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## COTTONSEED AND COTTONSEED MEAL CONTAIN A TOXIC COMPOUND, GOSSYPOL

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**Background.** For well over 100 years, cattlemen have relied on cottonseed feed products as nutritional supplements to improve production. Until the early 1980's, 2-3 million tons of cottonseed meal were fed annually while very little whole seed was consumed. Currently, 1.5 million tons of meal and 2.1 million tons of cottonseed are being fed. Recent questions concerning gossypol effects in cattle diets have prompted the need to pull together all available information and develop recommendations that will allow producers to continue to maximize the use of these feed ingredients which remain important to them.

**Current Information.** Gossypol is a naturally occurring substance found in the pigment glands of cottonseed that can be toxic. The empirical formula is  $C_{30}H_{28}O_8$ . Gossypol is present at about 0.6% of the weight of whole gin-run seed, but levels vary depending on variety of cotton, growing conditions and season. During the oil extraction process, the pigment glands are ruptured and gossypol is released. During the heating which occurs during the oil extraction process, some of the gossypol is bound to cottonseed protein. Because of this binding, gossypol will be found in cottonseed meal as both the "bound" and "free" forms. The free form is believed to be the toxic form. All of the gossypol in whole cottonseed is in the free form.

Methods of oil extraction which utilize greater amounts of heat and pressure produce cottonseed meals with lower amounts of free gossypol. Mechanical oil extraction processes (such as the mechanical or "old process") exposed the cottonseed to high levels of heat during the pressing of the seed to expel oil. However, during the energy crises of the 1970's, many plants switched to "direct solvent" processing which used much less heat, but left greater quantities of free gossypol in the cottonseed meal. To increase the efficiency of oil extraction in the past decade, almost all of these cottonseed processing plants have begun using an expander process prior to solvent extraction for oil removal. The expander process increases the amount of heat used and free gossypol content has been reduced to about one-third the levels found in direct solvent processed meal. Direct solvent extraction is becoming rare with over 95% of cottonseed processed in Texas and Oklahoma today being from expander or screw-press origin.

USDA data show that the average levels of gossypol in whole cottonseed have not increased in past years (1977-89). With the change away from direct solvent processing, it is therefore, logical to assume that average levels of free gossypol in commercial cottonseed meal

are lower than in past years.

**Recommendation.** Livestock and poultry producers have known about gossypol for many years. When properly managed, limited amounts of cottonseed meal can be used in swine or poultry diets. No whole cottonseed is used in diets for these species. Functioning ruminants have considerable ability to detoxify gossypol. Apparently, free gossypol is bound to proteins or minerals during ruminal fermentation which may account for part of the detoxification. There are limits to the amount of free gossypol that cattle can detoxify. Mature dairy cows have been shown to be unable to detoxify all of the free gossypol when they received over 24 grams of free gossypol in their daily ration from cottonseed meal (Lindsey et al., 1980. *J. Dairy Sci.* 63:562). This level, however, was derived from feeding over 20 lbs of direct solvent cottonseed meal.