

## **Turkey Breeder Hen Nutrition and Weight Control**

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Turkey breeder nutritional requirements are far less established in the literature than for growing turkeys. The NRC (1994) does not recommend special dietary nutrient specifications for turkey breeder candidates and only provides one set of recommendations for the entire duration of lay. However, most commercial turkey breeding companies have unique nutritional programs for turkey breeder candidates and breeding birds, depending on growth targets, strain, and egg production. Unlike commercial turkeys where growth rate and feed conversion must be optimized, the objective with turkey breeders is to control body weight to facilitate proper conditioning for optimum reproductive performance.

The growth rate of the turkey has increased dramatically over the last 20 to 25 years. Today we expect the male turkey to grow to 40 lb in 20 weeks compared to 20 lb in 20 weeks 25 years ago (Heffernan, 2000). Similar changes have occurred for 18-week male body weights. In 1985, the 18-week body weight for male turkeys was 23 lb while in 2001 it was 32.2 lb as reported in an industry survey (Ferket, 2002). Beginning in the early 1980's, increased genetic selection was placed on the turkey breeder hen to facilitate an increase in weights of market turkeys (Krueger, 1987; Felts, 1993; Hester and Stevens, 1990) resulting in increased turkey breeder hen growth rates and body weights (Douglas, 1997; Krueger, 1997). In a survey of turkey breeder personnel, Heffernan (2000) reported that the turkey industry can expect similar growth for the foreseeable future. One breeder representative stated that a 40 lb 17 week-old tom will be achievable by 2010. Using historical weight data, Ferket (2001) projected that by 2010 the industry average for 18 week-old toms will be 35.3 lb and 14 week-old hens will weigh 17.2 lb. This is compared to an industry mean of 28.6 lb for a 17 week-old tom in a 2001 turkey industry survey (Ferket, 2001). It is expected that the turkey breeder hen will continue to make a significant contribution to this increase in market bird growth rate.

However, there is a significant negative relationship between turkey hen body weight and egg production, which is mediated mainly as a decrease in intensity of lay (Nestor, 1971; Nestor et al., 2000). These effects were clearly demonstrated in a report by Nestor et al. (2000). A line of turkeys (F) selected for 30 generations for increased 16-week body weight was compared to the random bred line of turkeys (RBC) from which it was

initially obtained. The adult hen body weight of the RBC line was 21 lb compared to 38 lb for the F line hens. The 180-day egg production for the RBC line was 92.6 eggs per hen compared to 68.7 eggs per hen for the F line. While fertility was not significantly different (89 versus 87%), the hatchability of fertile eggs decrease from 85% for the RBC line to 75% for the F line. Days to first egg, clutch length, and rate of lay were all negatively affected by selection for increased body weight. The total days broody was not affected. Egg weight increased from 89 to 98 grams for the RBC line versus the F line. While the F line breeder hens reported by Nestor et al. (2000) may not be the same as those used by the turkey industry, this study does demonstrate what the turkey breeder hen of the future could be like. Although the adult weight of the breeder hens used by the turkey industry is much less than Nestor's F-line, there are signs that increased selection for body weight is creating management difficulties. A phone survey was conducted recently to provide a "snap-shot" look at turkey breeder hens and their current management.

Fifteen U.S. turkey breeder managers from across the U.S. were contacted by phone and were asked a series of questions. The basic questions and the results are presented in Table 1. There were 2.652 million hens represented in this survey. These were hens in production in 2001, including approximately 20% induced molted hens (range=0-30%, molted hen data not shown). We estimate that the total number of breeder hens in the U.S. in production last year was approximately 4 million birds including about 20% induced molted hens. This was estimated from polling the three major primary turkey breeder companies and one industry consultant. The USDA reported that in December of 1997 there were 5.5 million breeder hens on U.S. farms. This may over estimate hen numbers because it might include hens not in production. Therefore, based on these two estimates, this survey represents 48 to 66% of the reproductively active U.S. turkey breeder hen population. There are more Nicholas (54%) than Hybrid (33%) or BUTA (13%) hens represented in the survey. These percentages are provided only to describe the hens in our survey. Furthermore, they are not meant to describe the make up of the turkey breeder hen population in the U.S. There was a broad range for each strain and total number of hens per company. Many managers anticipate some changes in the percentage of each strain within their company.

The age at lighting for all hens was very constant at 29.5 to 30 weeks of age. Most managers listed photo-stimulating their hens at either 29 or 30 weeks of age as their standard operating procedure. However, there was variation in hen weight at lighting. This variation was observed across companies (not shown) and strains. However, there was more variation due to strain when effort to control hen weight was also taken into account. The Nicholas and BUTA hens were reported to be over a pound heavier at lighting than the Hybrid hen. In addition, there were more reports of efforts to control the Nicholas and BUTA hen body weight than the Hybrid hen. Noticeably, hens of all strains struggled with adequate body weight gain going into summer egg production as compared to winter egg production, especially in the southeastern U.S. Perhaps because of this struggle with weight gain going into the summer experienced by first cycle hens, molted hens were reported to have an advantage over first cycle hens going into summer egg production.

While there was a great deal of effort reported in reducing growth rate, there was not a lot of variation in technique. Most managers started weighing their hens at 6 to 8 weeks of age. Most managers stopped monitoring breeder hen body weights once they were photo-stimulated. If hens were out of the target weight range during rearing, they were switched to the next feed ration early. None reported using physical feed restriction programs although one manager had experimented with raising the feed lines after the hens had fed 1 to 2 hours per day. Another manager reported using shorter days during the dark-out period by using 6 and then 4 hours versus 8 hours of light. Another manager reported recently switching from market bird diets to separate breeder-rearing diets. One manager who had not experienced weight control issues (with Nicholas hens), was starting a qualitative feed restriction program at poult placement rather than waiting until 6 or 8 weeks of age, or later, when the hens might be out of their target range. Most managers reported that the turkey breeder hen will probably continue to get heavier and will be more difficult to manage. Many also questioned if the increase in market bird weight that is driving this trend would continue to offset the decreases in egg and poult production. The answer to this question will probably come as integrated turkey companies learn to optimize all of their inputs including breeder hen and market bird performance (Krueger, 1997).

This leaves the industry with practically one option and that is to learn how to manage increasingly heavier turkey breeder hens. Although some managers believe that the industry is on the verge of having to adopt a quantitative feed restriction program, a review of qualitative and quantitative programs and their effects on turkey hen performance might be in order. Hester and Stevens (1990) presented a thorough review of the literature on hen weight control, especially as related to qualitative programs. They categorized restriction programs into: 1) high-fiber or low energy diets, 2) low dietary protein, 3) limited quantities of feed, 4) rations on skip-a-day program, 5) distasteful compounds, and 6) combinations of these methods (Hester and Stevens, 1990). In general, restriction programs that reduced hen adult body weight also delayed sexual maturity, with no effect on fertility, hatch of fertile eggs, or hatch of all eggs set. Egg weight was not affected in most studies but decreases or increases were reported in some studies. There were variable effects of body weight restriction reported for egg production. However, most of these studies were reported before the increased selection pressure for increased body weight in breeder hens had begun. Still, the concepts on controlling body weight are very useful. Ferket and Moran (1986) used a low plane of nutrition, with reductions in dietary protein and energy, beginning at placement to successfully reduce breeder hen body weight without adversely affecting reproductive performance. This agrees with and supports the report by one manager in our survey who stated that his company successfully reduces the body weights of their Nicholas breeder hens by applying a qualitative program at placement.

The results using quantitative feed restriction to reduce turkey breeder hen body weight have been mixed. Hocking (1992) compared the response of a medium size turkey line that was photo-stimulated at 18, 24 or 30 wk and either fed ad libitum or restricted until point of lay. The rate of production of eggs with normal shells was higher in turkeys

photo-stimulated at older ages and in restricted birds as compared with those fed ad libitum. This resulted in 95.3 and 86.3 settable eggs per bird for the restricted and ad libitum fed hens, respectively. Renema *et al.* (1993) looked at the effect of BW restriction from 4 to 28 wk on grandparent stock. They reported no significant differences in hen-housed egg production on the basis of settable egg production. Restricted hens appeared to exhibit more broody behavior and loss of egg production. However, hen-day production showed a clear trend towards improved egg production. Egg numbers were 48.6, 52.8 and 55.4 for the control, 10 and 20% restriction treatment, respectively. Klein-Hessling (1994) reported that restricting BW of turkey hens to 45% of a control treatment at 16 wk improved reproductive performance. The 45% restriction treatment produced significantly ( $P \leq .01$ ) more eggs per hen than ad libitum-fed hens (92.4 vs 84.2 eggs per hen). More recently, Crouch *et al.* (1999) reported that hens with body weights feed-restricted to 45% of controls at 16 weeks of age entered lay with a higher rate of BW gain, which was associated with an increased peak egg production (Figure 1). This study also agreed with the report of Ferket and Moran (1986) demonstrating that turkey hens can be successfully feed restricted beginning at an early age (3 weeks).

Crouch *et al.* (2002) reported on study similar to the one reported by Crouch *et al.* (1999). Although Crouch *et al.* (1999) reported that feed restricted hens persisted in lay equally as well as the ad libitum-fed hens, Crouch *et al.* (2002) observed that the feed restricted hens had improved hen-housed production initially but it did not persist over that of hens fed ad libitum during the rearing periods (Figure 2). One major difference in the two studies by Crouch *et al.* (1999 and 2002) was that hens in the 2002 study were photo-stimulated for a summer season lay period, whereas the hens in the 1999 study were photo-stimulated for a winter lay period. In the 2002 study by Crouch *et al.*, all hens experienced a sharp decrease in egg production after 3 weeks of lay. This drop in egg production was associated with a sharp increase in weekly house mean high temperature, which increased from 21.1° C during week one of lay to over 26.7° C by the fourth week of lay. This increase in temperature was at a very critical time during peak and post-peak egg production. In addition, the mean high house temperature continued to increase to 31.1-32.2° C for the duration of the lay period. Although all hens experienced sharply decreased egg production, hens on restricted feed intake programs were affected the greatest (Crouch *et al.*, 2002). Moran (1987) concluded that the diet and BW gain of hens going into lay is very important, indicating that protein consumed by the hen going into production is directed to yolk and albumen formation. Restricted fed hens in the study by Crouch *et al.* (2002), which had a lighter BW (45% of controls at 16 weeks of age), consumed significantly more feed for the period prior to photo-stimulation (24-30 weeks) than did the heavier ad libitum-fed hens. Therefore, on a per kilogram BW basis, restricted-fed hens consumed more protein than the ad libitum-fed hens going into egg production. However, they probably did not have enough body mass or protein and/or did not consume enough nutrients to provide egg production equivalent to the control fed hens.

These two studies by Crouch *et al.* (1999 and 2002) might also explain why molted hens generally have been reported by industry managers to do better than first cycle hens



The studies reviewed here indicate that feed restriction programs can be effective in controlling turkey hen body weight. However, at this time, severe body weight restriction, especially for hens photo-stimulated for hot season egg production, may lead to reduced reproductive performance. Qualitative programs applied early in rearing, such as at placement, or combinations of early applied qualitative programs and some type of mild quantitative restriction program also applied sometime during early rearing should be adequate in controlling turkey breeder hen body weights for the near future. As the turkey breeder hen adult weight potential increases, effective growth control programs may have to become more important. However, adequate weight gain immediately prior to egg production appears to be beneficial for optimum reproductive performance. Hen body weight monitoring from pre photo-stimulation to post peak egg production may be very informative in determining the relationship between body weight dynamics and egg production during this period.

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**Table 1. Results of a Recent Turkey Breeder Hen Manager Phone Survey**

	<b>Nicholas</b>	<b>BUTA</b>	<b>Hybrid</b>	<b>Total</b>
Number of Hens (x1000)	1,422	353	877	2,652
Range/company(x1000)	23 – 486	60 - 128	30 – 250	60-540
Age at Lighting (wks)	29.8	29.5	29.9	
Range (wks)	29-31	29-30	29.5-31	
Weight at Lighting (lbs)	27.0	26.9	25.6	
Range (lbs)	25-28.5	26-27.5	24.5-27.5	
Mgmt to Hold Wt Down	Yes	Some	Mixed Response	
Methods to Manage Wt	No physical restriction. Mostly either protein reduction or switching to next feed One response: start qualitative program at placement One response: recently adding diets for rearing breeders One response: feed 1-2 hours per day, raise feed lines One response: decrease light 8-6-4 hours during dark-out			

**Table 2. Nutritional recommendations for turkey breeder candidates.**

<i>Feed Phase</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	
<i>Feeding Period</i>	<i>Hen</i>	<i>0-3</i>	<i>4-6</i>	<i>7-10</i>	<i>11-</i>	<i>Prebreeder</i>	<i>Prelay</i>	<i>-</i>
<i>(Weeks)</i>	<i>Tom</i>	<i>0-3</i>	<i>4-6</i>	<i>7-10</i>	<i>11-</i>	<i>Prebreeder</i>	<i>-</i>	<i>Breeder</i>
<i>Nutrient Restriction</i>								
Kcal ME / Kg		2800	2850	2900	2900	2750	2850	2900
Crude Protein, %		27.0	24	20	16.0	12	14.0	14.0
Lysine, %		1.65	1.40	1.20	.80	.42	.65	.73
Methionine + Cysteine, %		1.15	1.05	.85	.65	.55	.60	.60
Threonine, %		0.95	0.85	0.70	0.50	0.30	0.40	0.50
Calcium, %		1.40	1.30	1.25	1.15	1.00	1.45	1.10
Available Phosphorus, %		.80	.70	.65	.55	.50	.50	.50
Sodium, %		.17	.17	.17	.17	.16	.16	.16
Choline, mg		1900	1800	1650	1450	1300	1200	1100

**Table 3. Nutritional recommendations for turkey breeder hens during lay.**

<i>Phase of Production</i>	<i>Early Lay</i>		<i>Mid Lay</i>		<i>Late Lay</i>	
<i>Season of Production</i>	<i>Summer</i>	<i>Winter</i>	<i>Summer</i>	<i>Winter</i>	<i>Summer</i>	<i>Winter</i>
Kcal ME / Kg	3000	2950	2950	2900	2900	2850
Crude Protein, %	18	16	16	15.5	14	13.0
Lysine, %	.90	.75	.80	.70	.70	.65
Methionine + Cysteine, %	.75	.60	.65	.50	.60	.45
Calcium, %	2.75	2.70	2.85	2.80	3.00	2.90
Available Phosphorus, %	.45	.40	.40	.38	.38	.35
Sodium, %	.18	.16	.18	.16	.18	.16
Choline, mg	1800	1700	1700	1600	1500	1400

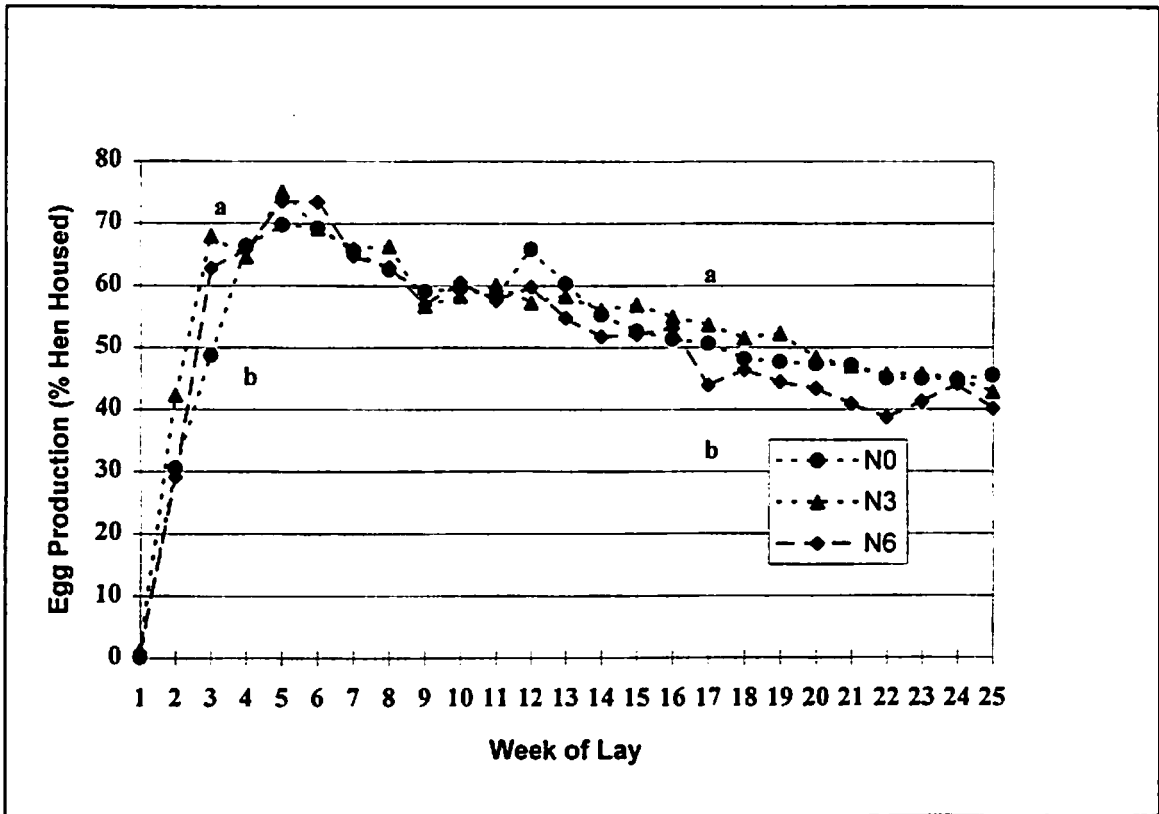
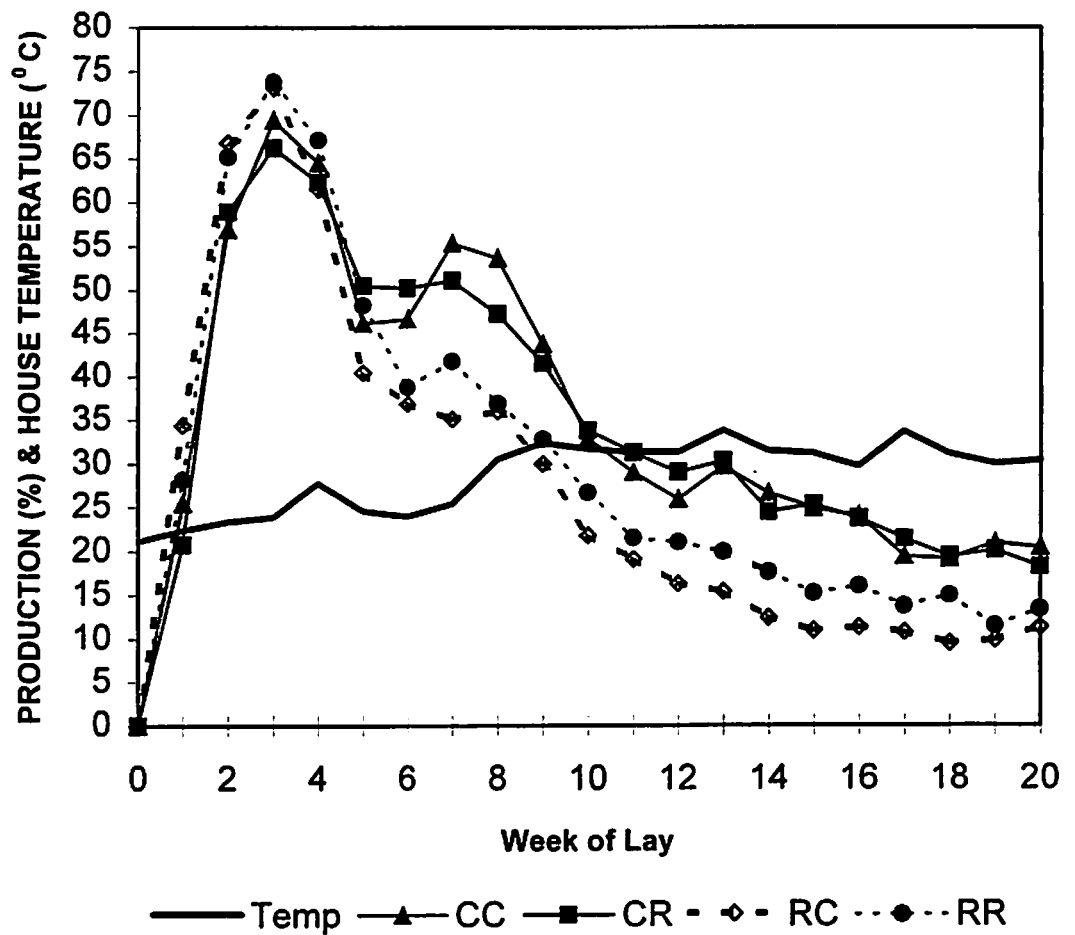


Figure 1. Egg production of turkey breeder hens feed restricted to obtain 45% of the control (N0) hen 16 week body weight beginning at 3 (N3) or 6 (N6) weeks of age and photo-stimulated for cool season egg production (Crouch *et al.*, 1999).



<sup>1</sup>Mean high temperature (°C) within the house for each week.

<sup>2</sup> CC – fed ad libitum, CR – feed restricted-fed from 16 to 24 weeks of age, RC – feed restricted from 3 to 16 weeks of age, RR – feed restricted from 3 to 24 weeks of age.

FIGURE 2. Weekly settable hen-housed egg production (%) and mean house high temperature<sup>1</sup> for Large White turkey breeder hens either fed ad libitum or feed restricted<sup>2</sup> and photo-stimulated for hot season egg production (Crouch *et al.*, 2002).