
An experiment was conducted to determine how four strains of commercial layering hens would respond to an increase or decrease in dietary energy. Forty of each of Hy-Line Brown, Hy-Line W98, Hy-Line W36 and DeKalb White hens were fed each of three diets from 36 to 44 wk of age. The energy contents of these diets were 2,519 (low), 2,798 (control) and 3,078 (high) kcal/kg. The energy of low and high diets was 10% less and 10% more than the control diets, respectively. Hens fed the low energy diet consumed 8.5% more feed than the controls, and hens fed the high energy diet consumed 1.5% less feed than hens fed the control diet. This indicated that the hens were more sensitive to lowering the energy than increasing energy in the diet. The Hy-Line W98 and the Hy-Line Brown were more sensitive to the change in energy than the Hy-Line W36 and DeKalb White. Egg production was not affected by dietary energy level. Feeding the high energy diet (containing 5.96% corn oil) significantly increased egg weight. This diet may be beneficial for improving early egg weight.

Key Words: laying hen, egg weight, dietary energy, strain difference


High available phosphorus corn (HAPC) was developed using the low phytic acid 1-1 (lpa1-1) allele of the corn lpa1 gene which contains lower phytic acid phosphorus (P) and more available P (Apv) than normal corn. A trial with laying hens (20 wk) examined if feeding HAPC for 20 weeks would maintain performance compared to hens fed a yellow dent corn (YDC) based diet. Dietary Apv levels were also studied. The 5 diets contained the following corn-Apv (%) combinations: YDC0.47; HAPC0.47; HAPC0.40; HAPC0.33 and HAPC0.26. Each diet was fed to 15 cages of hens (6 hens/cage). Weight gains during the first 28 days of the study, were greater for hens fed the HAPC0.47 and HAPC0.40 diets compared to the other treatments. For the 056, 084 and 0112 d periods, weight gains were not influenced by diet. By the end of the study, weight gains were greatest with all diets except hens fed the lowest Apv level. Hens fed the HAPC0.47 diet had the highest egg production while those fed the lowest Apv level (HAPC0.26) exhibited the lowest egg production. Hens fed the HAPC0.40 and HAPC0.33 diets exhibited similar egg production to hens fed the YDC0.47 diet, during the same periods. Only for 2 phases did diet influence feed intake/dozen egg. The lowest Apv level led to the greatest feed intake/dozen egg. Hens receiving the HAPC0.33 diet tended to have higher feed intake/kg of egg compared to hens fed the HAPC diets with higher Apv levels. Feed intake/kg of egg for hens fed YDC0.47 diet was generally comparable to the HAPC0.47 fed hens. The lowest Apv level fed was insufficient to meet hens needs for optimal egg production. Hens fed the HAPC0.47 diet exhibited heavier weights, greater egg production and optimal feed conversion (kg/kg egg). Reducing Apv levels from 0.47 to 0.40% in the HAPC diets did not adversely affect egg production.

Key Words: High available phosphorus corn, Layers, Egg quality, Phosphorus


High available phosphorus corn (HAPC) was developed using the low phytic acid 1-1 (lpa1-1) allele of the corn lpa1 gene which contains lower phytic acid phosphorus (P) and more available P (Apv) than normal corn. A trial with laying hens (20 wk) examined if feeding HAPC for 20 weeks would influence egg quality and cholesterol (CHL) significantly increased egg weight. This diet may be beneficial for improving early egg weight. Feed intake and feed conversion were monitored every 14 d subperiod, HAPC0.47; HAPC0.40; HAPC0.33 and HAPC0.26. Each diet was fed to 15 cages of hens (6 hens/cage). Egg weight decreased as dietary Apv level decreased, especially at the 0.33 and 0.26 Apv levels. Egg weights were comparable between hens fed the two highest Apv levels in the HAPC-based diets and the YDC0.47 diet. Shell thickness and albumen height were not influenced by the diets fed. Yolk weight was influenced at day 84 and 140, with hens fed the HAPC0.26 diet exhibiting the lightest egg yolks. Albumen weights at day 56, 112 and 140 were reduced with the two lowest Apv diets fed. Roche Color fan scores for day 84 to 140 were lower with the HAPC-fed birds. Egg CHL (g/egg) at day 28 was numerically reduced by utilizing HAPC (HAPC0.47 versus YDC0.47) in the diet, but was significantly reduced by day 140. Egg high density lipoproteins (HDL) and low density lipoproteins (LDL) were significantly lower from hens fed the HAPC0.47 diet compared to hens fed the YDC0.47 diet. Egg CHL, HDL and LDL levels decreased as dietary Apv levels decreased. Egg P and protein contents (DM basis) generally were not influenced by the diets fed. The lowest and possibly the second lowest levels of Apv fed were below the hens requirements. The HAPC may aid in reducing the CHL content of eggs.

Key Words: High available phosphorus corn, Layers, Egg quality, Phosphorus, Cholesterol


High available phosphorus/low phytate corn (HAPC) was developed using the low phytic acid 1-1 (lpa1-1) allele of the corn lpa1 gene which contains lower phytic acid phosphorus (P) and more available P (Apv) than normal corn. A trial with laying hens (20 wk) examined if feeding HAPC for 20 weeks would influence P excretion compared to hens fed a yellow dent corn (YDC) based diet. Dietary Apv levels were also studied. The 5 diets with the following corn-Apv (%) combinations were: YDC0.47; HAPC0.47; HAPC0.40; HAPC0.33 and HAPC0.26. Each diet was fed to 15 cages of hens (6 hens/cage). Feed P intake (g; DM) during the 24 h collection periods was influenced by the Apv level fed. P levels (g; DM) generally were influenced more by corn source rather than dietary Apv level. Hens fed HAPC instead of YDC excreted significantly less P. Calculated dietary phosphate P levels were similar across all HAPC diets and therefore did not decrease as dietary Apv decreased. Apparent feed P digestibility coefficients ([intake-excreta]/intake) generally were greater for hens fed the two highest dietary Apv levels in the HAPC-based diets when compared to the YDC0.47 diet. As dietary Apv level decreased, apparent feed P digestibility was reduced, because as supplemental level of P fell, the ratio of dietary phytate-bound P to total P increased. Crude protein intake (g; DM) was influenced by diet, but appeared to be affected more by actual analyzed dietary protein level, than corn type. Pellet protein excretion (g; DM) was not influenced by the Apv levels or corn sources utilized in this study. Protein excretion appeared to be more reflective of dietary protein levels and feed intake. By utilizing HAPC in the diet instead of YDC, P excretion can be reduced due to the lower phytate P content in the diet.

Key Words: High available phosphorus corn, Layers, Phosphorus excretion, Protein excretion, Digestibility

72 Performance and egg quality of hens fed 0.1% dietary metal amino acid chelates. M.T. Farra*n1, N.J. Daghir2, and V.M. Ashkarian1, 1American University of Beirut.

Two trials were conducted to study the effect of feeding 0.1% metal amino acid chelates, Replamin powder, produced by Allinson Laboratories Inc., on performance and egg quality of Single Comb White Leghorn laying hens of the Bovans Strain. In trial 1, a corn soybean diet (C) containing inorganic minerals and the same diet C+0.1% Replamin (CR) were fed each to 44 wk old hens in ten floor pens with 40 birds per pen for 8 wk in the summer of 99. In trial 2, the C and CR were made isominal and fed to 56 wk old birds for 6 wk in fall 99. Egg production, egg weight, egg mass, and total cracks were recorded on a daily basis. Feed intake and feed conversion were monitored every 14 d subperiod,
and specific gravity (SG) was measured on all eggs produced during the last 3 d of each subperiod. Haugh unit and yolk color scores were measured on 20 (Trial 1) and 25% (Trial 2) on eggs randomly selected from each pen for 3 consecutive days at the end of each subperiod. The ST and SG in both treatments although decreased during the heat waves (38°C) of the third subperiod in trial 1, it was higher (P<0.07) for the CR group. The ST and SG of the CR group were numerically higher all through the two trials, but the overall ST increased only in trial 1 and SG in trial 2 (P<0.05). All other criteria measured were not significantly different between the two treatments in both trials. The results indicated that Replamin may prove beneficial in improving eggshell quality, especially under heat stress, when used at proper levels.

**Key Words:** Replamin, Laying hens, Performance, Eggshell quality, Heat stress

### 73 Influence of linoleic acid content and type of fat added to the diet on egg weight and performance of laying hens. P. Cachaldora, R. Lazaro, J. Blanco, J. Mendez, G. G. Mateos.

A trial was conducted to study the influence of linoleic acid (LIN) content and type of fat added to the diet on egg weight and performance of laying hens from 19 to 47 wks of age. A total of 800 Isa Babcock hens were allotted at random into 10 treatments; two control diets based on corn and soybean meal with supplemental fat (0.77% of LIN) or with 4% of soy oil added (2.74% of LIN) and 8 additional diets in which the 4% of soy oil was substituted at 25, 50, 75, or 100% by either animal fat (2.29, 1.87, 1.32, and 1.02% of LIN, respectively) or fish oil (2.41, 1.75, 1.28, and 0.80% of LIN, respectively). Each treatment was replicated 4 times (20 hens caged in groups of 4). When the LIN content of the diet was less than 1.02%, egg mass production decreased and the difference was significant from 19 to 35 wks of age (P<0.05). Feed efficiency was also impaired from 19 to 47 wks when LIN content of the diet was less than 1.02% (2.31 vs 2.64 g/kg and 1.64 vs 1.83 g/ dozens of eggs; P<0.01). Further increases of LIN over 1.02% did not affect egg weight, egg mass or feed efficiency. Egg mass and hen day production were impaired from 31 to 35 wks (57.5 vs 59.7 g/d and 93.1 vs 95.5%, respectively; P<0.35) and feed efficiency from 31 to 47 wks (P<0.05) when 4% of animal fat or fish oil was used instead of 4% of soy oil. With respect to animal fat, the use of fish oil improved egg weight from 19 to 47 wks (P=0.07), egg mass and egg production from 23 to 27 wks (49.6 vs 48.6 g/d; P<0.05 and 86.6 vs 88.3%; P=0.06; respectively) and feed efficiency from 23 to 47 wks (P<0.05). It was concluded that an increase in the LIN content of the diet from 0.80% to 1.02% improved egg mass and egg production at the beginning of the laying period and feed conversion throughout the trial, but that no hens were observed with levels of use higher than 1.02%. Type of added fat also influenced egg size and performance of laying hens, with the poorest results obtained with fish oil.

**Key Words:** Linoleic acid, Fat, Laying hens, Egg size

### 74 Effect of pearl millet and corn based rations supplemented with different levels of soybean oil on productive parameters of laying hens. K. Muramatsu, J. H. Strighlini, M. B. Calef, R. M. F. Jardim, L. Andrade, N. K. Haga.

The purpose of this study was to determine if the use of pearl millet and corn based rations supplemented with different levels of soybean oil would affect the performance of laying hens. A 16 week feeding trial (37-53 week of age) divided in four period of 28 days was carried out using 256 Isa Babcocks hens allotted in a randomized block design. The eight experimental diets are: T1= corn + 0 % oil, T2= pearl millet + 0 % oil, T3= corn + 2.5 % oil, T4= pear millet + 3.3 % oil, T5= corn + 3.5 % oil, T6= pearl millet + 4.3 % oil, T7= corn + 4.5 % oil and T8= pearl millet + 5.3 % oil. The daily food intake (DFI) per hen was affected by the different diets (P<0.05); the pearl millet + 3.3 % oil diet had a lower feed intake than corn + 2.5 and corn + 4.5 % oil diets in the period 1, and it was lower than corn + 0 and corn + 3.5 % oil diets in the period 2. In the period 3, the pearl millet + 3.3 % oil diet had a higher feed intake than corn + 3.5 % oil diet. The feed conversion ratios (FCR) (kg/dz) were also significantly different (P<0.05) among the treatments; in the period 1 the pearl millet + 3.3 % oil diet had a better FCR (kg/dz) than corn + 0, corn + 3.5, corn + 4.5 % oil and pearl meal + 0 % oil diet; and better than corn + 0.0 and corn + 3.5 % oil diets in the period 2. The FCR (kg/kg) of the pearl millet + 3.3 % oil diet in the period 1 was better (P<0.05) than the pearl millet + 0 % oil diet. No significant differences (P<0.05) were detected for the egg production rate among the treatments. These results suggest that pearl millet can be included in layers rations and its utilization is supplemented with soybean oil improves some productive parameters of laying hens.

**Key Words:** Pearl millet, Soybean oil, Layers, Feed conversion rate, Production

### 75 Amounts of valine and threonine needed each day for egg production and egg weight. J. David Latshaw, The Ohio State University.

A diet was formulated to study the order of limiting amino acids in laying diets. The ingredients that supplied intact protein were corn, wheat, dehulled soybean meal, and peanut meal. Adequate amounts of each were stored for use in experiments, samples were analyzed for amino acid content, and diets were formulated on the basis of analysis. All diets included 20% wheat and 7% peanut meal. Corn and soybean meal percentages varied to provide the desired amount of amino acid in the basal diet. One diet, formulated for 100 g/day, had 0.55% valine. A second diet, formulated for 110 g/day, had 0.50% valine. Both diets provided 0.55g valine per day at the appropriate daily intakes. Valine was added to each daily treatment at a rate of 0.69, 0.76 or 0.83g per day. Other crystalline amino acids were added to provide a daily intake of 0.70g isoleucine, 0.65 methionine and cysteine, 0.60g threonine, 0.18g tryptophan and 1.15g phenylalanine and tyrosine. The 100 g/day diet was fed to Hy-Line W36 hens, and the 110 g/day diet was fed to DeKalb XL hens, all of them approximately 35 wk old. Two replicates, 10 hens per replicate, were fed each diet for 6 wk. Data were collected to determine rate of egg production, and feed intake by 2-wk periods. Eggs from the last day of each period were weighed. ANOVA indicated a significant valine effect on egg production and feed intake during wk 5 and 6 for both strains (P<0.05). Egg weight was not affected. Egg mass was also affected by dietary valine (P<0.05). Broken line regression analysis indicated the following break points for valine (g/day): W36 egg production, 0.66; W36 egg mass, 0.68; XL egg production, 0.63; XL egg mass, 0.65. A similarly designed experiment was completed with threonine as the amino acid variable. Dietary threonine amounts were planned for 0.38, 0.44, 0.50, 0.56 and 0.62g per day. Broken line regression analysis indicated the following break points for threonine (g/day): W36 egg production, 0.50; W36 egg mass, 0.52; XL egg production, 0.52; XL egg mass, 0.52.

**Key Words:** layers, threonine, valine

### 76 Egg output of layers as affected by dietary concentrations of tryptophan and isoleucine. J. David Latshaw, The Ohio State University.

A low protein diet was used to determine the point at which tryptophan became a limiting amino acid for layers. Adequate amounts of corn, wheat, dehulled soybean meal, and peanut meal were stored. Samples of each ingredients were analyzed for amino acid content and then used to formulate diets. All diets included 20% wheat and 7% peanut meal. Corn and soybean meal were combined to provide 0.12g tryptophan for hens eating 100g daily. Another diet, with 0.14% tryptophan was formulated for hens eating 105g daily. Tryptophan was supplemented in both diets to create treatments with 0.12, 0.14, 0.16, 0.18, and 0.20g tryptophan per hen each day. Other amino acids were supplemented in crystalline form. Diets formulated for 100g daily feed were fed to Hy-Line W36 hens, and the diet for 105g daily feed was fed to DeKalb XL hens. Each treatment was fed to 20 layers, two replicates of 10. Data on egg production and feed intake were averaged over 2-wk periods. Egg weight was determined on eggs from the last day of each period. ANOVA indicated a significant treatment effect on egg production and egg mass during weeks 5 and 6. Broken line regression analysis was used to estimate the daily amount of tryptophan needed to support egg production and egg mass. The following break points for tryptophan (g/day) were estimated: W36 egg production, 0.14g; W36 egg mass, 0.149; XL egg production, 0.138; XL egg mass, 0.138. Another experiment was completed using different dietary concentrations of isoleucine. One series used a diet that provided 0.42g isoleucine for hens eating 100g/day. It contained 20% wheat, and 3% blood meal plus corn and soybean meal. A second was formulated to provide 0.48g isoleucine for hens eating 100 g/day. It contained corn and soybean meal plus 3% blood meal. Each series had treatments that supplied 0, 0.08, 0.16, 0.24 and 0.32g added isoleucine/day. Both
ABSTRACTS OF PAPERS

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A trial was conducted to study the effects of feed restriction (FR) and enzyme supplementation (ES) on digestive and productive parameters of broilers from 4 to 46 d. A total of 675 one-day-old straight Cobb chicks were allotted at random into 5 treatments; 4 of them were based on rye and arranged factorially, with two FR (0 vs 30% from 4 to 14 d) and two doses of the enzyme complex (0 vs 500 ppm) and an additional control diet based on corn. The enzyme preparation used contained 858 IU of beta-glucanase and 864 IU of xylanase per g (Endofeed; GNC; Bioferm Inc.). Each treatment was replicated 9 times up to 25 d (15 chicks per cage) and 6 times from 25 to 46 d. Feed restriction reduced intestinal viscosity and the incidence of leg disorders and improved fat digestibility and feed efficiency at 46 d (P<0.05). The use of rye increased intestinal viscosity and the incidence of leg disorders and reduced nutrient digestibility and that both FR and ES reduced the magnitude of the differences. Enzyme addition improved productive performance, specially when birds were fed under ad libitum conditions.

Key Words: Broilers, Enzymes, Restriction, Rye, Digestibility


A total of 480 day-old male Ross broiler chicks were distributed in 4 treatments (T) and housed in 40 metabolic cages, in a controlled environment. A factorial 2x2 was used applying two energy levels with or without 0.10% of Vegpro® a multienzyme complex compound by pro- teases amylases and cellulases. From 1 to 21 days (Phase I), 20% CP and 2850 and 3050 kcal ME/kg diets were used for low (L) and high (H) energy (E). From 22 to 42 days (Phase II), CP and E levels were 22%,