

Detoxicated Cottonseed Meal

A New Process of Treating Meal and the Results of Some Feeding Experiments

BY PAUL MENAUL

SINCE the author's^{1,2} earlier contributions to the nature of the toxic substance inherent in cottonseed meal, a method for detoxicating cottonseed meal has been evolved and its value as a protein concentrate determined under actual farm feeding conditions

Heretofore the use of cottonseed meal has been limited and attended with danger on account of the poison, gossypol, which according to Clark³ is ten to twenty times as poisonous as white arsenic.

The gossypol isolated by other workers has been prepared by precipitating with aniline or acetic acid, with subsequent hydrolysis. It has been assumed that this yields the pure compound as it exists in the cottonseed, but this does not necessarily follow. A reactive molecule may suffer an intramolecular rearrangement or a change in composition, likewise there may be some other reactive compound associated with it in the poison glands of the cottonseed, which the aniline does not precipitate. In order to obtain this substance of the poison glands in as near as possible its original state, the author employed the method of extraction with immiscible solvents. The gossypol was extracted from the cottonseed with sulfuric ether, the resulting solution concentrated by evaporation, then the gossypol precipitated by petroleic ether; the precipitated substance washed with petroleic ether, redissolved in sulfuric ether, reprecipitated by petroleic ether, and this procedure re-

peated five times. This should yield the contents of the poison glands in a pure and original state.

Gossypol prepared by this method was found to be far more reactive chemically than that prepared by other workers. This preparation decomposed when heated to 100° C into water and an insoluble reddish brown caramel, (that described in the literature has a melting point of 187° C). This decomposition of the gossypol does not take place, however, unless the gossypol has been removed from the poison glands, i. e. exposed to air, neither does this decomposition occur when gossypol dissolved in cottonseed oil is heated to 100° C.

Using this new information it seemed logical that the gossypol could be decomposed in the meal, if it could be caused to exude to the outside of the meal granules, then heated above 100° C. The method employed comprises raising the moisture content of the meal to about forty percent, then heating above 100° C, preferably with steam under pressure. The moisture and the high temperature cause a swelling of the meal tissue, forcing the gossypol to exude from the poison glands or pockets to the outside of the meal granules where it readily decomposes. The meal has then a dark reddish brown color, the color of the harmless decomposition product of gossypol, and all tests have proven it perfectly non-toxic, even to young chicks, which are especially susceptible to gossypol poisoning. The decomposition of the

gossypol may not be 100% but feeding trials covering the last three years have failed to disclose a trace of toxicity, even among young animals receiving a ration containing as much as thirty percent non-toxic cottonseed meal, over long feeding periods.

Strange as it may seem, chicks raised from hatching to maturity on a ration containing a high percentage of non-toxic cottonseed meal showed a remarkable increase in size over the parent flock which was raised on other balanced mixed feeds.

A small experimental mill for detoxicating cottonseed meal was erected at Chickasha, Okla., and the results of feeding this product by prominent farmers under actual farm conditions are reported by the Feed Department of the Chickasha Cotton Oil Co. The following is a condensed summary of this report.

We found first of all that this non-toxic cottonseed meal can be fed safely to young chickens, calves and pigs in amounts which would constitute a safe protein content in a balanced ration. Baby chicks fed a ration consisting of one third non-toxic cottonseed meal, the other two thirds being corn meal, chops, bran, etc., showed unusual growth, almost no loss. These chicks were as large at six weeks of age as others were at eight weeks on other rations. Non-toxic cottonseed meal was substituted for meat scrap in feeding a flock of 5,000 hens, and the owner writes us that he has gotten an increased egg production at lower cost. As a result of another feeding trial using the non-toxic meal in feeding a flock of registered chickens, the owner informs us that he has gotten better results with this ration than with any other he has ever used. The chickens in one generation show an

increase in size over the parent flock which was raised on other rations. One feeder using this non-toxic meal in his hog ration reports that it is highly satisfactory and claims that he can produce pork more cheaply by its use than by the use of any other form of protein that he can buy. In the local feed pen a year ago, 200 head of yearling white faced steers fed a ration of non-toxic meal and hulls with corn chops added during the last 40 days made a much better gain in weight at a lower cost and sold for \$1. per cwt. more on the market than a similar pen of the same cattle fed the regular cottonseed meal with corn ration.

In another feeding trial this past season, steers fed this non-toxic meal made the same gain in weight as similar steers fed the same amount of commercial meal plus about two pounds of a mixed feed steer fattener per day, and those fed the non-toxic meal sold for 50c more per cwt. on the market. Two hundred baby calves averaging 250 to 275 pounds each were successfully fed this non-toxic meal from 3 up to 4 pounds per day with kafir chops and hulls for 130 days. The packers who bought them commented on the fine quality of the meat. In all cases the non-toxic meal produced a better quality of meat than the commercial meal. This was noticed especially in the cattle, which the packers graded as corn-alfalfa fed. In summing up what has been done to date, we are led to believe that this process does away with the toxicity in cottonseed meal. The feeding reports show that the protein of cottonseed meal has unusual growth promoting qualities.

Heretofore rations containing cottonseed meal have been supplemented with expensive protein con-

centrates such as linseed meal or meat scrap and much care taken that the percentage of cottonseed meal did not approach the 'threshold of toxicity.'

From these feeding reports it seems conclusive that cottonseed meal, the cheapest of all sources of protein, can be prepared in a non-toxic condition and that this product can be combined as the sole protein supplement with any economical grain and roughage for the pro-

duction of a balanced feedstuff.

It is known that the protein of cottonseed meal is especially rich in the essential amino acids, i. e., it approximates the theoretically complete protein.

¹ Menaul, Paul. 1922, Poisonous Substance in Cottonseed. Proc. Okla. Acad. of Sci. University of Oklahoma Bulletin N. S. No. 247, p. 68-70.

² Menaul, Paul. 1923, The Physiological Effect of Gossypol. Journal of Agricultural Research. Vol. XXVI, No. 5, p. 233-237.

³ Clark, E. P. 1927, Cotton Oil Press, June, p. 49.