1967

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A. S. Series 67-32

THE INFLUENCE OF ALFALFA COUMESTROL ON THE REPRODUCTIVE PERFORMANCE OF GILTS

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In Australia during the early 1940's, a syndrome known as "clover disease" was observed in sheep grazing subterranean clover. This syndrome was characterized by a marked reduction in fertility which was later proved to be due to a high content of estrogenic substances in the clover. Alfalfa has since been shown to contain varying levels of these plant estrogens. The most important of the plant estrogens present in alfalfa is coumestrol because of its relatively greater biological potency than the other plant estrogens and because of its more frequent occurrence. Plant physiologists have shown that alfalfa infected with certain fungus diseases contains a level of coumestrol which increases with the amount of disease present in the alfalfa plants.

Since alfalfa meal is such an important source of nutrients for farm animals and is often included in swine rations, this study was conducted to determine if alfalfa plants with coumestrol levels in excess of 100 parts per million (ppm) would have any effect on the reproductive performance of gilts when included in their ration.

Experimental Procedure

Forages are the only available source of coumestrol, because it cannot be produced commercially at the present time. This made it necessary to locate alfalfa hay with a high level of coumestrol for use in this study. A field of alfalfa infested with a fungus disease was examined and samples taken from the field showed the coumestrol content to be in excess of 500 ppm. Hay from this field was obtained and stored for use in compounding the high coumestrol ration. Although the preharvesting samples indicated that the hay obtained would be quite high in coumestrol, the amount actually measured in the hay and feed during the experiment were much lower than had been anticipated. Therefore, it was necessary to carry out this study with a lower level of coumestrol in the high coumestrol ration than had been originally planned.

The composition of the two rations used in this experiment is shown in table 1. The only difference between the two rations was that the control ration contained a commercial source of dehydrated alfalfa meal while the high coumestrol ration contained alfalfa hay which had been pelleted and ground before mixing with the rest of the ration. Since the coumestrol content of the hay varied somewhat from bale to bale, it was impossible to hold the coumestrol content of each batch of ration at a constant level. The level of coumestrol fed to the high coumestrol group during the prebreeding period was 37.5 ppm. During the breeding and postbreeding periods, the coumestrol level fed to this group varied from 27.8 to 32.3 ppm. The level of coumestrol in the ration of the control gilts varied from 9.4 to 14.6 ppm during the experiment.

Table 1. Composition of the Rations[a]

Ingredient	Pounds of Ingredient	
	High coumestrol	Control
Ground yellow corn	620	620
Ground oats	640	640
Dehydrated alfalfa meal[b]	--	600
Pelleted and ground alfalfa hay[c]	600	--
Soybean meal (44%)	70	70
Meat and bone scraps	20	20
Dicalcium phosphate	20	20
Trace mineral salt	10	10
Vitamin-antibiotic premix[d]	20	20

[a] Chemical analysis showed the rations contained 13.5% crude protein.
[b] Chemical analysis of the four batches of ration showed the coumestrol content to be 9.8, 10.7, 9.4 and 14.6 ppm, respectively.
[c] Chemical analysis of the four batches of ration showed the coumestrol content to be 37.5, 27.9, 27.8 and 32.3 ppm, respectively.
[d] The premix provided 2000 U.S.P. units vitamin A, 4 mcg. vitamin B_{12}, 5 mg. choline, 4.5 mg. niacin, 2 mg. pantothenic acid, 1 mg. riboflavin, 250 U.S.P. units vitamin D_3 and 5 mg. chlortetracycline per pound of ration.

In the fall of 1966, 44 six month old Yorkshire gilts from 16 litters were allotted at random within litters to the two treatment groups. During the first five weeks of the experiment, all gilts were self-fed the control ration and were checked daily for signs of estrus. Two gilts in each group failed to show estrus and were discarded from the experiment leaving 20 gilts in each treatment group. Beginning the sixth week of the experiment and continuing through the twentieth week, the control group was self-fed the control ration and the high coumestrol group was self-fed the high coumestrol ration. The gilts were checked for estrus each day and breeding was begun on November 16 after the gilts had been on the treatment rations for five weeks.

Six Yorkshire boars were allotted at random to breed the 40 gilts in pairs of two so that a boar bred one gilt from the control group and her littermate from the treatment group. The gilts were bred on the second day of estrus and only received one service per estrus. If the gilts returned to estrus 21 days after mating, they were rebred to the same boar. If the gilts did not return to estrus by 25 days after mating, they were sent to slaughter and their reproductive tracts were recovered for further examination. The experiment was terminated ten weeks after breeding began. At that time, all remaining gilts were slaughtered and their reproductive tracts recovered. The reproductive tracts of all gilts were examined closely for abnormalities, and the number of corpora lutea and normal embryos present in each gilt were recorded.

Results

All gilts continued to exhibit normal estrous cycles during the course of the experiment. There was no effect of treatment on the regularity or length of the estrous cycle of any of the gilts. No noticeable difference was observed between treatment groups in the mating behavior of the gilts.

A summary of the reproductive performance of the gilts is shown in table 2. None of the differences between treatment groups were statistically significant. However, it was observed that the gilts on the high coumestrol diet required more services per conception and ovulated more eggs than the control gilts. On the other hand, the control gilts had more embryos implanted in their uterine cornua than did the gilts on the high coumestrol diet.

Table 2. Summary of the Reproductive Performance of the Gilts[a]

	High coumestrol	Control
Number of gilts	20	20
Number open[b]	4	3
Number pregnant	16	17
Average number of services per pregnant gilt	1.31	1.11
Average number of corpora lutea	15.38[c]	14.00
Average number of embryos	10.23[c]	11.35

[a] None of the differences between treatment groups were statistically significant.
[b] One open gilt from each group was found to have a structural abnormality of the reproductive tract not associated with treatment which would have prevented conception. The other five open gilts were bred to two boars which were only able to settle three of the eight gilts to which they were mated.
[c] These values are the average of 13 pregnant gilts because the reproductive tracts of three pregnant gilts from the high coumestrol group were lost at the packing plant.

Estrogen in sufficient quantities is known to prevent implantation and interrupt pregnancy. Although the high coumestrol gilts had fewer embryos present than the controls, which is the effect that would be expected, the level of coumestrol used in this study was not high enough to have any significant detrimental effects on the reproductive performance of the gilts.

Summary

Under the conditions of this study, a level of coumestrol in the feed of up to 37.5 ppm did not significantly affect the reproductive performance of Yorkshire gilts.