Texas Agricultural Experiment Station
Texas Agricultural Extension Service
The Texas A&M University System

Overton Field Day Report - 1994

1994 Research Center Technical Report No. 94-1

Texas Agricultural Experiment Station • Edward A. Hiler, Director
The Texas A&M University System • College Station, Texas

SOYBEAN MEAL PHYTOESTROGENS DO NOT AFFECT SUPEROVULATORY RESPONSE OR GROSS REPRODUCTIVE SYSTEM MORPHOLOGY IN BEEF HEIFERS

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Background. Phytoestrogens are plant compounds capable of inducing estrogen-like effects in livestock. Plant species such as soybeans, alfalfa and some of the clovers commonly used exhibit estrogenic activity which has been associated with reduced reproductive performance. Currently, phytoestrogens are classified into three general categories: (1) Isoflavones, (2) Coumestans and (3) Resorcylic acid lactones. Formononetin, Biochanin A, Genistein and Daidzein are the major isoflavones shown to negatively affect fertility in animals along with the coumestan, Coumestrol. Livestock grazing phytoestrogenic pastures exhibit decreased fertility rates. Common findings across studies are an increased incidence of ovarian cysts, irregular cyclicity and overall infertility (increased number of services/conception and low calving or lambing rates), along with marked increases in size and weight of the reproductive organs. Soybeans are a very rich source of phytoestrogens, particularly Genistein and Daidzein. These compounds appear to carry over into soybean by-products and have been associated with infertility.

Because of the wide use of soybean meal as a protein supplement, the potential effects of daidzein and genistein on beef cattle reproduction were examined. Initial objectives were to examine superovulatory response and gross reproductive tract morphology following long term consumption of a ration supplemented with soybean meal known to contain high isoflavone concentrations.

Research Findings. Twelve 2-year old Brahman cows were fed balanced rations using soybean meal (SBM) or peanut meal (PM) as protein supplements during a 4-month period. Isoflavone content of SBM and PM was determined in triplicate samples by HPLC. High Genistein and Daidzein concentrations were detected in SBM (0.975 and 0.99 mg/gm, respectively). No detectable amounts of the isoflavones were found in PM. Six cows were randomly assigned to each ration; daily intakes of SBM and PM were 2.2 and 2.38 lb/hd/day, respectively. After 29 days on rations, cows in each treatment were superovulated using 28 mg of Follicle Stimulating Hormone (FSH-P, Schering, Kenilworth, NJ) over a 4-day period in a decreasing dose schedule (5, 4, 3 and 2 mg, twice daily). Animals were ovariectomized on day 5 and data on ovarian weights (gm), follicular fluid weight (gm), corpus luteum weight (gm) as well as the number of large ($\geq$ 8.0 mm), medium (4.0-7.9 mm) and small (<4.0mm) follicles resulting after superovulation recorded. Ninety days after ovariectomy the animals were slaughtered. Macroscopic evaluations of the reproductive tracts were performed and additional data collected on uterine weight, mammary gland weight and pituitary gland weight. Mean ovarian weight, follicular fluid weight and corpus luteum weight were not different (P>.05) across treatment groups. Likewise, mean number of large, medium and small follicles and total number of follicles following superovulation did not differ between treatments (P.>05), Table 1.

Table 1. Number of large, medium and small follicles following superovulation (mean±standard error).

Ration	Size Category			
	Large	Medium	Small	Total
PM	19.16 ± 3.57	17.50 ± 2.98	13.00±1.69	49.66 ± 5.8
SBM	19.50 ± 5.60	16.16 ± 5.7	9.16±2.32	44.83 ± 10.8

A similar trend was observed with regard to follicular size categories. Mean diameters (mm) of large, medium and small follicles were not different between treatments (P>.05): 10.29±0.55 vs. 10.11±0.49; 5.57±0.11 vs. 5.54±0.16 and 2.52±0.05 vs. 2.05±0.42 for the PM and SBM rations, respectively.

At slaughter, no significant macroscopic changes on the reproductive tract were observed. Furthermore, uterine weight, mammary gland weight and pituitary gland weight did not differ between treatments (P>.05; Table 2).

Table 2. Weight of reproductive system components after long-term consumption of Soybean Meal Phytoestrogens by ovariectomized cows (mean ± standard error).

Ration	Mammary Gland (kg)	Uterus Weight (gm)	Pituitary (gm)
PM	6.81±0.56	68.11±5.98	1.31±0.09
SBM	7.42±0.61	64.29±5.00	1.18±0.09

Application. These preliminary results support the use of soybean meal as protein supplement for beef females despite its high isoflavone content. Current findings suggest that soybean meal isoflavones do not affect the magnitude of the superovulatory response and do not reverse typical uterine macroscopic changes induced by long term ovariectomy. However, additional data are necessary to draw definitive conclusions with regard to their effects on reproductive function. Further studies are underway to examine possible relationships with estrogen receptor numbers, endocrinology of the follicle and pituitary responsiveness in cows after long-term consumption of these compounds.