Evaluation of limit feeding corn and distillers dried grains with solubles in non-feed-withdrawal molt programs for laying hens

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ABSTRACT An experiment was conducted using 504 Hy-Line W-36 Single Comb White Leghorn hens (69 wk of age) randomly assigned to 1 of 7 treatments. These treatments consisted of a 47% corn:47% soy hulls diet (C:SH) fed ad libitum; a 94% corn diet fed at a rate of 36.3, 45.4, or 54.5 g/hen per day (CORN 36, CORN 45, and CORN 54, respectively); and a 94% corn distillers dried grains with solubles (DDGS) diet fed at the same rates as the previous corn diets (DDGS 36, DDGS 45, and DDGS 54, respectively) during the molt period of 28 d. The intent was to feed the DDGS diets for 28 d; however, all hens on these diets had very low feed intakes and greater than anticipated BW loss. Thus, they were switched to a 16% CP corn-soybean meal layer diet on d 19 of the molt period. At d 28, hens on all treatments were fed the same corn-soybean meal layer diet for 39 wk (73 to 112 wk of age). All DDGS diets and the CORN 36 diet resulted in total cessation of egg production during the molt period and egg production of hens fed the CORN 45, CORN 54, and C:SH diets had decreased to 3 and 4%, respectively, by d 28. Body weight loss during the 28-d molt period ranged from 14% for the CORN 54 diet to approximately 23% for the 3 DDGS diets. Postmolt egg production (5 to 43 wk) was higher for hens fed the DDGS molt diets than those fed the corn diets. There were no consistent differences in egg mass, egg-specific gravity, feed efficiency, or layer feed consumption among molt treatments for the postmolt period. These results indicate that limit feeding corn diet and DDGS diet in non-feed-withdrawal molt programs will yield long-term postmolt performance that is comparable to that observed by ad libitum feeding a C:SH diet.

Key words: molting, distillers dried grain with solubles, laying hen, egg production

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INTRODUCTION

Induced molting can be an effective management tool in which the productive life of a flock is extended and egg production is maximized over the life span of the hen (Brake and Carey, 1983). The main objective of a molting program is to cause hens to totally cease egg production and enter a nonreproductive state (Webster, 2003). Earlier research focused on feed withdrawal methods based on a target BW (Baker et al., 1983; Brake and Carey, 1983), length of the feed withdrawal period (Koelkebeck et al., 1992), or feeding diets low in calcium (Douglas et al., 1972), among many others. Recently, concerns for the well-being of the hens during an induced molt have been voiced by animal welfare groups. They contend that the feed withdrawal method of inducing a molt is cruel and inhumane. Therefore, since the year 2000, research has been focused on using non-feed-withdrawal molting programs.

Feeding diets containing low protein, low energy (Anderson, 2002), high wheat middlings (Biggs et al., 2003), a combination of wheat middlings and corn (Biggs et al., 2004), high cottonseed meal (Davis et al., 2002), different ratios of alfalfa and layer diet (Donalson et al., 2005), or high levels of zinc (Park et al., 2004), among others, have resulted in effective non-feed-withdrawal methods for molting laying hens. With the large increase in ethanol production from corn in recent years, corn distillers dried grains with solubles (**DDGS**) has become a plentiful and relatively inexpensive feed ingredient in many areas. In addition, corn is also a readily available and relatively inexpensive feed ingredient in most areas. However, previous research in our laboratory (Biggs et al., 2004) showed that high corn and high DDGS diets (94 to 96%) fed ad libitum did not cause hens to totally cease production. Therefore, the objectives of the current study were to determine if limit feeding high corn and high DDGS molt diets would result in a total cessation of egg production during the molt period and provide for acceptable postmolt per-

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formance in a non-feed-withdrawal molt program for laying hens.

MATERIALS AND METHODS

All animal care procedures were approved by the university institutional animal care and use committee. An experiment was conducted using 504 Hy-Line W-36 Single Comb White Leghorns hens (69 wk of age). The hens were housed in a caged layer house of commercial design with water and feed provided for ad libitum consumption and exposed to a 17-h daily photoperiod before the start of the experiment. Six replicate groups of 12 hens each (2 adjacent cages containing 6 hens per cage, 60.9 × 58.4 cm) were allotted to 7 dietary treatments in a completely randomized design so that mean BW was similar for each treatment. The molt treatments consisted of a 47% corn:47% soy hulls diet (**C:SH**) fed ad libitum for 28 d; a 94% corn diet fed at a rate of 36.3, 45.4, or 54.5 g/hen per day for 28 d (**CORN 36**, **CORN 45**, and **CORN 54**, respectively); and a 94% DDGS diet fed at the same rates of the previous corn diets (**DDGS 36**, **DDGS 45**, and **DDGS 54**, respectively). The 7 molt diets were formulated to contain 2% calcium and at least 0.25% nonphytate phosphorus using NRC (1994) table values (Table 1).

At the start of the experiment (d 1), birds were fed their respective diets. The intent was to feed the DDGS diets for 28 d; however, all hens on these diets had very low feed intake and had greater than anticipated BW loss. Consequently, these hens were switched to a 16% CP corn-soybean meal diet on d 19 and were fed this diet for the remainder of the molt period (19 to 28 d). Hens fed the C:SH diet and the 3 corn diets were fed their respective diets for the entire 28-d molt period. On d 29, all hens were placed on a 16% CP layer diet (Table 1). The experiment consisted of a 4-wk molt period (69 to 72 wk) followed by a 39-wk postmolt production period (73 to 112 wk).

Two days before feeding the molt diets, the photoperiod was reduced from 17 to 10 h/d. On d 21, the daily photoperiod was increased to 12 h and then to 13 h on d 28. Thereafter, the daily photoperiod was increased 30 min per week until a 17-h photoperiod was established.

Egg Production and Performance

Egg production performance was measured for 43 wk after the initiation of feeding the molt diets. Egg production and mortality were recorded daily throughout the 43-wk experimental period. Specific gravity, egg weights, and mass were measured on all eggs produced on 2 consecutive days every week during wk 8 to 10, every 4 wk from wk 14 to 39, and then every week from wk 40 to 43. Specific gravity was measured using the flotation method with NaCl solutions varying in specific gravity from 1.056 to 1.100 g/cm^3 in 0.004-g/cm^3 increments. Egg mass was calculated using hen-day egg production and mean egg weight. Feed consumption was measured every week from wk 1 to 15 and from wk 40 to 43. Body weights of all hens were measured 6 d before onset of the experiment. Hens fed the DDGS diets were weighed on d 19. Hens fed the C:SH and corn diets were weighed at the end of the molt period (d 28).

Table 1. Composition of the experimental molt diets containing corn and soy hulls (C:SH), corn, distillers dried grains with solubles (DDGS), and the postmolt layer diet

Item, (%)	C:SH	Corn	DDGS	Layer
Ingredient				
Corn	47.15	93.74	0.0	68.70
Soy hull	47.10	0.0	0.0	0.0
DDGS	0.0	0.0	94.50	0.0
SBM[1]	0.0	0.0	0.0	18.40
Meat and bone meal	0.0	0.0	0.0	2.50
Limestone	4.10	4.66	4.85	8.50
Dicalcium phosphate	1.00	0.95	0.0	1.25
Salt	0.30	0.30	0.30	0.30
Mineral mix[2]	0.15	0.15	0.15	0.15
Vitamin mix[3]	0.20	0.20	0.20	0.20
Calculated analysis[4]				
CP	9.20	7.90	25.90	16.00
ME (kcal/kg)	1,894	3,140	2,927	2,865
Calcium	2.00	2.00	2.00	3.80
Nonphytate phosphorus	0.25	0.25	0.37	0.45

[1]Soybean meal.

[2]Provided per kilogram of diet: manganese, 75 mg from manganese oxide; iron, 75 mg from iron sulfate; zinc, 75 mg from zinc oxide; copper, 5 mg from copper sulfate; iodine, 0.76 mg from ethylene diamine dihydroiodide; and selenium, 0.1 mg from sodium selenite.

[3]Provided per kilogram of diet: vitamin A from vitamin A acetate, 4,400 IU; cholecalciferol, 1,000 IU; vitamin E from α-tocopheryl acetate, 11 IU; vitamin B_{12}, 0.011 mg; riboflavin, 4.4 mg; D-pantothenic acid, 10 mg; niacin, 22 mg; and menadione sodium bisulfate complex, 2.33 mg.

[4]Based on NRC (1994) feed composition tables.

Table 2. Body weight loss during the molt period (%)

Treatment[1]	Weight loss Day 19	Day 28
	(%)	
C:SH	—	20.6[a]
CORN 36	—	22.2[a]
CORN 45	—	16.6[b]
CORN 54	—	13.9[b]
DDGS 36	23.1[a]	—
DDGS 45	22.7[a]	—
DDGS 54	22.8[a]	—
Pooled SEM	1.10	0.94

[a,b]Means within a column with no common superscript differ significantly ($P < 0.05$).

[1]C:SH = 47% corn:47% soy hulls diet fed ad libitum; CORN 36 = 94% corn diet fed at a rate of 36.3 g/hen per day; CORN 45 = 94% corn diet fed at a rate of 45.4 g/hen per day; CORN 54 = 94% corn diet fed at a rate of 54.5 g/hen per day; DDGS 36 = 94% distillers dried grains with solubles (DDGS) diet fed at a rate of 36.3 g/hen per day; DDGS 45 = 94% DDGS diet fed at a rate of 45.4 g/hen per day; DDGS 54 = 94% DDGS diet fed at a rate of 54.5 g/hen per day.

Statistical Analysis

All data were analyzed by ANOVA procedures appropriate for a 1-way completely randomized design (Steel and Torrie, 1980). The Fisher's protected least significant difference test was used to determine significant differences ($P < 0.05$) among treatment means. Single degree of freedom comparisons among groups of treatments were also conducted where meaningful.

RESULTS

Hens fed the DDGS 36, DDGS 45, and DDGS 54 diets lost 23.1, 22.7, and 22.8%, respectively, of initial BW by d 19; however, they regained some weight by the end of the 28-d molt period after being switched to the corn-soybean meal on d 19 (Table 2). Hens fed the CORN 36 diet lost 22.2% BW, and those fed the CORN 45 and CORN 54 diets lost significantly less BW than those fed the C:SH diet or CORN 36 diet by the end of the 28-d molt period.

There were no differences in mortality among treatments during the molt period. Mortality was 1.4 and 5.5% for the DDGS 36 and DDGS 45 treatments, whereas no hens died in the other treatments (data not shown). There were also no significant differences in mortality for all remaining treatments during the postmolt period. Mortality was 0, 2.7, 2.7, 2.7, 4.1, 0, and 5.5% for the C:SH, CORN 36, CORN 45, CORN 54, DDGS 36, DDGS 45, and DDGS 54 treatments, respectively, during the postmolt period (data not shown).

The decrease in daily hen-day egg production during the 28-d molt period is shown in Figure 1, as are the weekly averages in Table 3. Hens fed the C:SH, CORN 45, and CORN 54 molt diets never went completely out of production but decreased to a low of 2, 2, and 1%, respectively, during the 28-d molt. Hens fed the CORN 36 molt diet went completely out of production by d 22, and hens fed the DDGS molt diets went completely out of production by d 16 (DDGS 45 and DDGS 54) and d 19 (DDGS 36). For the entire 28-d molt period, hens fed the CORN 54 molt diet produced more eggs than the hens fed DDGS, CORN 36, or C:SH treatments. Postmolt (wk 5 to 43) hen-day egg production was numerically highest for the DDGS 45 molt treatment but was not significantly different from the DDGS 36, DDGS 54, or C:SH molt treatments. Postmolt egg production was lower for the 3 corn treatments than for the 3 DDGS treatments when compared using a single degree of freedom contrast.

As expected, feed intake during the 28-d molt period was highest for hens fed the C:SH molt diet ad libitum

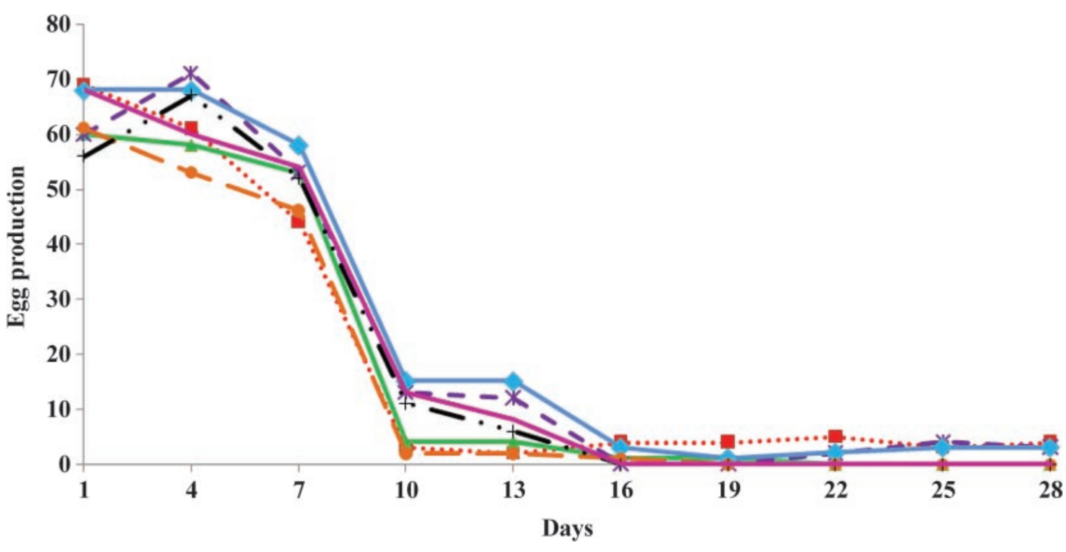

Figure 1. Daily hen-day egg production during the molt period of hens fed a corn:soy hulls diet (■), hens fed a corn diet at a rate of 36.3 g/hen per day (▲), hens fed a corn diet at a rate of 45.4 g/hen per day (×), hens fed a corn diet at a rate of 54.5 g/hen per day (♦), hens fed a distillers dried grains with solubles (DDGS) diet at a rate of 36.3 g/hen per day (●), hens fed a DDGS diet at a rate of 45.4 g/hen per day (+), and hens fed a DDGS diet at a rate of 54.5 g/hen per day (—). Color version available in the online PDF.

Table 3. Effect of non-feed-withdrawal molting treatments on hen-day egg production during the 4-wk molt period and 39-wk postmolt period[1]

	Molt period (wk)					Postmolt period (wk)
Treatment[2]	1	2	3	4	1 to 4	5 to 43
	(%)					
C:SH	47[b]	2[d]	5[a]	4[a]	15[bcd]	70[ab]
CORN 36	53[ab]	4[d]	1[b]	0[c]	14[cd]	68[b,y]
CORN 45	53[ab]	12[ab]	2[b]	3[ab]	17[ab]	68[b,y]
CORN 54	58[a]	15[a]	1[b]	3[ab]	19[a]	68[b,y]
DDGS 36	46[b]	2[d]	0[b]	1[bc]	13[d]	71[ab,x]
DDGS 45	52[ab]	6[cd]	0[b]	0[c]	15[cd]	73[a,x]
DDGS 54	55[a]	8[bc]	0[b]	0[c]	16[bc]	71[ab,x]
Pooled SEM	2.5	1.3	0.8	0.8	0.9	1.3

[a–d]Means within a column with no common superscript differ significantly ($P < 0.05$).

[x,y]Means within a column for the corn treatments are significantly different from the distillers dried grains with solubles (DDGS) treatments based on a single degree of freedom contrast ($P < 0.05$).

[1]Data are means of 6 groups of 12 hens each.

[2]C:SH = 47% corn:47% soy hulls diet fed ad libitum; CORN 36 = 94% corn diet fed at a rate of 36.3 g/hen per day; CORN 45 = 94% corn diet fed at a rate of 45.4 g/hen per day; CORN 54 = 94% corn diet fed at a rate of 54.5 g/hen per day; DDGS 36 = 94% DDGS diet fed at a rate of 36.3 g/hen per day; DDGS 45 = 94% DDGS diet fed at a rate of 45.4 g/hen per day; DDGS 54 = 94% DDGS diet fed at a rate of 54.5 g/hen per day.

(Table 4). Feed intake for hens fed the corn diets was almost identical to the amount of feed that was offered during the first 3 wk of the molt period. Feed intake of the corn diets was reduced during wk 4 of the molt period. Feed intake of hens on the DDGS 36 and DDGS 45 treatments was similar to the amount of feed that was offered for the first 3 wk, but intake was lower than the amount of feed that was offered for the DDGS 54 treatment. Feed intake increased greatly for all hens on the DDGS treatments when they were switched to the corn-soybean meal diet (wk 4).

Postmolt egg weight and egg mass (wk 8, 9, 8 to 10, 14 to 39, and 40 to 43) are shown in Table 5. Hens on the CORN 54 diet treatment generally produced smaller eggs than hens on the other treatments. This same difference was observed for egg mass except for the 40 to 43-wk period when no significant differences were observed among treatments. In contrast, egg mass for the 40 to 43-wk period was lower for the 3 corn treatments than for the 3 DDGS treatments when compared using a single degree of freedom contrast.

Postmolt feed intake during wk 8 to 15 was highest for the DDGS 45 diet and lowest for the CORN 54 diet but did not differ among the other treatments (Table 6). No differences were observed during the 40 to 43-wk period for postmolt feed intake.

For egg-specific gravity, some significant differences were observed among treatments for the 8 to 10-wk postmolt period (Table 7); these occurred because the C:SH and corn treatments generally yielded lower specific gravity than DDGS treatments. However, no differences in egg-specific gravity were detected among treatments for the 14 to 39- or 40 to 43-wk postmolt periods.

Table 4. Effect of non-feed-withdrawal molting treatments on feed intake during the 4-wk molt period[1]

	Week				
Treatment[2]	1	2	3	4	1 to 4
	(g/hen per day)				
C:SH	49.8[b]	83.1[a]	77.7[a]	68.9[b]	69.9[a]
CORN 36	36.3[d]	36.3[e]	36.3[d]	35.7[d]	36.1[d]
CORN 45	45.4[c]	45.4[cd]	45.4[c]	43.9[c]	45.0[c]
CORN 54	54.3[a]	54.5[b]	54.5[b]	50.8[c]	53.6[b]
DDGS 36	36.3[d]	35.9[e]	42.2[cd]	80.4[a]	48.7[c]
DDGS 45	44.9[c]	43.8[d]	43.8[c]	81.6[a]	53.5[b]
DDGS 54	51.2[b]	48.5[c]	45.6[c]	82.5[a]	56.9[b]
Pooled SEM	0.72	1.36	2.10	2.60	1.49

[a–e]Means within a column with no common superscript differ significantly ($P < 0.05$).

[1]Data are means of 6 groups of 12 hens each.

[2]C:SH = 47% corn:47% soy hulls diet fed ad libitum; CORN 36 = 94% corn diet fed at a rate of 36.3 g/hen per day; CORN 45 = 94% corn diet fed at a rate of 45.4 g/hen per day; CORN 54 = 94% corn diet fed at a rate of 54.5 g/hen per day; DDGS 36 = 94% distillers dried grains with solubles (DDGS) diet fed at a rate of 36.3 g/hen per day; DDGS 45 = 94% DDGS diet fed at a rate of 45.4 g/hen per day; DDGS 54 = 94% DDGS diet fed at a rate of 54.5 g/hen per day.

Table 5. Effect of limit feeding corn and distillers dried grains with solubles (DDGS) diets on egg weight and egg mass from wk 8 and 9, 8 to 10, 14 to 39, and 40 to 43 wk[1]

	Egg weight (g/egg)					Egg mass (g egg/hen per day)				
Treatment[2]	8 wk	9 wk	8 to 10 wk	14 to 39 wk	40 to 43 wk[3]	8 wk	9 wk	8 to 10 wk	14 to 39 wk	40 to 43 wk
C:SH	64.2[ab]	65.0[a]	65.2[ab]	66.8[ab]	66.6[a]	42[b]	51[ab]	52[bc]	50[ab]	45[a]
CORN 36	63.7[ab]	64.8[a]	65.3[ab]	67.2[a]	66.9[a]	44[ab]	52[ab]	52[bc]	48[ab]	41[a,y]
CORN 45	63.4[abc]	64.3[a]	64.5[b]	66.2[abc]	66.4[a]	41[b]	48[b]	50[c]	47[b]	41[a,y]
CORN 54	62.0[c]	62.6[b]	63.1[c]	65.5[c]	64.4[b]	30[c]	42[c]	47[d]	48[ab]	42[a,y]
DDGS 36	62.9[bc]	64.1[ab]	64.3[b]	65.9[bc]	66.0[a]	46[ab]	53[a]	53[ab]	49[ab]	45[a,x]
DDGS 45	64.7[a]	64.7[a]	65.8[a]	67.1[ab]	66.6[a]	49[a]	54[a]	55[a]	51[a]	46[a,x]
DDGS 54	64.4[a]	65.4[a]	64.8[ab]	66.2[abc]	65.8[ab]	47[ab]	54[a]	53[ab]	49[ab]	45[a,x]
Pooled SEM	0.5	0.5	0.4	0.4	0.5	2.5	1.5	0.8	1.0	1.7

[a–c]Means within a column with no common superscript differ significantly ($P < 0.05$).

[x,y]Means within a column for the corn treatments are significantly different from the DDGS treatments based on a single degree of freedom contrast ($P < 0.05$).

[1]Data are means of 6 groups of 12 hens.

[2]C:SH = 47% corn:47% soy hulls diet fed ad libitum; CORN 36 = 94% corn diet fed at a rate of 36.3 g/hen per day; CORN 45 = 94% corn diet fed at a rate of 45.4 g/hen per day; CORN 54 = 94% corn diet fed at a rate of 54.5 g/hen per day; DDGS 36 = 94% DDGS diet fed at a rate of 36.3 g/hen per day; DDGS 45 = 94% DDGS diet fed at a rate of 45.4 g/hen per day; DDGS 54 = 94% DDGS diet fed at a rate of 54.5 g/hen per day.

[3]Egg weights were measured weekly during wk 40 to 43.

DISCUSSION

As of January 2006, commercial egg producers in the United Egg Producers Animal Care Certified Program are required to use non-feed-withdrawal molting methods (United Egg Producers, 2008) if they choose to force-molt hens. The use of non-feed-withdrawal feeding programs has applicability in the commercial laying hen industry, but commercial producers who adopt such molting programs need to adapt it to their own situation and conditions. The price and availability of feed ingredients used in non-feed-withdrawal molting programs is always a factor to consider (Koelkebeck et al., 2006). Previous non-feed-withdrawal methods that have been studied including feeding high corn and wheat middlings diets (Biggs et al., 2003), combinations of corn and wheat middlings, high levels of corn gluten feed (Biggs et al., 2004), combinations of corn and soy hulls (Utterback et al., 2005), high zinc diets (Bar et al., 2003), high cottonseed meats diets (Davis et al., 2002), diets containing 20% guar meal (Gutierrez et al., 2008), and feeding different ratios of alfalfa meal and layer diet (Donalson et al., 2005) have all been shown to be effective methods for molting laying hens. However, previous research in our laboratory (Biggs et al., 2004) has shown that high corn and high DDGS diets (94 to 96%) fed ad libitum were not as effective because they did not cause hens to totally cease production.

The objective of the present study was to determine if limit feeding corn and DDGS diets would provide for acceptable postmolt performance in a non-feed-withdrawal molt program for laying hens. Corn and DDGS are readily available and economical feed ingredients and could serve as alternatives for induced molting in laying hens. The levels of feed consumption during the molt period were equal to 3.6, 4.5, and 5.4 kg of feed per 100 hens per day. Also, based on previous research in our laboratory, these feed intakes are from 60 to 90% of what hens would normally consume for a corn diet and 50 to 70% of what hens would consume for a DDGS diet during the molt period (Biggs et al., 2004).

Table 6. Effect of limit feeding corn and distillers dried grains with solubles (DDGS) diets on feed intake and feed efficiency from wk 8, wk 9, 8 to 15 wk, and 40 to 43 wk[1]

	Feed intake (g/hen per day)				Feed efficiency (g of egg:g of feed)			
Treatment[2]	8 wk	9 wk	8 to 15 wk	40 to 43 wk	8 wk	9 wk	8 to 15 wk	40 to 43 wk
C:SH	106[b]	108[b]	111[b]	98[a]	0.392[a]	0.469[ab]	0.464[ab]	0.454[a]
CORN 36	108[b]	107[b]	112[b]	101[a]	0.406[a]	0.482[ab]	0.468[ab]	0.409[b]
CORN 45	110[ab]	108[b]	112[b]	100[a]	0.378[a]	0.446[bc]	0.450[bc]	0.414[ab]
CORN 54	99[c]	101[c]	108[c]	99[a]	0.304[b]	0.417[c]	0.439[c]	0.428[ab]
DDGS 36	108[b]	109[b]	113[b]	98[a]	0.421[a]	0.485[ab]	0.465[ab]	0.456[a]
DDGS 45	114[a]	112[a]	118[a]	102[a]	0.434[a]	0.482[ab]	0.464[ab]	0.449[ab]
DDGS 54	108[b]	108[b]	112[b]	99[a]	0.434[a]	0.503[a]	0.474[a]	0.453[ab]
Pooled SEM	1.4	1.2	1.0	1.7	0.024	0.014	0.007	0.016

[a–c]Means within a column with no common superscript differ significantly ($P < 0.05$).

[1]Data are means of 6 groups of 12 hens.

[2]C:SH = 47% corn:47% soy hulls diet fed ad libitum; CORN 36 = 94% corn diet fed at a rate of 36.3 g/hen per day; CORN 45 = 94% corn diet fed at a rate of 45.4 g/hen per day; CORN 54 = 94% corn diet fed at a rate of 54.5 g/hen per day; DDGS 36 = 94% DDGS diet fed at a rate of 36.3 g/hen per day; DDGS 45 = 94% DDGS diet fed at a rate of 45.4 g/hen per day; DDGS 54 = 94% DDGS diet fed at a rate of 54.5 g/hen per day.

Table 7. Effect of non-feed-withdrawal treatments on egg-specific gravity during the postmolt period[1]

Treatment[2]	Week			Mean
	8 to 10	14 to 39	40 to 43	
	(g/cm^3)			
C:SH	1.0816[c]	1.0778[a]	1.0737[a]	1.0774[a]
CORN 36	1.0827[bc]	1.0785[a]	1.0745[a]	1.0783[a]
CORN 45	1.0830[b]	1.0775[a]	1.0740[a]	1.0777[a]
CORN 54	1.0815[c]	1.0784[a]	1.0747[a]	1.0780[a]
DDGS 36	1.0837[ab]	1.0784[a]	1.0750[a]	1.0786[a]
DDGS 45	1.0833[ab]	1.0785[a]	1.0741[a]	1.0783[a]
DDGS 54	1.0845[a]	1.0786[a]	1.0738[a]	1.0785[a]
Pooled SEM	0.0004	0.0005	0.0006	0.0005

[a–c]Means within a column with no common superscript differ significantly ($P < 0.05$).

[1]Data are means of 6 groups of 12 hens each.

[2]C:SH = 47% corn:47% soy hulls diet fed ad libitum; CORN 36 = 94% corn diet fed at a rate of 36.3 g/hen per day; CORN 45 = 94% corn diet fed at a rate of 45.4 g/hen per day; CORN 54 = 94% corn diet fed at a rate of 54.5 g/hen per day; DDGS 36 = 94% distillers dried grains with solubles (DDGS) diet fed at a rate of 36.3 g/hen per day; DDGS 45 = 94% DDGS diet fed at a rate of 45.4 g/hen per day; DDGS 54 = 94% DDGS diet fed at a rate of 54.5 g/hen per day.

All dietary treatments in the current study were effective for decreasing egg production and BW during the molt period. All of the DDGS treatments and CORN 36 resulted in complete cessation of production by 16 to 22 d and the C:SH decreased egg production to 2% by d 14 and the CORN 45 and CORN 54 treatments gradually decreased egg production to as low as 2 and 1%, respectively, which was obtained by d 21. These results suggest that limit feeding corn and DDGS may be good alternatives to feed withdrawal for induced molting programs.

The differences in egg production response among dietary treatments during the molt period might have been due to differences in palatability, amino acid digestibility, or energy content of the diets. During the first 2 wk, the above factors probably contributed to the low feed intake of the DDGS diets, which was below the restricted amount for some treatments. The high DDGS diets may have been less palatable, probably had lower amino acid digestibility, and were lower in energy than the corn diets. The DDGS used in this study was very dark in color and digestibility of lysine in the DDGS was only 56% (this was determined in a separate study using a precision-fed cecectomized rooster assay). After 19 d, the low feed intake of the hens on the DDGS diets had caused a greater than expected BW loss and the hens had to be switched to a 16% CP layer diet. The very low feed intake is probably the primary reason why hens fed the DDGS diets decreased egg production faster than those fed the corn and C:SH diets. In contrast to our findings, Biggs et al. (2004) reported that DDGS diets were not effective for ceasing egg production because the diets did not cause sufficient reduction in feed intake. The differences between the results of the current study and the Biggs et al. (2004) study were probably due to the source or type of DDGS used in the 2 studies. Another major difference between the 2 studies that may have contributed to the contrasting results is that in the current study feed was restricted, whereas in the study by Biggs et al. (2004) feed was available for ad libitum consumption.

There were some differences in postmolt egg production (wk 5 to 43) among treatments, with the DDGS diets yielding higher egg production than the corn diets. These differences may be related to the length of rest or ovarian-oviduct regression obtained during the molt period. Brake and Thaxton (1979) reported that the absolute and relative weight of the oviduct during a molt decreased significantly, which is related to a decrease in ovarian function. All DDGS treatments resulted in higher BW loss and generally lower egg production during the molt period than the CORN 45 and CORN 54 treatments. Thus, the hens on the DDGS treatments probably had increased length of rest or ovarian-oviduct regression.

Long-term postmolt egg-specific gravity (wk 8 to 43) was not affected by limiting feed intake of corn or DDGS. Even though eggshell quality (specific gravity) at the end of the laying cycle (wk 40 to 43) was reduced and substantially lower than that during the 8 to 10-wk period, there were no differences among treatments. These results indicate that hens can be successfully molted by limit feeding a high corn or DDGS diet without substantially reducing eggshell quality compared with ad libitum feeding of a C:SH diet.

Overall, results of the current study indicate that limit feeding a high corn or high DDGS diet is as effective as a non-feed-withdrawal molt program that provides comparable postmolt performance as ad libitum feeding a C:SH diet.

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