sire. In conclusion, addition of a CIDR to the Ovsynch protocol results in increased AI pregnancy rates in crossbred, mature beef cattle.

Key Words: Estrous synchronization, CIDR, Postpartum

203 Single versus a split dose of PGF_{2α} administered 18 or 19 d after a 14 d melengestrol acetate (MGA) treatment to synchronize estrus in *Bos taurus* x *Bos indicus* heifers. G. A. Bridges*, G. P. Portillo, M. K. Shaw, J. W. de Araujo, and J. V. Yelich, *University of Florida, Gainesville*.

Melengestrol acetate (MGA[®] Premix) and PGF_{2α} (LUTALYSE[®] Sterile Solution) were used to synchronize estrus in *Bos taurus* x *Bos indicus* heifers in 3 replications. Replications 1 (n = 139) and 2 (n = 146) were conducted at the same location in consecutive years, while replication 3 (n = 410) was conducted at a separate location. All heifers were administered MGA for 14 d at a rate of 0.5 mg head⁻¹·d⁻¹. In replications 1 and 2 heifers were randomly distributed to receive either 25 mg PGF_{2α} i.m. 19 d following MGA or 12.5 mg PGF_{2α} i.m. on d 19 and 20 following MGA. In replication 3, heifers received the same PGF_{2α} treatments and were randomly divided into two groups with PGF_{2α} treatments initiated either 18 or 19 d following MGA. Visual detection of estrus was conducted in the AM and PM for 72 h after PGF_{2α} and heifers were AI 8 to 12 h after exhibiting estrus. Heifers not observed in estrus by 72 h following PGF_{2α} were timed-AI and received GnRH (100 μg i.m.; FERTAGYL[®]) at such time. Pregnancy was diagnosed by ultrasonography 50 to 60 d following the synchronized breeding within each replication. Within replication 3, duration from MGA withdrawal to PGF_{2α} administration did not effect any treatment variables analyzed, so data were combined. There were no significant treatment x replication effects for any variable analyzed so data were pooled. Heifers receiving a split dose of PGF_{2α} (50.1%; n = 341) had a greater (P < 0.05) three-day estrous response compared to the single dose (43.2%; n = 354) heifers. Modifying the dosage of PGF_{2α} from a single to a split dose also increased (P < 0.05) timed-AI pregnancy rates (23.9 vs 33.5%), and overall AI pregnancy rates (34.5 vs 42.5%), respectively. In