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The environmental temperatures in the layer houses in the Midwest may range from 60 F to 90 F because of extreme cold weather in the winter and hot weather in the summer. Research suggests that cold temperatures increase the maintenance energy requirement of layers to increase body temperatures and hot environmental temperatures lower the maintenance energy requirement to enhance the elimination of body heat. Since feed consumption of layers is primarily controlled by their energy requirements the change in temperature drastically effects daily feed consumption. Alterations in feed intake of layers caused by changing temperatures create many problems for layer nutritionists because feed consumption information is important to provide optimum daily intakes of essential nutrients. The objectives of the research discussed in this paper were to determine the effect of environmental temperatures upon layer performance and also to develop information to assist in predicting feed intake of layers at different temperatures. The first experiment is for layers from 20 to 36 weeks of age and the second experiment is for layers from 36 to 65 weeks of age.

Fourteen hundred and forty DeKalb-XL Leghorn pullets, 18 weeks of age, were housed in six environmental rooms with each room containing two portable racks of cages that contains 60 cages per unit (120 cages). The six environmental rooms were maintained at temperatures of 61 F, 66 F, 72 F, 77 F, 82 F and 88 F. The relative humidity was maintained at 60% and the ventilation rate changed from 1.5 cfm per bird at 61 F to 6 cfm per bird at 88 F. The experimental diets consisted of 1200, 1250, 1300, and 1350 kcals of metabolizable energy per pound with nutrients formulated on a per therm basis to provide an equivalent amount of nutrients per therm in order to assure that all pullets received adequate levels of amino acids, minerals and vitamins. The Leghorn pullets were fed a 17% protein experimental pre-lay pullet diet from 18 weeks to 20 weeks of age prior to feeding. The two weeks helped each of the Leghorn pullets acclimate to the various temperatures. The body weights were determined every two weeks during the 16 week experiment and feed consumption was determined weekly. Egg production was charted each day and once a week all dietary treatments eggs were weighed for determination of egg weight differences.

The hen day egg production from hens housed in the six environmental rooms was equivalent for all temperatures (Figure 1). The mean egg weight for the four laying periods ranged from

a low 50.55 grams across all diets in the 88 F rooms up to 53.6 grams across all diets for layers housed at 61 F (Figure 1). The 3 gram increase in egg weight was due to the higher feed consumption of the birds housed at 61 F compared to birds housed at warmer temperatures. The hens housed at 61 F had a mean feed consumption per hen per day at 110 grams down to 88.4 grams of feed consumed per hen per day for hens housed at 88 F. The diets containing higher levels of energy (1350 kcals metabolizable energy per pound) produced higher caloric feed intake for all temperatures compared to the lower dietary calorie diets (Figure 3). The mean kcal consumed per hen day for hens housed in the 61 F rooms were 309 kcals and the hens housed at 88 F consumed 248 kcals per hen per day. The body weight gain of layers during the 16 week period was 333 grams across all diets for hens housed at 61 F and only 217 grams gain for hens housed at 88 F (Figure 2). Since the layers housed at 88 F produced the same hen day egg production as hens housed at 61 F and because of the low feed intake of hens housed at the high temperatures, the layers had an excellent feed utilization at the high temperatures. The grams of feed consumed per gram egg mass for hens housed in the room with 88 F is 2.11 compared to 2.51 grams feed consumed per gram egg mass for layers housed at 61 F. The low feed intake of layers housed in the warmer temperatures produce smaller egg size and this could be a detrimental factor when egg prices are significantly different between medium and large. The tremendous savings in feed cost in housing layers at warmer temperatures may very well offset egg size differences after layers have reached a larger size egg. Egg producers may need to increase feed consumption early in order to quickly increase egg size and then increase housing temperatures to help regulate feed intake and improve feed utilization.

The second experiment consisted of utilizing the same DeKalb layers (36 weeks of age) and housing layers at 65, 75 and 85 F environmental temperatures. The relative humidity was maintained at 60%. The layers housed in the environmental temperatures of 65, 75, and 85 F received 400 cfm air/room, 1000 cfm air/room and 1600 cfm air/room, respectively. Egg production was taken daily and feed consumption records determined every two weeks for seven 28-day periods. The eggs from each group were weighed once a week to determine temperature effect upon egg weights. The dietary formulas were continually adjusted for layers in each environmental temperature to provide equal essential nutrients per day for all layers.

The layer performance of hens housed at the three separate environmental temperatures are shown in table 1. Hen day egg production, egg weights, and egg mass were not affected by temperatures in this experiment. The feed consumption of layers housed at 65 F was approximately 4 pounds per 100 hens per day higher than at 85 F. The increased feed consumption also decreased the feed efficiency for the layers because layers housed at 65 F required 2.35 grams of feed per gram egg mass whereas hens housed at 85 F required 1.98 grams of feed per gram egg mass. The layers housed at 85 F also had a slight weight

gain during the 37 to 65 week period whereas birds housed at 65 F showed no increase in weight gain. The reason the layers housed at 65 F did not gain more additional weight from 36 to 65 weeks of age was because the layers had already gained a significant amount of weight from 20 to 36 weeks of age. The second experiment shows the tremendous advantage of housing layers at warmer temperatures because of the decrease in the feed consumption which greatly improved feed efficiency. A nutritionist must formulate for this decrease in feed consumption and provide the same amount of nutrients per day. The main reason layers can be more efficient with high temperatures is because of the lower maintenance energy requirement thus allowing more nutrients to be utilized for the production of eggs. These two experiments combined show the need to increase feed consumption early to increase egg size and then the advantages are to increase temperatures and decrease feed consumption to maintain an improvement in feed efficiency for the remainder of the laying cycle.

Table 1. The Performance of Hens Housed at Different Temperatures From 37 to 65 Weeks of Age

	Temperatures (F)		
	65	75	85
Hen day egg production, %	83.0	84.7	84.5
Egg weights, g	58.7	58.3	58.5
Egg mass, g	48.7	49.4	49.4
Feed consumption			
(g/hen/day)	114.4	106.2	97.6
(lbs/100 hens/day)	25.2	23.4	21.5
Feed efficiency			
(g feed/g egg mass)	2.35	2.15	1.98
(lbs feed/dz. eggs)	3.64	3.31	3.05
Weight gain, g	- 6.4	10.9	65.4

Figure 1. EFFECT OF TEMPERATURE (61-88°F) ON PERFORMANCE OF XL-DEKALB WHITE LEGHORN HENS FROM 20 TO 36 WEEKS OF AGE

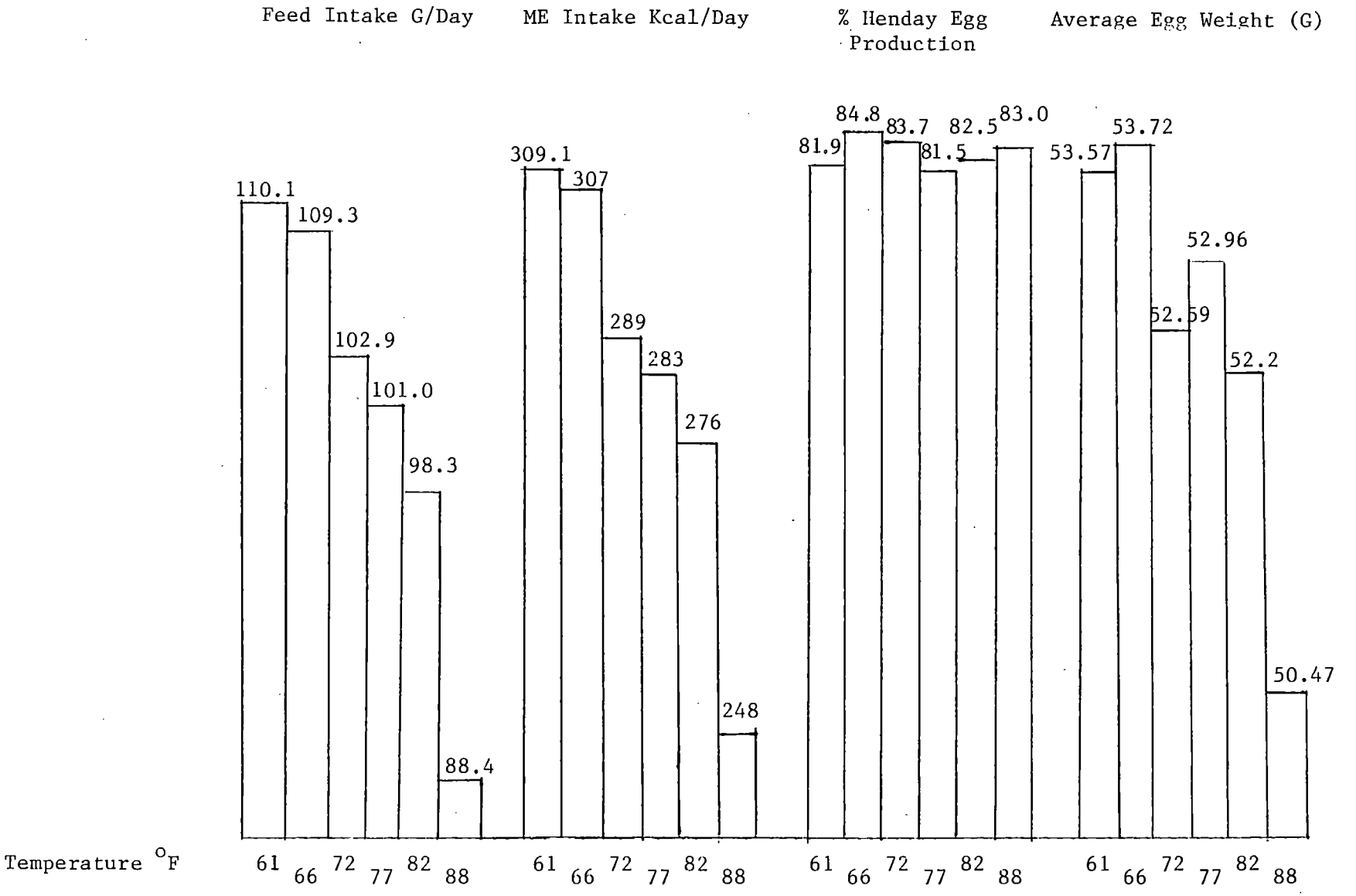

Figure 2. EFFECT OF TEMPERATURE (61-88°F) ON PERFORMANCE OF XL-DEKALB WHITE LEGHORN HENS FROM 20 TO 36 WEEKS OF AGE

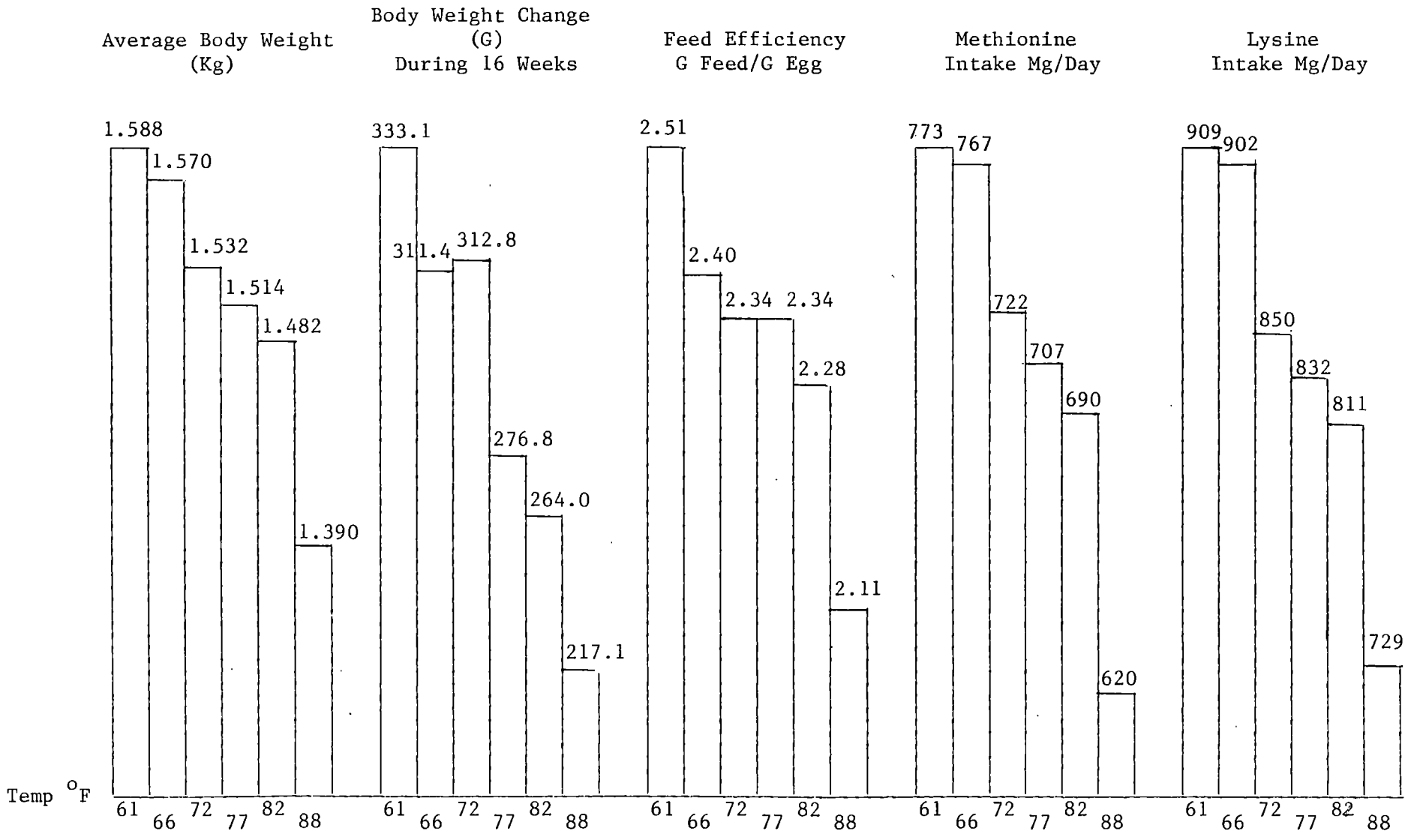

Figure 3. EFFECT OF ENERGY (2645-2976 Kcal/Kg) ON PERFORMANCE OF XL-DEKALB WHITE LEGHORN HENS FROM 20 TO 36 WEEKS OF AGE

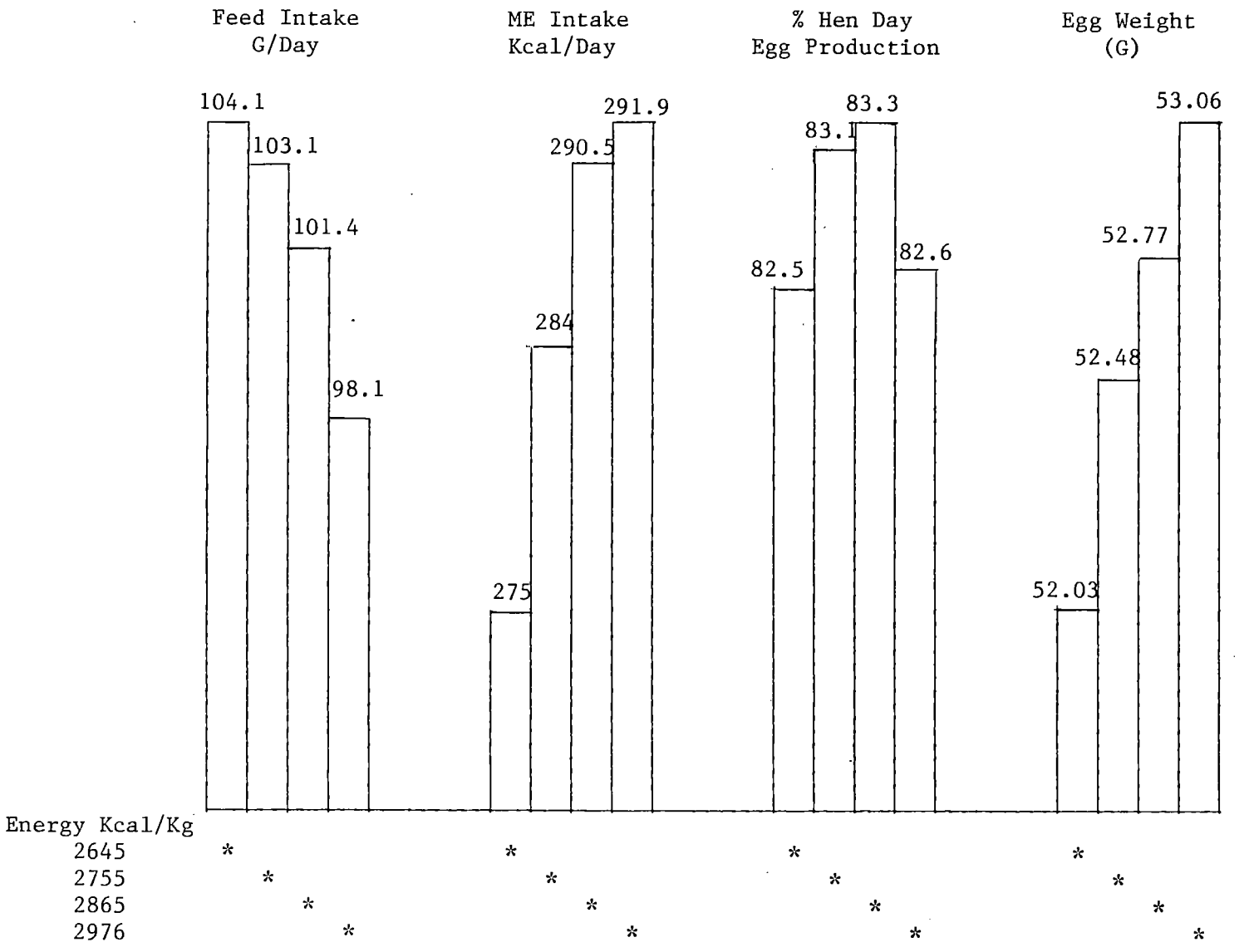

Figure 4. EFFECT OF ENERGY (2645-2976 Kcal/Kg) ON PERFORMANCE OF XL-DEKALB WHITE LEGHORN HENS FROM 20 TO 36 WEEKS OF AGE