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## High Feed Prices! – Reevaluating Turkey Slaughter Ages and Weights

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### **Background**

High feed and fuel prices certainly have everyone in the livestock industry on edge these days. Feed makes up 65% to 70% of the cost of producing turkeys and is the single most important input cost. With corn and bean futures seemingly going up the limit every day, fine tuning our management practices and production strategy were never more important. Better utilization of genetic resources and economic modeling are two production strategies often overlooked that can help take the edge off high production costs.

### ***Genetic Potential...understanding it and putting it to use.***

Many turkey producers erroneously assume that the genetic potential of the turkey is “locked in” with the purchase of their Parent Stock...wrong! With the exclusive use of artificial insemination in commercial turkey breeding, it is extremely odd that this misconception continues to exist. While the genetic progress made by the primary turkey breeders over the last decade has been nothing less than remarkable, there is still genetic potential to be captured by proper Parent Stock breeder male selection and utilization. Primary breeders continue to improve commercial performance (weight for age) about 1% to 2% annually, however, there is at least as much improvement to be gained in each generation from the proper selection and utilization of Parent Stock breeder males. The integrated swine industry has utilized this concept to great advantage to improve reproduction and breeding costs while simultaneously improving commercial performance; yet it continues to be largely ignored in the turkey industry. With the increasing reproductive and commercial production costs in the turkey industry properly using this strategy could mean the difference between profit and loss.

To better understand these concepts consider the following simple equation is often used to describe livestock performance:

$$P = G + E + (G \times E)$$

Where:

**P** = **Performance** (or better stated... profitability)

**G** = **Genetics** (genetic potential of the turkey for livability, growth, feed conversion, yield, etc.)

**E** = **Environment** (plane of nutrition, climate, housing density, veterinary practices, slaughter age, feed additives,... basically anything in the production system that cannot be attributed to genetics)

**( G X E )** = **Genotype by Environment Interaction** (in general, how a given genotype responds to a particular set of environmental parameters).

Primary breeders strive to simultaneously improve the growth rate and feed conversion of the commercial turkey while slightly improving or holding reproductive capacity constant. Since the mid 1980's, a critical part of their selection strategy has been selection for feed efficiency during the later weeks of the growing cycle. This direct selection for feed efficiency (independent of absolute growth rate) has reduced the rate of fat deposition and accentuated the already rapid development of breast muscle during this period. Today's turkeys are gaining more weight on less feed with a higher percentage of this weight gain attributable to breast muscle....particularly during the later weeks of the growing cycle (.i.e., after 75 and 100 days of age in hens and toms, respectively).

An indirect result of the selection for feed efficiency has been to shift more emphasis to the far right component of the above equation. The ever improving genetic potential for rapid growth and higher breast meat yield requires that increased attention be given to the GXE component...that is the genotype by environment interaction. Currently only about 25% of our turkey flocks achieve the primary breeders' standards. The failure of most flocks to achieve their genetic potential for growth lies in management's inability to properly address the GXE component of the above equation. To remain competitive with other livestock species, primary turkey breeders are forced to make continuing improvements in genetic potential but, as a result, the expression of this potential becomes more dependent upon providing an environment (proper nutrition, health, etc.) that will allow this potential to be *optimally expressed*.

One of the most critical aspects of turkey production in the Southeastern US is that of modulating the environmental temperature. The ideal environment for maximizing growth rate in commercial turkeys after eight weeks of age is probably a cycling temperature between 50 and 70 deg F (averaging about 55 deg F) and 30% to 50% relative humidity (with adequate dust control). However, in most high density growing barns, we can only achieve these conditions about 4 months of the year. Even in high tech housing with tunnel ventilation systems where wind chill and other considerations must also be considered, it is extremely difficult to achieve these "ideal" conditions during the coldest and hottest times of the year. Consequently, we see as much as a 3 to 5 pound variation in weight for age between commercial toms slaughtered in March-April and those slaughtered in August-September. This adverse effect of high environmental temperatures on growth also results in a swing of 2% to 3% breast meat yield (CWOG basis) between the seasons.

An interesting side note here is the use of the words ***optimally expressed***. Consider this...the dairy industry, which operates under the same production equation described above, has found it increasingly difficult to fully exploit the genetic potential of the modern dairy cow. As a result, some dairymen have stopped pushing their cows for maximum milk production and have found that by reducing certain inputs (i.e., labor for heat detection and artificial insemination, high powered nutrition, use of somatotrophin, etc.) and increasing cow longevity, they actually produce less milk, but with higher returns and profit...more importantly, a sustainable profitability. Perhaps at some time in the future, primary turkey breeders may be forced to address other issues in their selection programs such as late livability, reduced susceptibility to heat stress, tolerance to higher density production systems, etc. at the expense of maximum progress for growth rate. Similarly, commercial producers may be faced with decisions surrounding the input versus output parameters of their own production systems to determine the best management strategy for optimal returns and sustainable profitability. With feed price increases likely to continue, turkey producers, like the dairymen, must carefully evaluate production systems and find the correct balance to optimize the “P” in the performance equation.

### ***Maximization versus Optimization***

Economists suggest that the optimization point in any production or manufacturing system is often miscalculated when viewed at a specific “moment in time”. Some paradigms concerning maximization versus optimization include:

- With few exceptions, maximizing a system will result in optimization.
- As a result, maximization seldom equals optimum sustainable profitability.
- Optimization is an elusive and constantly moving target. Input costs and production processes must continually be retested based on the available resources as well as current and future anticipated market conditions.
- It is much easier to look backwards in time and determine how a system *could* be optimized than to look forward and predict how to optimize in the future.

### ***An optimization problem....determining the correct slaughter weight of turkeys***

An example of a current optimization problem for the commercial turkey industry is determining the optimum slaughter weight in the face of high feed prices and possibly low finished goods prices. To better understand the problem, one must understand the growth physiology of the commercial turkey which is quite different between toms and hens. However, for the sake of brevity, only the tom turkey will be considered in this discussion.

Figure 1 presents a series of graphs which plot allometric growth patterns for three hypothetical types of commercial tom turkeys. These are described as follows:

***Turkey growth type 1*** – Early maturing with high breast meat yield

***Turkey growth type 2*** – Intermediate growth, feed conversion, and breast meat yield

***Turkey growth type 3*** – Late maturing with low (good) feed conversion

Hypothetical growth, feed conversion, CWOG, and breast yield curves are shown for each of the different growth types. The differences in these “growth types” could be the result of differences in management, nutrition, growing density, genetic selection, and/or season of the year in which the turkeys are grown. It is interesting to note that the difference in growth rate between the different types differs by no more than 2% at any age. However, significant differences exist between feed consumption, feed conversion, and carcass traits at various ages and weights, especially as the different types approach market age/weight.

The interaction between the turkey growth types and two feed cost and production system scenarios were compared using a simple deterministic economic model. The following table describes the most important input variables used in the different scenarios:

**Table 1.**

Live bird value, \$/pound FOB plant =		\$0.6500	
Boneless skinless breast meat value, \$/lb =		\$1.25 and \$1.75	
Whole thigh and drum value, \$/lb =		\$0.6500	
Average value, all other parts, \$/lb =		\$0.3500	
Feeding regime	Days of age begin feeding	Scenario, \$/ton	
		#1 Low feed cost	#2 High feed cost
Hatch to 100 days of age	100	\$275	\$375
Late growing period	101	\$250	\$350
Finishing period	121	\$225	\$325

All other input costs (i.e., poult cost, grower pay, processing costs, etc.) were held constant for the comparisons.

For the live production cost based operation, the optimum slaughter age/weight was determined using the **dollar**

**margin per bird over feed cost** as feed cost was the only variable changed in the model. Costs such as grower pay, live haul, etc. were adjusted for weight on \$/live pound produced basis. Costs such as overhead and administration, tech services, etc. were held constant at a \$/bird value irrespective of the slaughter age/weight. For this comparison, using the dollar margin per bird over feed cost would seem more appropriate than cost per live pound of production as it is more likely that a live production based company will be set up on a per bird basis.

Under the fully integrated operation system, the optimum slaughter age/weight was determined using **margin per live pound delivered as impacted through the carcass cut up operation**. In the fully integrated system, there is a cascading set of inputs from live production through first and second processing that interact with the value of different carcass parts to impact optimization.

This simple exercise did not attempt to evaluate the complex interaction of various factors such as late growing livability/DOA's/condemnations and possibly the increased processing costs (i.e., line speed, chilling costs, etc.) associated with larger birds, etc. that exist in a real world operation. It is acknowledged that the magnitude of these input costs and their interactions with slaughter weight could have a significant impact on estimating optimization points. However, this is beyond the scope of this exercise. Nevertheless, they are important and must be given consideration when modeling real world production systems and making real world decisions. The intent here is to concentrate on the

specific input variables described in the above table to begin understanding the complexity of determining optimization as impacted by differences in growth parameters.

The outcomes of each run of the economic model are presented in the graphs of Figure 2 and summarized in Table 2. The results from this exercise are only meaningful when evaluated using these specific allometric growth patterns and input cost variables. Estimation of the optimization points in any real world operation is dependent upon a myriad of other performance factors and input variables, and their sometimes subtle and not so subtle interactions.

**Table 2. Estimated effect of different allometric growth patterns of tom turkeys on optimum slaughter weight (pounds) under different production systems and feed cost scenarios.**

	Type of Production System						
	Live Operation Cost Center			Fully Integrated			
	Growth Type			Growth Type			
	1	2	3	1	2	3	
Scenario #1 - Low feed cost	46.0	46.5	>50	>50.0			Boneless Skinless Breast value @ \$1.75/pound
Scenario #2 - High feed cost	36.3	36.5	41.0				
				Growth Type			
				1	2	3	
Scenario #1 - Low feed cost				38.0	40.5	>50.0	Boneless Skinless Breast value @ \$1.25/pound
Scenario #2 - High feed cost				<30.0	30.0	33.0	

**Summary**

From this simple exercise, it is obvious that the recent increase in feed cost (i.e., 65%-70% of the total live production cost) has had an enormous impact on profitability in turkey operations, especially those which live or die based upon live production costs. The exercise also suggests that as feed costs continue to increase and live costs remain constant, the production characteristics (growth, feed conversion, and yield) of the turkey strongly interact with environmental temperature (season), genetic selection, and nutrition to determine the optimum slaughter age and weight. However, in fully integrated operations, the impact of breast meat yield is so influential and so dilutes the impact of most other inputs (even feed cost!) that the “bigger is better concept” is probably valid. This would be especially true in operations where breast meat and dark meat are fabricated into added value products.

The growth rate parameters used in this exercise would be considered aggressive by most. However, 20%-25% of commercial flocks achieve the average flock weight for age performance used in this example. Obviously the outcome (estimated optimum slaughter age/weight) of such an exercise is highly dependent upon the specific performance and input costs one chooses to use. Nevertheless, it suggests the following:

- Continued genetic improvements in growth rate, feed efficiency, and carcass yield are absolutely essential if turkey production is to remain competitive with other livestock meat production systems.

- Feed efficiency in turkeys, independent of growth rate, will continue to be a major focus point for primary turkey breeders. Not only will it reduce production costs, but it has the added benefit of being highly correlated with lean muscle deposition and improved carcass yield.
- Developing technology that will improve feed efficiency after 75 days of age in hens and 100 days of age in toms will have a significant impact on profitability.

### ***Closing remarks***

The dramatic improvement in growth rate and feed efficiency in commercial turkeys would suggest that maximizing the available genetic potential would be in a producer's best interest. However, as previously discussed using the dairy industry example, this approach may not necessarily be correct depending upon the cost of certain inputs in the system...namely feed cost, feed conversion, and late livability. If we compound this with the dramatic seasonal variation in growth rate, breast meat yield, and finished goods' price, the optimization point in a production system becomes a moving target. While the system may at first seem unmanageable, consider the complexity and decision making process that must currently be in play in the automobile manufacturing industry!!! New technologies are becoming available to help better manage production systems, but there is no question we still have much to learn about the optimization process in turkey production.

**###**

**Figure 1. Three Allometric growth scenarios for commercial toms.**

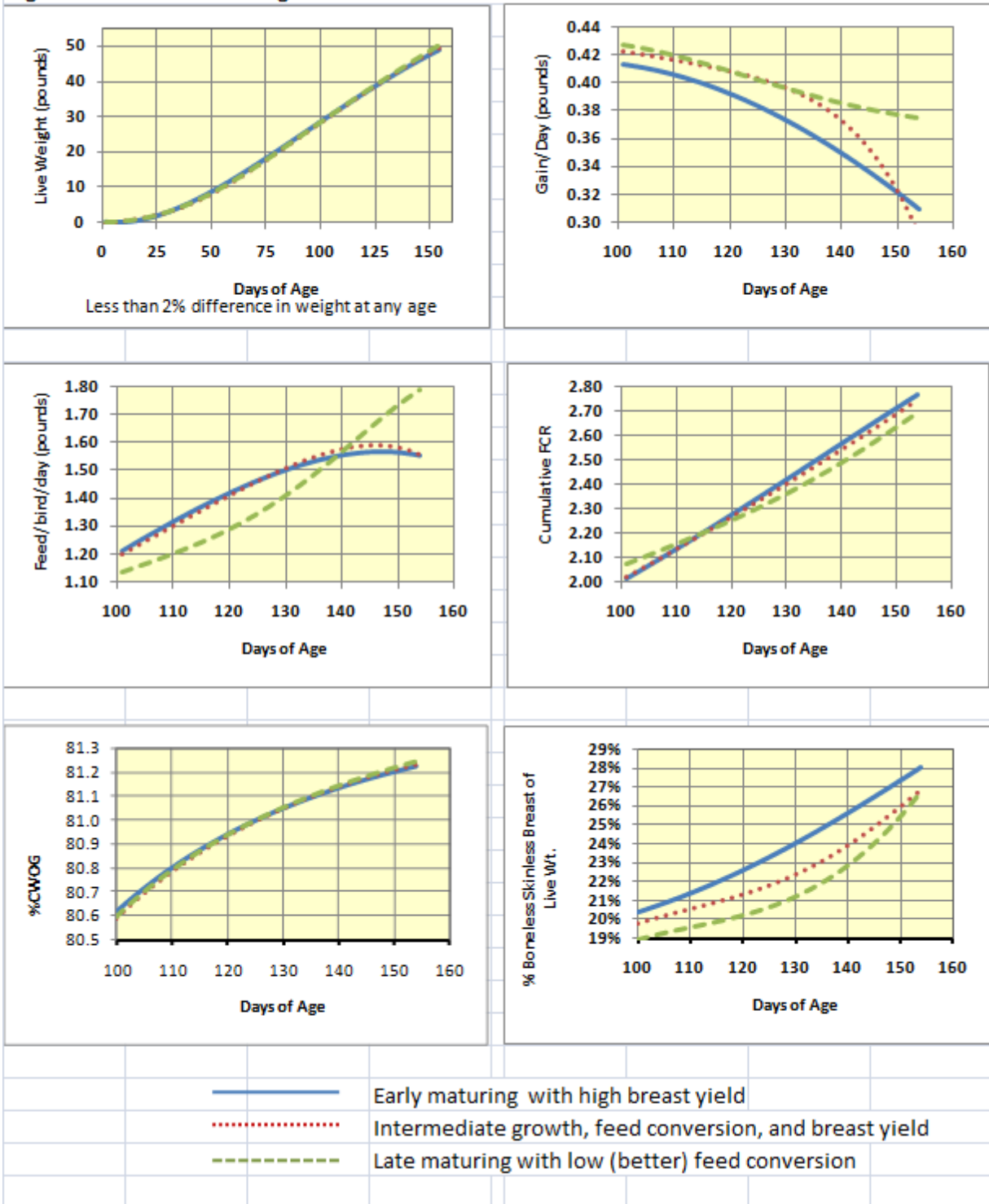


Figure 2. Impact of different allometric growth examples on margins in a live production versus fully integrated turkey production System.

