T123 Validation of the NCCC-42 vitamin-trace mineral premix in grower pigs. T. D. Crenshaw*[1], M. D. Lindemann[2], H. H. Stein[3], and NCCC-42 Swine Nutrition Committee[1], [1]*University of Wisconsin, Madison*, [2]*University of Kentucky, Lexington*, [3]*South Dakota State University, Brookings*.

A multi-state (WI, KY, and SD) experiment with 20 to 50-kg pigs was conducted by the NCCC-42 Swine Nutrition Committee to evaluate a vitamin trace mineral premix (VMP). A VMP was formulated to provide minimal quantities of vitamins and trace minerals needed to complement nutrients supplied by ingredients typical in US swine diets. Because of limited data on bioavailability of several B vitamins (biotin, choline, folate, pyrodixine, and thiamin) in feed ingredients, another premix (+B) was used to supply these vitamins at minimal concentrations. Diets were formulated with either corn and soybean meal (C-SBM) or C-SBM plus amino acids (C-AA). Added amino acids (Lys, Trp, Thr, Met, Val, and Ile) reduced SBM such that additional B vitamins, particularly folacin (F) might be needed. VMP was added to all diets at either 1X or 1X+B where X equals quantities of vitamins to meet minimum requirements if nutrients from other ingredients are considered. One treatment involved added F to C-AA diets (1X+F). A sixth treatment (St) involved addition of standard premixes used at each respective station. Trace minerals were constant in all diets except St. Pigs were allowed continuous access to assigned meal diets and water throughout a 35-d trial. Differences among stations were detected ($P < 0.05$) in ADG, but not ADFI or G:F. An interaction between diets and station was detected ($P < 0.05$) for ADG. No differences were detected in ADG of pigs fed C-SBM diets with 1X or 1X+B, however pigs fed C-AA diets gained less ($P < 0.05$) than pigs fed C-SBM diets regardless of 1X, 1X+B or 1X+F additions. No advantages in ADG were detected in pigs fed C-AA diets with +B or +F. In conclusion, 1X VMP allowed adequate growth over a 5-wk grower trial. Additions of higher concentrations of B vitamins did not improve growth.

Table 1

Trait[1]	C-SBM 1X	C-SBM 1X+B	C-AA 1X	C-AA 1X+B	C-AA 1X+F	St	SEM
ADG, kg/d	0.832[a]	0.824[a]	0.806[b]	0.790[c*]	0.787[c*]	0.831[a]	0.01
ADFI, kg/d	1.69[a]	1.75[a]	1.68[a]	1.71[a]	1.67[a]	1.72[a]	0.05

[1]Means based on 11 pens/treatment. Means within a row with different superscripts differ (P<0.05) or [*](P<0.10).

Key Words: Swine, Premix, Vitamins

T124 Effect of Se and vitamin E supplementation on growth performance, nutrient digestibility and blood characteristics in finishing pigs. J. C. Park*[1], H. J. Kim[2], B. J. Min[2], J. H. Cho[2], Y. J. Chen[2], J. S. Yoo[2], Q. Wang[2], Y. H. Kim[1], H. J. Jung[1], I. C. Kim[1], S. J. Lee[1], and I. H. Kim[2], [1]*Swine Research Division, National Livestock Research Institute, RDA, Cheonan, Chungnam, Korea*, [2]*Dankook University, Cheonan, Chungnam, Korea*.

This study was conducted to investigate the effect of Se and vitamin E supplementation on growth performance, nutrient digestibility and blood characteristics in finishing pigs. A total of eighty (Landrace×Yorkshire×Duroc) pigs (74.74kg initial BW) were randomly allocated into five treatments with four replications and fed for 6 wk. Dietary treatments included 1) CON (basal diet), 2) ISE2 (CON+0.2 ppm inorganic Se+100 ppm vitamin E), 3) ISE4 (CON+0.4 ppm inorganic Se+100 ppm vitamin E), 4) OSE2 (CON+0.2 ppm organic Se+100 ppm vitamin E) and 5) OSE4 (CON+0.4 ppm organic Se+100 ppm vitamin E). Through the entire experimental period, ADG and G:F were not different ($P>0.05$). ADFI (2.739, 2.677 vs. 2.490 kg) was improved in treatments of CON and ISE2 compared with treatment of ISE4 ($P<0.05$). Nutrient digestibility was not different ($P>0.05$). The white (WBC) and red (RBC) blood cell content in blood tended to increase treatment of ISE2, but were no different ($P>0.05$) among the treatments. Differences of HDL cholesterol, LDL cholesterol, triglyceride and total cholesterol concentration in the pigs fed the OSE2 treatment was lower than those of the pigs fed the other treatments ($P<0.05$). In conclusion, Se and vitamin E were effective for increasing ADFI and influencing WBC, RBC and the cholesterol concentration.

Key Words: Se, Vitamin E, Cholesterol

T125 Effect of copper and zinc supplementation on growth performance, nutrient digestibility and carcass characteristics in finishing pigs. Y. H. Kim[1], H. J. Kim*[2], B. J. Min[2], J. H. Cho[2], Y. J. Chen[2], J. S. Yoo[2], Q. Wang[2], J. C. Park[1], H. J. Jung[1], I. C. Kim[1], S. J. Lee[1], and I. H. Kim[2], [1]*Swine Research Division, National Livestock Research Institute, RDA, Cheonan, Chungnam, Korea*, [2]*Dankook University, Cheonan, Chungnam, Korea*.

This study was conducted to investigate the effect of copper and zinc supplementation on growth performance, nutrient digestibility and carcass characteristics in finishing pigs. A total of 72 (Landrace×Yorkshire×Duroc) pigs (58.10kg initial BW) were randomly allocated into six treatments with three replications and fed for 10 wk. Dietary treatments included 1) COE (basal diet+10ppm copper+80ppm zinc), 2) COH (basal diet+10ppm copper+120ppm zinc), 3) CTE (basal diet+30ppm copper+80ppm zinc), 4) CTH (basal diet+30ppm copper+120ppm zinc), 5) CSE (basal diet+60ppm copper+80ppm zinc) and 6) CSH(basal diet+60ppm copper+120ppm zinc). Through the entire experimental period, ADG (0.752 vs. 0.680, 0.684 kg) was improved for pigs fed CTE compared with pigs fed CTH and CSE (P<0.05). ADFI (2.348 vs. 2.193, 2.122, 2.133 kg) was improved for the pigs fed COH compared with pigs fed COE, CTH and CSH ($P<0.05$). The G:F (0.343 vs. 0.301, 0.305) was improved in treatment of CSH compared with treatments of COH and CSE ($P<0.05$). DM digestibility (72.38, 72.96, 73.25 vs. 69.78 %) was improved in treatments of COE, COH and CTH compared with treatment of CSH ($P<0.05$). N digestibility (74.07, 73.30, 72.76 vs. 70.14 %) was improved in treatments of CTH, CSE and CSH compared with treatment of COH ($P<0.05$). Carcass grade (1.00 vs. 1.75) was improved in treatment of CTH compared with treatment of CSE ($P<0.05$). In conclusion, dietary supplementation of copper and zinc at the level of 60ppm and 120ppm is effective on feed efficiency, while at the level of 30ppm and 120ppm, it has beneficial effects on nutrient digestibility and carcass grade.

Key Words: Copper, Zinc, Growth performance

T126 Effects of dietary probiotic on growth performance, nutrient digestibility, blood characteristics and fecal noxious gas content in growing pigs. Y. J. Chen*[1], K. S. Son[1], B. J. Min[1], J. H. Cho[1], O. S. Kwon[1], B. C. Park[2], and I. H. Kim[1], [1]*Dankook University*, *Cheonan, Chungnam, Korea*, [2]*NutraBio Inc*, *Seoul, Korea*.

The aim of this study was to assess the effects of dietary complex probiotic (*Lactobacillus acidophilus*, 1.0×10^7 CFU/g; *Saccharomyces cerevisae*, 4.3×10^6 CFU/g; *Bacillus subtilis* 2.0×10^6 CFU/g) on growth performance, nutrient digestibility, blood characteristics and fecal noxious gas content in growing pigs. A total of 90 [(Duroc×Yorkshire)× Landrace] pigs (initial BW of 39.75±1.97 kg) were allocated into three treatments by a randomized complete block design. There were five pens per treatment with six pigs per pen. Dietary treatments were: 1) CON (control diet); 2) CP1 (CON + complex probiotic 0.1%) and 3) CP2 (CON + complex probiotic 0.2%). During the entire experimental period of 6 wk, results showed that addition of complex probiotic at the level of 0.2% to diet increased ADG (623 vs. 576g) significantly. Digestibility of DM and N tended to increase, however, no significant differences were observed ($P>0.05$). Blood characteristics (IgG, albumin, total protein, RBC, WBC and lymphocyte) of pigs were not affected ($P>0.05$) in two complex probiotic supplementation treatments. Fecal NH_3-N was decreased (11.8%) significantly by the addition of complex probiotic ($P<0.05$), but no effects were observed on fecal acetic acid, propionic acid and butyric acid concentrations ($P>0.05$). In conclusion, results in this experiment indicated that dietary complex probiotic supplementation had a positive effect on growing pigs performance and could decrease fecal NH_3-N concentration.

Key Words: Probiotic, Digestibility, Growing pigs

T127 Effects of reducing dietary crude protein on growth performance, noxious gas emission from manure and blood urea nitrogen and IGF-1 concentrations of serum in nursery pigs. J. H. Cho*[1], B. J. Min[1], Y. J. Chen[1], H. J. Kim[1], J. S. Yoo[1], Q. Wang[1], T. C. Ko[2], Y. Hyun[2], and I. H. Kim[1], [1]*Dankook University*, *Cheonan, Chungnam, Korea*, [2]*Dodram B&F Inc*, *Eumseong, Chungbuk, Korea*.

Two experiments were conducted to investigate the effects of reducing dietary crude protein on growth performance, noxious gas emission from manure and blood urea nitrogen and IGF-1 concentrations of serum in nursery pigs. In Exp 1, the dietary treatments were 1) CON (CP 19.5%) and 2) T1(CP 16%). Eight crossbred (Landrace×Yorkshire×Duroc) pigs(14.58±0.10kg) housed in metabolic cages were fed each of two diets for 8-d periods. The experimental designs were 2 × 4 Latin squares with pigs and periods as blocking criteria. Feces and urine were collected on d 7 and 8 of each period. NH_3, H_2S, mercaptans and VFA emissions were not significantly different between treatments in mixed fecal and urine. Pigs fed T1 diet had lower($P<0.05$) NH_3, H_2S and VFA emissions in fecal. In Exp 2, the dietary treatments were 1) CON (CP 19.5%) and 2) T1(CP 16%). Twenty eight crossbred (Landrace×Yorkshire×Duroc) pigs(13.58±0.10kg) were used in a 42 days growth trial. The pigs were assigned to the treatments according to body weight and each treatment had 7 replicates of 2 pigs per pen in a randomized complete block design. Through the entire experimental period, ADG and ADFI in pigs fed CON diet were higher than in pigs fed T1 diet($P<0.05$). Blood urea nitrogen and IGF-1 concentrations in serum increased in the pigs fed CON diet compare to pigs fed T1 diet. From d 0 to 14, digestibility of nitrogen in pigs fed CON diet was greater than in pigs fed T1 diet($P<0.05$). From d 14 to 42, pigs fed CON diet showed higher($P<0.05$) digestibility of dry matter than pigs fed T1 diet. In conclusion, these results indicate that reduction in dietary CP concentration decreased NH_3, H_2S and VFA emissions in fecal and growth performance.

Key Words: Crude protein, Noxious gas emission, Growth performance

T128 Effects of dietary *bacillus*-based probiotic on growth performance, nutrient digestibility, blood characteristics and fecal noxious gas content in finishing pigs. Y. J. Chen*[1], B. J. Min[1], J. H. Cho[1], O. S. Kwon[1], K. S. Son[1], H. J. Kim[1], B. C. Park[2], and I. H. Kim[1], [1]*Dankook University*, *Cheonan, Chungnam, Korea*, [2]*NutraBio Inc*, *Seoul, Korea*.

This study was conducted to evaluate the effects of supplementation *bacillus*-based probiotic (*Bacillus subtilis*, 1.0×10^7 CFU/g; *Bacillus coagulans*, 2.0×10^6 CFU/g and *Lactobacillus acidophilus*, 5.0×10^6 CFU/g) on finishing pigs growth performance, nutrient digestibility, blood characteristics and fecal noxious gas content and to determine the optimal addition level of this probiotic preparation. A total of forty eight pigs with an initial body weight of 90.60 ± 2.94 kg were allotted to three dietary treatments (four pigs per pen with four pens per treatment) according to a randomized complete block design. Dietary treatment included: 1) CON (control, basal diet); 2) BP1 (basal diet + *bacillus*-based probiotic 0.1%) and 3) BP2 (basal diet + *bacillus*-based probiotic 0.2%). The experiment lasted 6 weeks. Through the entire experimental period, ADG was improved by 11% ($P<0.05$) in pigs fed diets supplemented with 0.2% *bacillus*-based probiotic compared to pigs fed basal diet. ADFI and G:F were not affected among all the treatments ($P>0.05$). Supplementation of *bacillus*-based probiotic did not affect either DM and N digestibilities or blood characteristics ($P>0.05$) of pigs. Fecal ammonia nitrogen (NH_3-N) measured at the end of experiment were reduced ($P<0.05$) when pigs fed diets with 0.2% *bacillus*-based probiotic. Fecal butyric acid concentration also decreased significantly ($P<0.05$) whereas acetic acid and propionic acid concentrations were not affected ($P>0.05$) when pigs fed diets added *bacillus*-based probiotic. In conclusion, dietary supplementation of *bacillus*-based probiotic can increase growth performance and decrease fecal noxious gas content concentration.

Key Words: Probiotics, Digestibility, Fecal noxious gas

T129 Energetic efficiency of fat deposition from highly fermentable NSP in fattening pigs. V. Halas and L. Babinszky*, *University of Kaposvár*, *Hungary*.

The use of non-starch polysaccharide (NSP)-rich components in pig feeds has increased in recent years, leading us to study the energetic efficiency of fat deposition from fermentable NSP (fNSP) compared to digestible starch and oil (dSt and dO) at two feeding levels (2.4 and 3.4 times maintenance). A 3x2 factorial design was used with 3 dietary energy sources (DES): maize starch, sugar beet pulp and soy oil, all added to a basal diet fed at 2 energy levels (EL). In each EL isocaloric daily intakes (200 kJ DE/$kg^{0.75}$) from each energy source (11, 11, and 5 g/$kg^{0.75}$ for fNSP, dSt, dO, respectively) were provided above the basal diet. Protein intake was limiting for protein gain at each EL (8 vs 11 g/$kg^{0.75}$/d) to avoid the use of protein for fat gain. A total of 58 individually housed pigs (48–106 kg) were used. Chemical body composition was determined at 48 kg (10 pigs) and 106 kg (48 pigs), and fecal digestibility of nutrients at 80 kg BW. Effects of DES and EL on ADG, G:F and protein and fat gain (PD, FD; g/d) were tested by ANOVA. Utilization of different energy sources for fat gain was computed by multivariate regression analysis: $PD=[\Sigma(DE_i*tp_i)$-

a]/0.0236 and FD=[Σ(DE_i*tf_i*(1-tp_i))-PD*0.0236*0.48-NEm]/0.0393, where DE_i-DE intake (MJ/d) from i (i=protein, NSP, starch, oil), tp_i and tf_i-efficiency of transformation for protein and fat gain of i, a-intercept, 0.48-net energy cost for protein gain (kJ/kJ) taken from literature, NEm-maintenance net energy requirement as 750 kJ/$kg^{0.60}$/d. Results show that the measured parameters were not affected by DES but differed at two ELs (ADG 453 vs 786g/d, G:F 0.24 vs 0.30 kg/kg, PD 60 vs 91g/d, FD 112 vs 260g/d; P<0.05). Energetic efficiency (NE/DE) of NSP, starch and soy oil was 62, 73 and 62 %, respectively, and the values were independent of energy supply. These efficiency values for starch and soy oil have been also reported in the literature. Our results support that highly fermentable NSP can be used in pig diets, and its relatively high energetic efficiency should be considered at diet formulation.

Key Words: Fattening pig, NSP, Energetic efficiency

T130 Effect of feeding rye silage on growth performance, blood and carcass characteristics in finishing pigs. J. H. Cho*[1], Y. K. Han[2], B. J. Min[1], Y. J. Chen[1], H. J. Kim[1], J. S. Yoo[1], J. W. Kim[1], and I. H. Kim[1], [1]*Dankook University*, *Cheonan, Chungnam, Korea*, [2]*Sungkyunkwan University, Faculty of Life Science & Technology*, *Suwon, Gyeonggi, Korea*.

This study was conducted to evaluate the effects of feeding rye silage on growth performance, blood and carcass characteristics in finishing pigs. The total of eighteen (Landrace×Yorkshire×Duroc) pigs(74.22±0.71kg) were used in 49-days assay. Dietary treatments included 1) CON(basal diet), 2) S1(basal diet + 1.66% rye silage), 3) S2(basal diet + 3.32% rye silage). Through the entire experimental period, ADFI in CON(2,446g) and S2(2,385g) treatments was higher than S1(2,295g) treatment(P<0.05). Pigs fed rye silage were significantly decreased on serum cortisol concentration difference(-1.79,-1.21 vs 0.30) compare to pigs fed basal diet(P<0.05). The Hunter's L^* value(44.16) of loin of pigs fed S2 diet was higher than that(38.83) of loin of pigs fed CON diet(P<0.05). The b^* value(3.40, 3.47) of loin of pigs fed S1 and S2 diets were higher than CON(2.65) treatment(P<0.05). Backfat thickness in CON treatment(22.45 vs 17.35, 16.78mm) was significantly increased compare to S1 and S2 treatments(P<0.05). In leans fatty acid contents, the content of palmitic(21.91 vs 19.92, 20.65) and stearic(13.28 vs 11.45, 11.16) acids were significantly higher in CON than others(P<0.05), also, eicosenoic(1.27 vs 0.91, 0.69) and linolenic(0.30 vs 0.23, 0.24) acids were the highest in S2 treatment among treatments(P<0.05). Total SFA(34.41 vs 33.66, 33.87) was the highest in CON(P<0.05). S1 and S2 treatments were higher USFA/SFA ratio(1.80, 1.81 vs 1.56) than CON treatment. In fats those, linolenic acid was higher in S2(0.38) treatment than those of S1(0.28) and CON(0.29) treatments(P<0.05). Digestibility of DM(81.39, 81.59 vs 77.61%) in pigs fed S1 and S2 diets were greater than that of pigs fed CON diet(P<0.05) and S1 treatment was higher than CON on digestibility of N(84.38 vs 76.25%)(P<0.05). VFA emission from fecal, measured after 1d, was significantly increased in pigs fed S1 and S2 diets(P<0.05). In conclusion, our results showed that feeding rye silage might be beneficial in cortisol concentration difference, hunter's L^* value and b^*, fatty acid contents and nutrient digestibility.

Key Words: Rye silage, Growth performance, Carcass characteristics

T131 Effect of sex and feeding level on productive performance and carcass quality of Iberian × Duroc pigs. M. P. Serrano[1], D. G. Valencia[1], J. C. Sánchez[1], R. Lázaro[1], A. Fuentetaja[2], and G. G. Mateos*[1], [1]*Universidad Politécnica de Madrid*, *Spain*, [2]*Copese*, *Segovia, Spain*.

Iberian pigs are the ancestral dark–haired pigs of Spain. Currently, they are reared under free range or intensive production systems and sacrificed at 150 to 180 kg BW, and both sexes are castrated. We used 160 Iberian pigs under an intensive system to study the influence of sex (EF, entire females; CF, castrated females; and CM, castrated males) and feeding level (AL, *ad libitum*; RT, 23% restriction of *ad libitum* feed intake from 42 to 112 kg) on productive performance and carcass quality at 152 kg BW. There were six treatments (3 × 2) and four replicates (seven pigs) per treatment. From 42 to 152 kg BW, EF tended to eat less (2762 vs. 2902 and 2840 g/d; $P \leq 0.10$) than CF or CM but sex did not affect ADG or G:F. From 42 to 112 kg BW, AL fed pigs grew faster than RT pigs (720 vs. 551 g/d; $P \leq 0.001$). However, from 112 to 152 kg BW, after the end of the feed restriction period, RT pigs recovered, and ate more feed (3714 vs. 3390 g/d; $P \leq 0.05$) and grew faster (822 vs. 655 g/d; $P \leq 0.001$) than AL fed pigs. As a result, G:F was better for RT than for AL pigs ($P \leq 0.01$). At the end of the trial, RT fed pigs grew less ($P \leq 0.001$) than AL fed pigs but G:F was not affected. Carcass yield ($P \leq 0.10$) and carcass fat (51.7 vs. 58.2 and 58.9 mm at P_2 and 40.9 vs. 49.4 and 49.1 mm at m. *Gluteus medius*; $P \leq 0.01$) were lower and primal cuts yield was higher (43.8 vs. 41.9 and 41.4%; $P \leq 0.001$) for EF than for CF or CM. Carcass yield (80.1 vs. 81.0%; $P \leq 0.001$) and carcass fat (52.8 vs. 59.8 mm at P_2 and 43.2 vs. 49.7 mm at m. *Gluteus medius*; $P \leq 0.001$) were lower but primal cuts yield were higher (42.9 vs. 41.8%; $P \leq 0.05$) for RT than for AL fed pigs. The use of EF rather than CF is recommended when Iberian pigs reared under intensive production systems are destined to the dry cured industry. Also, a 23% feed restriction from 42 to 112 kg BW might improve primal cuts yield of pigs at slaughter without jeopardizing gain to feed ratio.

Key Words: Iberian pigs, Productivity, Carcass quality

Physiology and Endocrinology: Reproductive Physiology

T132 Production and cryopreservation of embryos from Sarabi cattle. M. H. Fazeli*[1,2] and S. M. Mirtorabi[2], [1]*Azad University, Shahre Kord Campus*, *Shahre Kord, Iran*, [2]*Animal Breeding Center*, *Karaj, Iran*.

Endogenous breeds of cattle despite of their genetic values in terms of adaptability to the suboptimal or adverse environmental, management, and disease conditions are becoming extinct. They are either being crossed with exotic breeds or totally replaced in most cases by the European breeds. Preservation of the breeds has been an important implication of the embryo transfer technology. A program concerning preservation of several native cattle breeds was launched by the Animal Breeding Center, Karaj, Iran. The program consists of collection and freezing of both semen and embryos. The results of production and freezing of embryos from Sarabi, a breed of cattle native to the north-east of Iran is reported here. A total of 127 Sarabi cows were super-ovulated by either eCG or FSH following synchronization by two injections of PGF 11 days apart. Embryo collection by non-surgical technique was attempted on 97 cows (76%) which were considered to have responded favorably to the super-ovulatory treatments. The remaining cows were not flushed due to failure of response (ovarian