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EC 55-200

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# DIETHYLSTILBESTROL AS A FEED FOR SLAUGHTER CATTLE

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The Federal Pure Food and Drug Administration has recently approved the use of diethylstilbestrol in commercial cattle feeds. While its use in livestock feeds is new, the substance itself is not. During the past several years it has been used in human and veterinary medicine as a therapeutic agent for reproductive disorders.

Stilbestrol has also been implanted experimentally in pellet or paste form under the skin of fattening animals and poultry. Favorable results with poultry led to approval of its use by the Federal Pure Food and Drug Administration. Fattening cattle and sheep fed this substance have produced more rapid and efficient gains than those not treated. Varying degrees of altered sex behavior, mammary stimulation and body conformation change have accompanied the use of this material. Implantation of stilbestrol has not increased fat deposition and has usually resulted in the production of less desirable carcasses. Hogs have shown no beneficial effects from implantation of the substance.

The compound was approved for cattle feeding only after extensive tests showing that it did not appear in the tissues of animals to which it was fed. These tests and pioneer studies with stilbestrol in fattening rations were conducted at the Iowa Experiment Station. Promising results of early tests prompted the Iowa State College Research Foundation, Inc., to apply for a patent for its use in livestock feeds and later to enter into a contract with Eli Lilly and Company for the production of a stilbestrol premix which has now been made available to feed manufacturers. Because of the high potency of this chemical, the Federal Pure Food and Drug Administration has imposed for the present rather strict regulations pertaining to its use as a livestock feed. Only properly licensed feed manufacturers may obtain



the premix, and the amount of stilbestrol that may be used in any stilbestrol supplement is limited to 5 milligrams per pound.

Some of the questions most frequently asked about diethylstilbestrol are discussed briefly in the following paragraphs.

What is diethylstilbestrol? It is a synthetic, highly potent, estrogenic chemical manufactured in the form of a white powder. It is neither a hormone nor a feed nutrient but a drug that is capable of causing many of the physiological effects produced by the female hormones, the estrogens. Chemical substances similar to the estrogens occur naturally in some feeds, namely, the legumes and some of their by-products. Three terms which are used quite frequently in discussing the use of the substance in fattening cattle rations are: (1) diethylstilbestrol, its chemical name; (2) stilbestrol, its common or drug name; and (3) Stilbosol, the trade name of the premix produced by Eli Lilly and Co.

What is a hormone? A hormone is a chemical agent liberated by cells in one part of the body and transported by the blood to another part of the body on which it exerts an effect. Diethylstilbestrol does not qualify as a hormone because it is not produced by the body--it is a synthetic.

Why has the compound received so much emphasis as a cattle feed? Shortly after scientists at the Iowa Experiment Station found that some legumes contained appreciable amounts of estrogenic substances, tests were initiated in which known amounts of diethylstilbestrol were added to cattle and sheep rations. Steers and heifers fed the substance in moderate amounts have consumed more feed and gained more rapidly and more efficiently than cattle fed the same ration without it. The Iowa Animal Husbandry specialists believe that the proper amount of stilbestrol in the feed increases the average gain of fattening cattle by 15 to 20 per cent and the efficiency of gain by about 10 per cent. While gains have been quite variable, cattle fed stilbestrol have

gained more rapidly and efficiently in each test than cattle not fed the substance. However, the few tests in which steers fed stilbestrol made spectacular gains account for the great interest in its use in fattening rations.

How does stilbestrol bring about this stimulation? While the mode of action of stilbestrol is not fully known, scientists are certain that it does not substitute for any of the nutrients needed by cattle. In other words, a poor quality unbalanced ration cannot be made to produce rapid or efficient gains by the addition of stilbestrol.

Among the theories advanced explaining the stimulatory action of stilbestrol are the following:

1. More efficient digestion of the various ration components.
2. Increased nitrogen, calcium, and phosphorus retention.

This can be interpreted as indicating faster growth of bone and muscle and may possibly result from the stimulation of other glands in the body.

These and/or other possible causes result in increased appetite which in itself contributes to faster and more economical gains. Work at Purdue University indicates that the greatest stimulation occurs during the early phases of the feeding period and that improved rate and efficiency of gain cannot be attributed entirely to increased feed consumption.

Is the chemical equally valuable in all types of fattening rations? Sufficient data have not been accumulated to evaluate the use of stilbestrol with a wide variety of rations. Most of the tests at Iowa were conducted to determine the amount that should be fed. Few other stations have yet reported results of tests in which it has been fed.



The data at Iowa indicate that the greatest increase in rate and economy of gain occurs when stilbestrol is fed with highly concentrated rations. Only slight increases in rate and efficiency of gain were obtained when it was fed with a ration containing large amounts of roughage.

How much should be fed? Scientists at the Iowa Experiment Station believe that maximum benefits are obtained when animals are fed about 10 milligrams per head daily and that level of feeding is recommended by them. Table 1 summarizes the four tests conducted at Iowa comparing the benefits from feeding different levels of stilbestrol to fattening cattle.

Table 1 shows that when 5 or 6 milligrams were fed the results were nearly as good as when 10 or 12 milligrams were fed. Feeding more than 10 milligrams of stilbestrol per steer daily may result in slow and inefficient gains.

In arriving at the amount of stilbestrol to feed, each cattle feeder should consider the following points in addition to those mentioned above:

1. High protein content supplements are usually cheaper per pound of protein than low protein content supplements and thus contribute to more efficient gains.
2. Two pounds of protein supplement per steer daily may be more than is needed to balance farm-grown feeds.
3. Stilbestrol is being added to low protein content supplements by most feed companies.
4. Both alfalfa hay and soybean oil meal are known to contain small amounts of estrogenic substances.

Is it advisable to feed diethylstilbestrol to animals other than fattening cattle? At this time experimental work has not progressed far enough to safely recom-

mend feeding the compound to animals other than fattening cattle. No data have been obtained to show that feeding low levels of stilbestrol is either harmful or beneficial to beef or dairy breeding animals. Preliminary work with sheep and swine has not been conclusive. Until proved beneficial, stilbestrol should not be fed to any animals other than slaughter cattle except as directed by a veterinarian.

Does the compound produce equal results when fed to different classes of fattening cattle? So far heifers have not responded as well as steers to either the feeding or implantation of stilbestrol. The effect of feeding the substance to calves over long feeding periods is not known. As yet tests have not been reported in which the substance has been fed to cattle weighing under 600 lbs.

What is the effect on hogs following cattle fed the substance? Fattening hogs following stilbestrol-fed cattle at Iowa State College showed neither beneficial nor harmful effects. As a safety precaution, the investigators suggest that animals to be used for breeding stock should not be allowed to follow the cattle.

Are the carcasses of stilbestrol-fed cattle affected in any way? The Iowa scientists state that cattle thus fed appear normal in every respect. Selling price, dressing percentage and carcass grade of cattle fed the same length of time have been essentially the same whether or not stilbestrol was fed. Carcasses of the stilbestrol-fed cattle were not more desirable as one would ordinarily expect with faster gains in the feed lot.

In recent work at the Purdue Experiment Station, carcasses of stilbestrol-fed cattle were slightly inferior to those produced by cattle not fed estrogenic materials.

No detectable residues of stilbestrol have been found in the meat of cattle fed the substance.

What special precautions should be taken when feeding the compound? The feed manufacturer must be sure that the stilbestrol is thoroughly mixed with the supplement because large doses of diethylstilbestrol can actu-



ally suppress growth and fattening. Likewise the feeder should mix the stilbestrol supplement thoroughly enough that no one animal can get appreciably more than his share.

No more than 10 milligrams should be fed per steer daily. At high levels undesirable effects may occur similar to those obtained from implantation of diethylstilbestrol pellets under the skin. These include excessive riding, high tailheads, and lower quality carcasses. At the Missouri Experiment Station, lambs fed comparatively high levels of stilbestrol have developed undesirable effects and, in New Zealand, undesirable effects have occurred in lambs grazing on clover found to contain large amounts of estrogenic substances. Probably the most unusual undesirable effect, in the latter instance, was udder development and milk production by wether lambs.

No experiments have been reported in which the substance has been fed to calves weighing below 600 pounds at the start of the feeding period. Neither has it been used in long feeding periods nor with large amounts of alfalfa hay. Thus, we cannot be certain of the effects of stilbestrol under these conditions.

Is diethylstilbestrol being fed on an experimental basis by the Nebraska Experiment Station? Yes. Tests using stilbestrol are now in progress at the North Platte Station.

Will other estrogenic substances produce similar results? Perhaps some will, but not all. Some of the female sex hormones may not be effective when administered in the feed but synthetic estrogens similar to diethylstilbestrol may be as effective. The Purdue Experiment Station recently tested two such substances, dienestrol and hexestrol. The rate and efficiency of gain of steers fed hexestrol was equal to that of steers fed stilbestrol. Those fed dienestrol gained less rapidly than steers fed either stilbestrol or hexestrol but significantly faster than those not fed estrogenic materials. The steers fed hexestrol and dienestrol produced carcasses which graded slightly higher than those



Table 1. --Benefits of feeding different levels of stilbestrol to fattening cattle. \*

Level of stilbestrol	Sex of cattle	Initial weight	Length of feeding period	Avg. daily gain	Increased gain over controls	Increased appetite over controls	Feed saved over controls
Mg. daily		Lbs.	Days	Lbs.	%	%	%
5.0	steers	1021	43	2.83	33	8	19
5.5	steers	696	112	2.64	19	7	7
6.0	heifers	643	114	2.23	10	0	11
5.0	steers	823	120	2.58	9	0	8
Avg. benefits from 5-6 mg.					18	4	11
10	steers	1036	43	2.50	18	8	7
11	steers	696	112	3.06	37	6	20
12	heifers	643	114	2.34	15	2	14
10	steers	823	120	2.48	5	0	5
Avg. benefits from 10-12 mg.					19	4	11

\* Data obtained from Iowa Animal Husbandry publications 649 and 662.

of steers fed stilbestrol, yet each group was inferior in carcass grade to the groups not fed estrogenic materials. Although these substances appear desirable, the Federal Pure Food and Drug Administration must give its approval before they can be fed commercially, and this approval has not yet been given.