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## EFFECT OF GOSSYPOL ON REPRODUCTION AND RECOMMENDATIONS FOR USE OF COTTONSEED AND COTTONSEED MEAL TO BEEF CATTLE

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**Background.** The greatest concern about feeding gossypol-containing products to beef cattle arose about 10 years ago when Chinese researchers discovered that gossypol is a potent male contraceptive in humans. A dose level of only 20 mg of free gossypol/day for 60 days produced sterility in 99.98% of 4000 men in a Chinese study. This infertility is apparently reversible as early as 6 weeks after removal of the gossypol.

**Current Information.** The obvious question for cattlemen is whether gossypol poses any real problem for bulls. Research shows that gossypol will cause some detrimental effects when fed to bulls, but requires prolonged feeding of diets containing significant amounts of free gossypol. Effects include degeneration of testicular tissue and increased percentages of abnormal sperm. Tissue effects have been reversible.

Gossypol appears to be more damaging to reproductive function in young males near puberty than to older, more mature males. For example, two studies in which the percent abnormal sperm was increased involved feeding 15 grams of free gossypol from whole cottonseed to yearling bulls for 60 days or feeding 19 grams of free gossypol from whole cottonseed or 1.9 grams of free gossypol from cottonseed meal to young weaned bulls for 400 days. When the whole cottonseed or meal was removed from the diet of the yearling bulls, they recovered.

These studies did not show any impairment to breeding and it is unlikely that beef breeding bulls would be exposed to continuous feeding of either cottonseed meal or whole cottonseed for 400 days. To our knowledge, data do not exist showing impaired breeding caused by normal supplementation of range bulls with cottonseed meal or whole cottonseed. One clinical report in dairy cattle (Smalley and Bicknell, 1982. *Comp. Cont. Educ. Pract. Vet.*, Vol. 4, No. 9, pp. 378-381) found a severe reproductive problem when bulls received 3 lbs/head/day of cottonseed meal plus 8 lbs/head/day of whole cottonseed. These bulls did not fail a breeding soundness evaluation but failed to impregnate the cows. Although gossypol could not be directly identified as the cause of the fertility problem, this large combined amount of cottonseed and meal would probably have resulted in a very high level of gossypol intake and should be avoided with breeding bulls.

The most consistent physiological finding from feeding gossypol is increased erythrocyte (red blood cell) fragility. This could potentially cause problems if animals were subjected to heat

stress. The greatest concern for increased heat stress is with confined dairy cows and there is no evidence for practical problems with beef cattle. Beef breeding herds are normally fed protein supplements in the winter when heat stress is not a concern.

**Recommendation.** At this time, information is not available and is only now being accumulated to provide exact guidelines for the amount of free gossypol that cattle can tolerate. Type of diet (roughage or concentrate), feeding frequency, size and age of animal, length of time gossypol is fed and concentration in the diet all affect the response. However, after studying current research results and evaluating historical feeding experience, the following guidelines are provided.

*Beef Cows and Range Bulls.* Based on studies with beef and dairy cows, feeding "normal" levels of cottonseed meal (2 lbs/head/day of direct solvent extracted; 4 lbs/head/day of expander processed; 4 lbs/head/day of screw press processed meal; or 4-6 lbs/head/day of whole cottonseed) should not pose any practical problems for fertility. These recommendations fall within typical levels fed in the industry.

*Young Bulls Being Grown or Developed for Breeding.* Young developing bulls or show bulls are often kept on concentrate-based diets for many months where cumulative effects of gossypol may build up. Whole cottonseed should be limited to 15 to 20% of the total diet for most cattle and to 10% or less for young developing bulls. Although little high free gossypol meal (0.3% or 3000 PPM) is not being produced, when used, it should be limited to 5% of the total diet. Cottonseed meal from the old screw press method and the more common expander process containing less than 0.1% or 1000 PPM can be used at levels up to 15% of the total diet.

When using combinations of cotton products (hulls, meal or whole seed), the combined concentration of gossypol will need to be considered. The total amount will depend on the proportion of each product used and its gossypol concentration.

*Embryo Transfer Programs.* Again, to be cautious, producers with embryo transfer programs in which large sums of money are involved per animal may wish to use a conservative approach since other protein sources are available. The difference in protein costs would be minuscule in comparison with total expenses.

*Preruminant Calves.* Preruminant calves (under 8 weeks of age to be safe), especially dairy calves, should not be fed gossypol containing products until ongoing research establishes safe feeding levels.

Refinements in these recommendations will be forthcoming as results of research in progress are obtained.