FATS AND PROTEINS RESEARCH FOUNDATION, INC.

Director's Digest

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Energy Economics for Growing Market Turkeys — Revised

Outlook for profitable turkey production is encouraging for the early part of 1978, but projected increases in numbers of turkeys and competition from other meats late in 1978 indicates reduced returns and possible losses after mid-year.

Since the early work of Potter, Jensen, Waibel and others (1960's and early 1970's) describing the effects of adding fat to turkey diets, there has been some, but not complete acceptance of this practice. Some Producers routinely add from 6 to 10% fat to turkey feeds from start to market, others add no fat to any of the grow-out feeds while increasing numbers of turkey growers follow an intermediate practice i.e.: adding 2% fat to prestarter and starter diets and then gradually increasing levels to 6 or 8% in growing and finishing feeds. This latter practice may give most benefit, since early growth is highest in protein and water, whereas weight gains after about 8 weeks is increasingly higher in fat and lower in protein and water.

There is general acceptance that higher energy in turkey diets does improve feed conversion, weight gains, finish and in many instances profit per bird. But today, producers are increasingly concerned about the economics of adding fat to their feeds, particularly since the relative price of grains and fat appear to fluctuate somewhat independently of each other and are not at all directly related to the price of finished turkey meat.

Knowledge of energy costs and relative metabolism efficiency of fat or carbohydrate calories has an economic value for turkey producers. A brief review of the subject follows. Energy in feed may be derived from either carbohydrates (starches or sugars), protein or fats. The following diagram is often used when explaining energy values commonly used in the feed trade.

As a general rule, fat contains from 2½ to 3 times as much energy (ME or PE calories per pound) as does corn, depending on the kind and quality of the fat. However, when comparing the grains as sources of energy and other nutrients, corn stands out above the rest. Corn contains from 25 to 30% more productive calories than oats (1150 vs 750 to 850) and is usually less costly per pound. Likewise, corn contains 5% more productive calories than milo and also costs less per pound, except for certain areas in the south and southwest. Corn is superior to most strains of wheat in energy and is far superior to barley or rye. A specific example of this is shown in a computor analysis of a 20% turkey grower ration containing 6% added fat (1488 Calories/lb. ME). With fat priced at 3 levels for 1978 and corn priced at $4.00 per cwt., other grains have the following nutrient worth for equal energy and critical amino acids in this ration.

WHEN FAT COST PER CWT IS:		$12.00	$15.00	$18.00
GRAIN	CRUDE PROTEIN %	Nutrient worth (energy and critical amino acids) of other grains compared to corn at $4.00 per cwt. is:		
WHEAT	10.5	$4.00	$3.93	$3.87
MILO	9.0	3.63	3.51	3.39
BARLEY	10.0	2.71	2.24	1.78
RYE	12.0	3.16	2.76	2.36
OATS	10.0	2.61	2.07	1.54

Total energy (in the feed) MINUS Energy lost in feces and urine

Equals	Metabolizable energy	(ME)	MINUS	Energy lost in maintenance (such as body heat and digestion)
Equals	Productive energy	(PE)		Energy available for producing meat, milk or eggs — (or fat deposition — finish in turkeys, etc.)

The short-chained fatty acids formed from this bile and enzymatic action enter the blood directly thru the portal vein capillaries. The longer-chained fatty acids and monoglycerides are converted back into triglycerides in the intestinal mucosa. Here they are surrounded by a fat-protein membrane which permits them to slip thru the wall of the small intestine into the lymphatic system and then to the liver for further metabolic changes.

Biological energy values of the various fats and oils is quite different from the gross energy (9.4 calories per gram) and their ME or PE will depend on the proportions of essential fatty acids present and the arrangement of the fatty acids in the molecule. For example, beef tallow is poorly utilized for energy by the young bird (0 to 4 weeks) and is credited with only 3000 Calories per pound (ME), whereas pork lard is well utilized and provides approximately 4000 Calories per pound (ME). The difference can be explained on the basis that in beef tallow more of the saturated fatty acid (palmitic) is located at the terminal ends of the glycerol and this fatty acid is less effectively split off by enzymatic action. This resulting large fatty acid-glycerol fragment is less efficiently absorbed thru the intestinal wall and so a portion is lost as usable energy. With pork lard, the palmitic acid is attached to the center position of the glycerol and once the terminal unsaturated fatty acids are split from the triglyceride, the remaining long-chain palmitic monoglyceride is more readily absorbed into the lymphatic system.

Whereas unsaturated fats (liquid at room temperature) generally contain more metabolizable energy than saturated fats (solid at room temperature), it is known that saturated fats are more effectively assimilated into the blood and lymphatic systems when they are in the presence of unsaturated fats. In other words, more energy can be obtained from feed fats when both saturated and unsaturated fats are fed together as a mixture. Also, because of the tendency toward oily carcasses in the dressing plant, turkey producers are aware that at least 20% of the fat mixture should be of animal origin to avoid greasy bird problems. In this condition, oil is secreted onto the skin of the bird making for greasy carcasses, slippery floors and costly cleanup.

ECONOMICS OF FAT FOR TURKEYS

Supplemental fat has played an important part in development of an expanding turkey industry in the United States. Yet several years ago a frequent comment heard was that turkeys did not respond to added fat in their diet or that pelleting feed was equally as effective as adding fat. It is now accepted that both pelleting and adding fat to turkey feeds results in separate and additive responses as long as all nutrients (protein, essential amino acids, minerals and vitamins) are in balance to support the increased calories in the diet. But the prime consideration of adding fat must always be economics because the turkey industry is in constant keen competition with broiler, pork or red meat.

In an attempt to evaluate the merits of adding fat during 1978, the following calculations were developed using current ingredient prices on practical formulas, 1977 growth and feed standards (Turkey World January 1977) and L. M. Potter's values for effect of fat on turkey performance.

Providing the assumptions of Potter are valid for the three average ranges of added fat (6, 4, 0%), it appears that increasing fat within these ranges will result in a greater return over feed costs for both toms and hens. Addition of higher levels of fat to turkey growing feeds requires greater skill in feed mixing to insure uniform fat distribution thru the feed. Some producers have accomplished this by reducing the size of pellet (3/16ths inch) which most likely aids in absorption of fat to the center of the pellet. This can prevent fat from seeping and help reduce soft or crumbling pellets to an extent.

Turkey producers should consider several items before deciding whether to add or delete fat from turkey feed, ie: (1) less time to equal market weights with higher fat levels, (2) possible improvement in finish and grade by higher fat levels and (3) less total manure accumulation in confinement reared turkeys from higher fat feeds. In any event, feed formulas for commercial operations should be formulated for optimum density when marketing birds of specific weight for age requirements are important factors.