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# Dynafac, Fat and Diethylstilbestrol for Fattening Cattle

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# DYNAFAC, FAT AND DIETHYLSTILBESTROL FOR FATTENING CATTLE

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BY

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DYNAFAC, FAT AND DIETHYLSTILBESTROL FOR

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This thesis is approved as a creditable, independent investigation by a candidate for the degree, Master of Science, and is acceptable as meeting the thesis requirements for this degree, but without implying that the conclusions reached by the candidate are necessarily the conclusions of the major department.

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# INTRODUCTION

By nature the ruminant animal was designed to be primarily a forage consuming animal. Under usual conditions, a large percentage of the nutrients consumed by ruminants are furnished by high-fiber feeds. The large storage capacity of the digestive tract and the bacterial breakdown of food therein enables the ruminant to consume and utilize large quantities of these feeds. While high-quality roughages can be consumed in amounts adequate for maintenance and some growth, such rations are too low in digestible energy to produce rapid rates of gain and adequate fat deposition often demanded of feedlot cattle. Thus, at times it is necessary to feed high-energy feeds such as cereal grains to increase the rate of gain and to produce carcasses of a quality suitable to the meat consumer. Because the ruminant animal was meant to be a roughage consuming animal and was endowed with a complicated digestive tract, the feeding of high-concentrate rations poses some problems not encountered in animals with a simple stomach.

The ruminant animal is relatively inefficient in the conversion of food nutrients into body tissues. There is a considerable loss of energy that occurs in the fermentation process within the rumen. Most workers agree that the maximum potential of the ruminant in regard to rate, efficiency and economy of gain is not realized. There is a continual search for ways to improve the efficiency of production. Ways are being sought to improve both the efficiency of the animal and the ration.

Not only is the ruminant relatively inefficient in feed conversion, it is also more prone to digestive disturbances when high-concentrate rations are fed. Scours, founder and bloat are not uncommon in the feedlot. Prevention of these ailments by improved rations or other means plus an improvement in the efficiency of the animal and the ration would be beneficial to the livestock feeder.

Improvement in the animal must come from effective selection and/or breeding of more efficient animals or from alteration of the physiological processes governing the animals' metabolism which will promote increased digestion and assimilation of food nutrients. Improvement in the ration could come from improved methods of preparation, more proper nutrient balances and stimulatory feed additives which will increase the effectiveness of the ration.

This study was designed to test the effectiveness in ration improvement from certain additions to a high-concentrate basal ration fed to fattening cattle. The improvement in rate, efficiency and economy of gain and the quality of the carcasses produced were the main criteria used to determine the value of the additions to the basal ration. A record was also kept of all abnormal conditions or disorders that occurred in the animals during the trial. The materials tested in the trial were dynafac, inedible animal fat and diethylstilbestrol implants. (For the sake of brevity, diethylstilbestrol will be referred to as stilbestrol or DES throughout the thesis.)

Dynafac is the name given a feed additive compound consisting of 20% trimethylammonium stearate and 80% carrier, soybean meal or steamed bonemeal. The active ingredient, trimethylammonium stearate, is produced by the chemical alteration of fat. The resultant product from this alteration is reported to have antibacterial and antifungal properties and is referred to as a "chemobiotic." It has been claimed that dynafac is selective in its action and controls harmful bacteria throughout the digestive tract without impairing the beneficial microorganisms of the rumen. Other claims are that it acts against toxin-producing fungi of the digestive tract by killing the reproductive spores and is effective in minimizing trouble from enterotoxemia, feedlot bloat and scours.

Work has shown that only a small amount of dynafac is absorbed into the bloodstream and stored in the tissues (Mameesh et al., 1958). It would appear that if more healthful conditions could be maintained within the intestinal tract through the use of dynafac, the animal should respond with increased weight gains and improved feed efficiency. Also, digestive disturbances that are often associated with the feeding of cattle might be controlled.

Fats are a rich source of energy and many fats are highly digestible. Inedible animal fats are also relatively low in price at the present time because of large accumulated surpluses. The surpluses have resulted from reduced exports, reduced domestic use in making soaps and more fat trim from carcasses because of the demand for leaner cuts by the consumer. If the inedible animal fats could satisfactorily replace part of the carbohydrates in livestock fattening rations, this would serve as an outlet of considerable magnitude for these surpluses. In addition, fat could be used in formulating rations of higher energy value which may prove more efficient and could result in more economical meat production.

Stilbestrol, a synthetic estrogenic compound, has been widely and effectively used in many feeding operations. The substance has both anabolic and estrogenic properties and appears to alter the normal physiological processes of the ruminant animal. This alteration has generally resulted in an increased rate, efficiency and economy of gain, but with some undesirable side effects.

The work reported herein is the results obtained with beef cattle from the addition of the three additives, dynafac, animal fats and stilbestrol, either singly or in combination, and with dynafac added at different levels to a basal corn-alfalfa fattening ration.

# REVIEW OF LITERATURE

## Dynafac

Several experiments have been conducted where dynafac was fed to cattle and sheep. The results of many of these experiments have been reported in a preliminary form in mimeographed reports. A review of these reports and the published literature shows that both positive and negative results have been reported when dynafac was used as an additive to ruminant rations. These variable results indicate that either the type of ration or some other factors are involved which may alter the effects of the additive.

Some of the first work reported was by the research personnel of Armour and Company who produced this compound (Shinn et al., 1956). In a feeding trial, 345 lambs weighing about 80 lb. were used to evaluate the effects of dynafac and chlortetracycline on growth. The lambs were divided into 15 uniform lots, assigned to 5 treatment groups and fed for 54 days on fattening rations. The dynafac-treated lots were fed rations containing either 50, 75 or 100 mg. of the additive per pound of feed. Both additives were reported to have resulted in a positive response with the 50 mg. level of dynafac giving a 17.5% greater daily gain and 11.6% improvement in feed efficiency when compared to the control group. Carcass grades were not affected and enterotoxemia was effectively controlled by all levels of dynafac and the antibiotic.

Dynafac appeared to give a favorable response with yearling steers at the Washington station (Dyer and McGregor, 1957). In the trial, a fattening ration consisting of barley, cull peas, beet pulp, molasses and alfalfa hay was self-fed to 120 yearling steers in 6 groups for 71 days. Treatments consisted of control, 36 mg. stilbestrol implants, 2 gm. dynafac and a combination of stilbestrol and dynafac. Daily gains were 3.0 lb. for the control lot, 3.5 lb. when dynafac or stilbestrol was used singly and 3.7 lb. when both were fed in combination. These gains are quite high and indicate a beneficial effect from dynafac but the trial was of short duration.

In trials at the South Dakota station (Zimmer and Embry, 1958), dynafac was tested in self-fed cattle fattening rations and in digestion trials with lambs. In the cattle fattening trial, 26 head were divided into two lots, hand fed for 31 days until on full-feed and placed on self-feeders for the duration of the 160-day trial. A high-concentrate ration composed of 67.5% rolled shelled corn, 20% ground alfalfa hay and 10% soybean meal plus added minerals was fed. The rate of gain, incidence of bloat and ability of the animals to stay on feed were observed in the trial. The control lot gained 2.79 lb. daily compared to 3.10 lb. for those getting the ration containing 200 gm. of dynafac per ton of total ration. The 0.31 lb. difference in daily gain amounted to an 11% increase for the dynafac lot. There was no founder or bloat observed in the treated lot while 3 steers foundered and 2 steers bloated occasionally in the control lot. More scouring was also noticed in the control lot when the animals were first put on the self-feeders.

In the digestion trials using eight wether lambs on both high- and low-concentrate rations, it was found that the digestibility of none of the nutrients of the ration was affected by the addition of dynafac at

1 gm. per head daily.

Klosterman et al. (1957) appraised the value of dynafac in a self-feeding trial using 14 steers on a high-concentrate ration for 168 days. The results of the trial showed the steers getting dynafac ate slightly more corn, graded and dressed a bit more than the controls, but gained at a slightly slower rate. Gains were 2.13 lb. daily for the controls and 2.05 lb. for the treated animals. None of the differences were considered significant.

Considerable work with dynafac has been reported from the Montana station. Thomas (1957) compared the value of dynafac, stilbestrol and Synovex when added to a concentrate mix of two-thirds rolled barley and one-third dried molasses beet pulp and fed with grass hay as the roughage source. The rations were fed to 100 yearling steers and 100 yearling heifers for 112 and 84 days, respectively. Each animal was fed 1 lb. of a supplemental pellet daily which contained 32% protein, with and without dynafac or stilbestrol added. Dynafac was included in the pellets in amounts to furnish 1 1/2 gm. per head daily. Rates of gain for the steers and heifers were 2.33 and 1.74 lb. daily, respectively, when fed the control ration. With dynafac as the only additive, the steers gained 5% and the heifers 12% faster than the controls. The steers that received both dynafac and stilbestrol gained 22% more than the controls and 10% more than those that received stilbestrol alone. The heifers that received both dynafac and stilbestrol gained 37% more than the controls and 27% more than those that received stilbestrol alone.

In another trial, 4 lots of 10 head of steers were self-fed a high-concentrate ration on irrigated pastures with dynafac and stilbestrol used as the additives to the basal ration (Thomas *et al.*, 1957). A progress report after 109 days on trial showed the average daily gain for the controls was 3.15 lb., 3.22 lb. for the dynafac lots and 3.36 lb. for the lots that received stilbestrol.

The effects of dynafac, stilbestrol and an antibiotic were observed in a high-roughage wintering ration with weanling calves (Thomas, 1958). Seven lots totaling 178 steers were fed an average of 12 lb. of alfalfa-grass hay, 1.6 lb. of ground barley, 1.25 lb. of alfalfa pellets and 1 lb. of a grain pellet daily for the 118-day wintering period. The steers were all fed at the same level and daily gains obtained were 1.31, 1.53, 1.53 and 1.75 lb. daily for the control, dynafac, stilbestrol and dynafac-stilbestrol lots, respectively. Feed efficiency ranged from 1206 lb. of feed per 100 lb. of gain for the controls to 903 lb. for the combination of dynafac and stilbestrol. Even though it was thought that dynafac would be of greatest value in high-concentrate rations, it appeared to also benefit the high-roughage ration in this trial.

In two other trials at the Montana station (Thomas *et al.*, 1958), the value of dynafac and stilbestrol were tested in complete pelleted fattening rations. In both trials the daily gain was improved by each additive when fed singly but with a greater improvement when fed in combination. Daily gains of 2.41, 2.78 and 3.01 lb. were made by cattle fed the control, dynafac and dynafac-stilbestrol rations, respectively, in the first trial. Stilbestrol was not fed alone in the trial. In the second trial, the gains for the different treatments were: controls, 2.33 lb.; dynafac, 2.45 lb.; stilbestrol, 2.59 lb. and dynafac plus stilbestrol, 2.85 lb. A positive response to dynafac was shown when fed as the only additive or when fed in combination with stilbestrol in these two trials.

In a third trial using pelleted rations, 30% and 70% roughage rations, with and without dynafac, were compared in a steer fattening trial (Thomas and Willson, 1959). Fifty percent sun-cured alfalfa meal and 50% dehydrated alfalfa meal made up the roughage portion of the ration while the remainder consisted of barley, beet pulp, molasses and minerals with 300 gm. of dynafac per ton of feed for the dynafac-treated lots. After about 125 days on trial, the daily gains for the steers getting dynafac with either roughage level was lower than the gains made by the controls. Daily gains were 2.65 and 2.90 lb. for the dynafac lots and 2.93 and 3.02 lb. for the controls when fed the 70 and 30% roughage levels, respectively. While the negative response to dynafac with the 70% roughage diet appears to be of considerable magnitude, it is possible that part of the difference may have been due to normal variation for the number of animals were small with only seven head per lot.

Dyer and Ham (1958) reported a beneficial response to dynafac when fed in an all-pelleted ration to yearling steers for 89 days. Average daily gains reported were 3.08 and 2.97 lb. for two control lots and 3.18 lb. for the steers getting dynafac. There was little difference in feed requirements per unit of gain.

The effects of dynafac on yearling steers being fed either a wintering or fattening ration was investigated by North Carolina workers (Wise *et al.*, 1959). In the wintering trial, 24 steers weighing about 500 lb. were divided uniformly and fed a basal ration of peanut hay *ad libitum* and 3 lb. of a concentrate mixture containing 2 parts corn and 1 part cottonseed meal for 139 days. Dynafac was added to the basal ration to supply 1.5 gm. per head daily to the treated lot. Results of the trial showed a slightly greater daily gain for the controls, 1.45 lb. compared to 1.36 lb. for the treated group. Feed intake and feed required per 100 lb. of gain were reduced slightly by the inclusion of the dynafac.

In the fattening trial, 20 yearling steers and heifers weighing about 600 lb. were fed for 68 days on a fattening ration composed of ground corn, protein supplement and grass hay. The corn was limited to 8 or 9 lb. per head daily and the supplement was fed at 1.5 lb. daily. Hay was fed *ad libitum*. Average daily gains were 2.68 lb. for the controls and 2.78 lb. for the group getting 1.5 gm. of dynafac. The group that received dynafac required 38 lb. less ground corn, 2 lb. less protein supplement and 70 lb. less hay per 100 lb. of gain than did the controls. The workers concluded there was some indication that dynafac might result in a feed savings in a drylot fattening regime.

In two trials conducted at the Iowa station (Burroughs *et al.*, 1958) where dynafac was fed at the 1 gm. or 2 gm. level, it was reported that no beneficial effects were shown in respect to rate of gain, feed efficiency, cost per pound of gain or in the improvement of carcass characteristics. Neuman et al. (1958) also reported no beneficial response to dynafac in a beef cattle fattening trial.

From the literature reviewed, it would appear that a beneficial response may be obtained under certain feeding conditions. However, these conditions have not been established and the response to dynafac appears to be rather inconsistent.

## Fat

Under usual conditions in livestock feeding, carbohydrates furnish energy more cheaply than do fats. However, under certain conditions the energy needs might be more efficiently and economically supplied in part by fat.

In recent years the surplus of animal fats has been steadily increasing. In a summary by Farnworth (1959) it was stated that between the years of 1949 and 1957, apparent production of tallow and grease went from 2.1 billion to 3 billion pounds annually. This increased production coupled with decreased exports and domestic use has resulted in large surpluses with a resultant decrease in price. In view of the surplus of fat and with the price low enough to be competitive with carbohydrates as an energy source, fat may have considerable merit as an addition to livestock rations.

Researchers have been investigating the ability of animals to utilize large amounts of fats in the ration. It has been shown that, within limits, increasing the fat content of a ration for growing pigs and fattening steers increases the feed efficiency beyond that which could be accounted for by the additional energy provided (Maynard and

Loosli, 1956). This phenomenon has been explained on the basis that with equicaloric diets, increasing the fat component decreases the heat increment which results in more energy being available for production.

Some early work was done at the Nebraska station in trials designed to compare different types of fats and to determine optimum levels at which they could be utilized in cattle fattening rations. In the first trial, 30 yearling steers were fed in three lots for 150 days and a comparison made between rations containing no added fat and rations with either corn oil or beef tallow added at a level of about 2.5% of the ration (Matsushima et al., 1954b). Results of the trial showed that the daily gains were similar between the animals that were fed the control ration and those fed the ration containing the added tallow. The steers that were fed the corn oil ration gained the least, and it was presumed to be due partly to decreased feed intake resulting from the development of rancidity and strong odor in the ration with corn oil before the end of the trial. Daily gains were 2.11, 2.00 and 1.74 lb., respectively, for the control, beef tallow and corn oil lots. Feed costs were lowest for the lot that received the tallow and highest for the lot fed the corn oil. There were no differences shown between carcass grades and selling price for the different treatments.

A second trial was conducted to compare the value of edible and inedible tallow fed at three different levels (Matsushima et al., 1954a). The tallow was incorporated into pellets and fed with a standard fattening ration of corn and alfalfa hay. Three levels of the edible and inedible tallow were fed to six lots of yearling steers for 160 days.

Consumption by the steers during the trial approximated 0.45, 0.85 and 1.25 lb. of tallow per head daily for the three levels in the rations. Daily gains for the three lots of steers that were fed the edible beef tallow was 2.37 lb. compared to 2.47 lb. for those that received the inedible tallow. It appeared that as the level of tallow was increased in the ration the daily gains were decreased. Average daily gains for the steers on the two types of tallow at the 0.45, 0.85 and 1.25 lb. levels were 2.57, 2.40 and 2.30 lb., respectively. There were no digestive disturbances encountered and carcass grades were not affected by either type or level of tallow used in the trial.

In another trial, steers were fed a standard cornbelt fattening ration to which either 0, 0.5 or 1.0 lb. of inedible tallow was added and fed with or without stilbestrol. The experiment was designed to measure the value of the different levels of fat and the effect of stilbestrol when used in conjunction with it (Matsushima et al., 1956). Six lots of steers with nine per lot that weighed about 650 lb. were fed for 210 days in the experiment. Two lots were fed each level of fat and one lot on each level was fed 10 mg. stilbestrol daily. Results showed average daily gains of 2.96 and 2.19 lb., 2.96 and 2.49 lb. and 2.77 and 2.33 lb. for the three levels of fat (0, 0.5 and 1.0 lb.) with and without stilbestrol, respectively. Daily gains and feed requirements per 100 lb. of gain for the three levels of fat were 2.58, 880; 2.73, 831 and 2.55, 840 lb. Gains were increased only when the 0.5 lb. level was fed but feed efficiency was improved at both levels of added fat. It appeared that stilbestrol was more effective in stimulating gains when used with the rations devoid of added fat. However, in the experiment there was a rather large difference shown in gains made by the controls and the stilbestrol-treated cattle (2.19 lb. vs 2.96 lb.) when no fat was fed. Normally the response to stilbestrol isn't this great. No differences were shown in dressing percent or carcass grades between any treatments.

From these trials it was concluded by the Nebraska workers that animal fats could be utilized satisfactorily by beef cattle as an energy source and that 1 lb. daily was nearing the maximum optimum level. Also, dressing percent, carcass grades and the response of animals to stilbestrol were not affected by the addition of fat to the ration. It was stated that it would be uneconomical to pay more than 2.5 times the cost per pound of ground shelled corn for each pound of animal fat as a source of energy in cattle fattening rations.

Work done by Schweigert and Wilder (1955) was designed to evaluate the efficiency of energy utilization from fat and corn. Two groups of steers were fed for 109 days on rations that were similar except in one ration 2.5 lb. of corn was replaced with 1 lb. of stabilized tallow. At the conclusion of the trial, both lots had gained at nearly the same rate with the control group gaining 1.94 lb. and the fat-fed group 1.99 lb. daily. No differences were noted in carcass quality. It was concluded by these workers that the calories from animal fat, when fed at a level of 1 lb. per steer per day, were utilized as well as those from 2.5 lb. of corn.

The response of yearling cattle to a fattening ration containing 5% added animal fat was measured by Barrick et al. (1954). For the ration with added fat, 6 lb. of ground shelled corn in 100 lb. of control diet was replaced with 5 lb. of fat and 1 lb. of soybean meal. The replacement kept the protein content about equal between the two rations and increased the T.D.N. content of the ration with added fat by about 6%. Results showed that the added fat resulted in increased daily gains, increased feed efficiency and improved carcass grades. Average daily gain for the controls was 2.17 lb. and 2.40 lb. for the group fed the fat while the feed requirements per 100 lb. of gain were 1009 lb. and 908 lb., respectively, for the control and fat-fed groups. It was concluded by these workers that fat was effective as a substitute for 5% of the corn in a fattening ration for beef cattle when the protein content of the rations was equalized.

Meiske et al. (1959) reported that after 109 days on trial, steers that were being fed a fattening ration in which 10% of the ground shelled corn of the ration had been replaced with 10% fancy tallow were not gaining as fast but were making more efficient gains than were the steers on the ground shelled corn ration. Daily gains for 12 steers getting the shelled corn ration were 2.52 lb. compared to 2.41 lb. for an equal number of steers being fed the ration with the added fat. Feed efficiency favored the group fed the fat with 783 lb. of feed required per 100 lb. of gain in comparison to 845 lb. required by the control group. It was reported that the 10% fat addition appeared to reduce the palatability of the ration and in turn reduced consumption. However, even though total consumption was reduced the intake of total digestible nutrients by the fat-fed group was about equal to the control cattle.

It was reported by Jones et al. (1960) that fat will effectively replace corn when added to a fattening ration for beef cattle at a level of 5% of the total ration. In a 169-day trial, 650-lb. yearling steers were fed a basal ration composed of ground corn cobs, soybean oil meal, ground shelled corn, molasses and minerals. This ration was compared with one in which 620 lb. of the corn and 80 lb. of molasses were replaced with 500 lb. of corn cobs and 100 lb. each of soybean meal and inedible fat. Results showed an average daily gain of 2.14 lb. for the controls and 2.10 lb. for those with the fat added. Feed requirements were 846 and 905 lb. per 100 lb. of gain for the controls and fat-fed group, respectively. Conclusions drawn from this experiment were that fat will effectively replace corn when added to fattening rations for beef steers at a level of 5% of the total ration.

Erwin et al. (1956a) stated that the response of beef cattle to added animal tallow in the ration depended to some extent on the other ingredients of the ration. To test this, 7% bleachable fancy tallow was fed for 183 days in a pelleted ration that contained either alfalfa hay as a high-quality roughage or wheat straw as a low-quality one with each being fed in conjunction with concentrates. Results showed that the fat increased gains significantly when fed with the alfalfa and reduced gains significantly when added to the ration containing straw. Dry matter and crude fiber digestibility were reduced significantly by the fat. It was suspected that coating of the fiber by the fat may have prevented or retarded access to it by cellulolytic microorganisms and caused the reduced fiber digestion.

Other workers (Ward et al., 1957; Pfander and Verma, 1957) have postulated that the depressing effect of supplemental fat on crude fiber digestibility was produced by coating the fibrous portion of the ration. It has been shown, however, that a reversal of corn oil depression of crude fiber or cellulose digestion can be effected by feeding alfalfa ash or added calcium (Brooks et al., 1954; Summers et al., 1957; Grainger et al., 1957). Indications were that ruminal requirement for calcium was increased in the presence of supplemental fat.

In a two-phase growing and fattening steer trial where green-chopped alfalfa served as the roughage portion of the ration, the addition of fat resulted in increased daily gains, improved feed efficiency and reduced incidence and severity of bloat according to Erwin et al. (1957). An average daily gain of 2.58 lb. with 715 lb. of dry matter required per 100 lb. of gain was obtained from the group fed the added fat. This compared to a gain of 2.21 lb. with 828 lb. of dry matter required for the animals that received rations without added fat during the growing phase. Gains and feed requirements as dry matter per 100 lb. of gain during the fattening phase were reported to be 2.70, 772 lb. and 2.41, 836 lb. for the fat-fed and control groups, respectively.

Ten percent animal fat was used to control grain intake of steers on pasture and its value compared to the use of salt which is more commonly used for this purpose (Buck and Barrick, 1957; Barrick and Wise, 1958). In the first trial the fat was not as effective in limiting feed intake as was salt. However, daily gains were significantly higher in favor of the fat over the salt, 2.53 lb. compared to 2.17 lb., and the carcasses graded higher. In the second trial, feed consumption was about equal but the group receiving the fat gained 7% faster and returned $9.00 more per head.

It would appear from the reviewed literature that waste fat can be used satisfactorily as partial replacement for concentrates in cattle rations. It appears a level of 5% or about 1 lb. per head daily is approaching the maximum level that fat should be added to cattle rations. Benefits reported from the inclusion of fat other than increased gains and improved feed efficiencies were improved carcass quality, reduced dustiness of the ration, improved mixing and handling qualities, reduced wear on feed handling equipment, faster mixing and pelleting and a reduction in cases and severity of bloat.

## Stilbestrol

Such a large amount of work has been done with stilbestrol by the many experiment stations and other workers that there will be no attempt made to report all of the literature available. Results of a few representative trials involving the use of different levels and different methods of administration will be reviewed along with some studies other than gain and feed efficiency responses. Most of the research reported has shown that when stilbestrol is administered by implant or fed orally it provides an economical and effective method for improving rate of gain and feed efficiency in cattle and sheep.

Activity of Stilbestrol and Tissue Residues

The mode of action of stilbestrol is not known. It has been suggested that stilbestrol fed orally may have some effect on the rumen organisms which cause an increase in digestion of the feed in the rumen. Brooks *et al.* (1954) reported that stilbestrol increased the digestibility of cellulose in the artificial rumen and increased cellulose and protein digestion when fed to sheep. Erwin *et al.* (1956b) reported that stilbestrol had no effect on digestibility of dry matter, crude fiber, crude protein or ether extract when fed to steers. It was reported by Story *et al.* (1957b) that part of the benefits from stilbestrol in lambs was due to increased digestion of ration nutrients and improved utilization of nitrogen in metabolism. Bell *et al.* (1957) reported that calcium, phosphorus and nitrogen retention was increased when 4 mg. of stilbestrol were fed daily to lambs; however, there was no significant effect on the digestibility of ration nutrients.

It has also been suggested that stilbestrol fed orally may exert some action on the metabolism of the animal's tissue which is thought to occur when the compound is implanted (Clegg and Cole, 1954). It has been shown that implanted stilbestrol increased the retention of nitrogen in lambs but had no effect on ration digestibility (Jordan, 1953; Whitehair *et al.*, 1953).

It appears that the primary stimulus obtained from stilbestrol administration is that of growth stimulation (Shroder and Hansard, 1958). Increased growth would account for the increased retention of calcium, phosphorus and nitrogen as it would be required for bone and tissue formation.

There is more or less general agreement that the compound must stimulate gains by its effect on the pituitary and adrenal glands for these glands are generally found to be significantly larger in treated animals (Clegg and Cole, 1954; Goetsch, 1955; Cahill et al., 1956).

It appears that when stilbestrol is administered orally there is little, if any, of the compound assimilated and stored in the tissues of animals. Feces from cows receiving 10 mg. daily contained as much estrogenic activity as did the ration fed (Turner, 1956).

In a trial conducted by Story et al. (1957a) to study the amounts retained, 4 wether lambs were fed 2 levels of stilbestrol during a trial that was divided into 4 separate periods. No stilbestrol was fed the first and fourth periods of the trial. One mg. per lamb daily was fed during the second period and 2 mg. were fed during the third period of the trial. Using the mice uterine weight assay technique, it was shown that there was no estrogenic activity in the collected feces or urine in periods 1 and 4 and about 80% of the stilbestrol fed during periods 2 and 3 was recovered in the urine and feces. The fate of the 20% not recovered was unknown but was thought to have been destroyed through metabolic degradation or degradation by the rumen organisms. The absence of estrogenic activity in the urine and feces in period 4 would indicate there had been no temporary retention of the compound by the animals.

Radioactive stilbestrol was fed to steers in a study designed to measure the amount of residue that remained in the meat of stilbestrol-fed cattle (Mitchell et al., 1956). Tissues were examined 24 hours after the last dose of stilbestrol had been administered. Little residue was found and the workers concluded that natural foods often contained higher levels of estrogenic activity than was shown in the tissues of the stilbestrol-treated steers. These observations would indicate that if the compound is retained at all, retention is of very short duration.

Preston et al. (1956) examined the tissues of beef cattle that had been fed stilbestrol and found no residue in the lean, fat, liver, heart, kidney or offal tissues.

Composite tissue samples were made from 20 steers that had been fed 10 mg. of stilbestrol daily and the samples were examined for residual estrogens (Turner, 1956). No residue was found in any of the tissues, glands or organs investigated with the possible exception of the kidneys and lungs. Minute amounts of 4 parts per billion were detected in the kidneys and 10 to 12 parts per billion found in the lungs.

## Stilbestrol in Cattle Rations

Discovery of the effectiveness of stilbestrol in improving gains and feed efficiency of ruminants was followed by work directed toward the establishment of optimum levels to be used. Most of the levels used initially were greater than the present recommended levels, and side effects of a serious nature were often reported which detracted from the beneficial effects shown by use of the compound.

Maynard and Loosli (1956) state that when the compound was administered at levels of 12 mg. to lambs and 60 mg. to steers marked growth stimulation occurred with less feed required per unit of gain. While these improvements were noted, there tended to be a lowering of the carcass grade in the treated animals due partly to a reduced amount of marbling. Some other effects noted from the use of the compound on animals were mammary development in steers and wethers, pelvic changes in cattle, vaginal and rectal prolapses, difficult urination and changes in the organs of the urogenital tract.

A report of some earlier work with stilbestrol at the California station (Clegg *et al.*, 1951) showed that 60 mg. implants increased the gains of heifers and steers. Also, the treatment resulted in significant mammary development with considerable milk present in the mammary glands of the heifers when slaughtered. It was reported that vaginal prolapses were not uncommon among the treated heifers.

Radabaugh and Embry (1959) summarized the results of several trials in which stilbestrol had been used. They reported that implant levels of 60 mg. and above, which were used in the earlier trials, appeared to show the most effective response in rate of gain. However, undesirable side effects such as depressed loins, elevated tailheads, mammary development and lower carcass grades were often noted when the higher levels were used. It was stated that when direct comparisons were made between levels of implants, the 36-mg. level gave just as good results in increasing gains as did higher levels with a reduced frequency of undesirable side effects.

Andrews *et al.* (1950) used stilbestrol implant levels of 0, 60 and 120 mg. on fattening yearling steers and reported a daily gain of 2.47 lb. and 2.68 lb., respectively, as compared to a gain of 2.24 lb. daily for the controls. There was no mention made of side effects from these high levels of treatment.

Most of the early work with stilbestrol implants was with high levels. Several workers have since shown that only small amounts are needed to stimulate gains, and when implants are made they are effective for a considerable length of time. In work done to investigate the absorption rate of the pellets and the length of time a single implant should be effective, 24 steers were implanted with two 12-mg. pellets in the ear (Hale et al., 1957). Residues were removed from 6 randomly selected steers at 28, 56, 84 and 112 days. Average residue at 112 days was 4.26 mg. per pellet. The half-life for the pellets was calculated to be 63 days. The average daily absorption rate per pellet for the 112-day period was 74 mcg. It was thought by the workers that a single implant would exert a growth promoting effect for 150 to 200 days.

In a 237-day feeding trial, Klosterman et al. (1958) studied the value of re-implanting after 100 days on trial. Four lots, with 10 head of steer calves per lot were used in the experiment. Treatments included: (1) control lot, (2) a 36-mg. implant at start of the trial, and a 36-mg. re-implant after 100 days on trial, (3) a single implant of 36 mg. at start of the trial and (4) a single implant of 36 mg. administered after 100 days on trial. Results obtained from the trial showed average daily gains of 2.03, 2.28, 2.23 and 2.05 lb., respectively, from the four different treatments. It was concluded that there was no advantage in re-implanting after 100 days and the best results from one implantation were obtained when it was made at the start of the experiment.

Radabaugh and Embry (1959) reported that growth response to stilbestrol implants begins to drop off after 120 to 140 days. Pellet residues were recovered by these workers at 66 and 120 days after implantation, and it was calculated that one-half of the initial amount implanted had been absorbed after 66 to 87 days.

Two trials were conducted by O'Mary et al. (1956) to test the effectiveness of low levels, and the effect of giving an additional low-level implantation of stilbestrol during the course of the trial.

In the first trial, 50 Angus and Hereford steers were used. Twenty-five steers served as controls and an equal number were implanted with 36 mg. of stilbestrol at the beginning of the trial. After 42 days on trial, 10 steers initially implanted were re-implanted with 36 mg. and the trial was run for a total of 105 days. At 85 days after the initial treatment, 5 judges scored the steers on straightness of top line. Data on carcass grade and dressing percent were obtained at slaughter. Results of the trial showed there was no benefit gained from re-implanting after 42 days. It did show that both treated groups had highly significant greater gains than the controls (1.74 lb. vs 1.34 lb. daily). Analysis of the top line scores showed that levels as low as 36 mg. would cause the loins of steers to be depressed. Carcass grades and dressing percent were not affected significantly by the levels used.

The second trial conducted by the workers was very similar to the first trial, except the 10 steers that were to be re-implanted were given 12 mg. initially and an additional 24 mg. after 8 weeks on trial. The daily rate of gain for the steers during the first 8 weeks of the second trial was 1.54, 1.65 and 2.08 lb. daily for the controls, 12-mg. plus 24-mg. group and 36-mg. group, respectively. An analysis for the first period of the trial showed there was a significant increase in gains for the group that received the 36-mg. implant but no significant difference between the controls and the group implanted with 12 mg. Indications were that 12 mg. was not an adequate amount to give a significant response.

During the second 8-week period after an additional 24 mg. had been added to the initial 12-mg. implant, the steers gained as well as those that had received the 36-mg. implant initially. When the trial was terminated after 140 days, the results showed a highly significant difference in rate of gain between the steers treated with 36 mg. of stilbestrol and the controls. The steers that were treated with the 12- plus 24-mg. implants gained more rapidly than the control steers; however, the difference in gain was not statistically significant. The over-all gains were 1.64 lb., 1.85 lb. and 2.03 lb. for the controls, 12- plus 24-mg. and the 36-mg. implanted groups, respectively. The treated steers showed a depression of the loin after 65 days on trial.

These trials would indicate that a dosage level of 12 mg. is inadequate to give a satisfactory response. Also, it points out the importance of getting good gains when animals are first started in a feeding operation for the gains at the beginning of a fattening period are generally greater than during the latter phase.

Mitchell *et al.* (1959) studied the effects of different levels of stilbestrol implantation in an effort to determine optimum levels for its use. Two trials were conducted.

In the first experiment 40 Hereford calves that averaged 507 lb. were divided into 5 groups and implanted with 0, 12, 24, 36 and 48 mg. of stilbestrol and fed fattening rations for 230 days. Results of trial 1 showed that all levels of stilbestrol used produced significantly greater gains than were made by the control steers. However, none of the differences between implanted groups was statistically significant. It was apparent that the 24-mg. and 36-mg. levels produced the most desirable response. The gains made by these two groups were 2.45 lb. and 2.40 lb. daily, respectively, as compared to 2.26 lb. for the 12-mg. and 2.28 lb. for the 48-mg. implants. The daily gain made by the controls was 2.14 lb. It was stated that the steers implanted with 12 mg. did fairly well at first but did poorly the last 2 months on trial. It was felt the level of stilbestrol was too low to induce a continued response. The steers that received the 48-mg. implant lost weight the last 2 weeks on trial for no apparent reason and this lowered their average daily gain considerably.

The second trial consisted of 2 phases, wintering and fattening. The wintering phase lasted for 112 days followed by a 167-day fattening phase for a total of 279 days. In the trial, 30 Hereford calves that averaged 435 lb. were allotted to the same five treatment levels as used in trial 1. The calves were implanted at the beginning of the wintering phase and re-implanted with the same levels at the end of 175 days. During the wintering phase, response to the different levels of implant varied considerably and no pattern was evident. Average daily gains for the period were 2.14, 2.26, 2.45, 2.40 and 2.28 lb., respectively, for the 0, 12, 24, 36 and 48 mg. of stilbestrol.

During the finishing phase, it was apparent the 12-mg. implant was not adequate since gains were only a little better than those made by the untreated steers. Over the entire 279-day trial, there was little difference in rate of gain between the groups of steers that received the 24, 36 or 48 mg. of stilbestrol as implants. Gains for these three groups were 1.92, 1.90 and 1.96 lb., respectively, while the controls gained 1.60 lb. daily and the 12-mg. implanted steers gained 1.80 lb. daily.

A comparison between oral and implant methods of administration was made by Ohio workers in a steer fattening trial (Klosterman et al., 1956). Nine lots of 7 steers each that averaged 725 lb. were fed for 126 days on a fattening ration composed of mixed hay and ground ear corn. Stilbestrol was given at levels of 0 and 10 mg. fed daily or 60 mg. implanted. Levels of protein supplementation to the basal ration were varied, with 0, 0.75 lb. and 1.50 lb. fed daily. Results of the trial showed that there was little difference in rate of gain whether the compound was fed orally or implanted. The cattle that were implanted had a higher dressing percent, graded slightly lower and had higher tailheads than those fed stilbestrol. There was little difference in sale value of the cattle between the two stilbestrol treatments. In regard to the different protein levels, it was noted that an increase in gain from stilbestrol became greater as the level of protein was increased.

The response of steers to a low-level implant compared to orally administered stilbestrol was made by Clegg and Carroll (1957). Three groups of eight 550-lb. steers were treated with either 10 mg. orally, 15 mg. implanted or none. The experimental period was 207 days.

The workers reported from this trial that: (1) treated groups gained faster than the controls, (2) there was no real difference in rate of gain between oral and implanted groups, (3) maximum gain occurred the first 60 to 80 days, (4) after 150 days the oral group started outgaining the implanted group, (5) both treated groups ate slightly more feed than the controls, (6) no undesirable side effects were noted and (7) live slaughter grades were comparable for all groups.

Field trials were run concurrently with the above trial in which various levels of stilbestrol were implanted and compared to the 10 mg. per head daily oral level. It was shown that in these trials when a 60-mg. implant was used it resulted in a higher average daily gain, a larger increase in feed efficiency and a greater reduction in carcass grade. Carcass grade was sacrificed for better growth response when the higher levels were used. In the trials, implantation of 30 to 60 mg. resulted in an average daily gain increase of approximately 25% and an average increase in feed efficiency of 20% with a slight reduction in carcass grade when compared to the control steers.

Various levels of implants were compared with orally fed stilbestrol by Perry et al. (1958). Seventy-two steer calves were fed in 12 lots of 6 head each for 233 days. The steers were either fed 10 mg. orally or implanted with levels of 12, 24, 36 or 48 mg. per steer. Results showed that both methods of administration apparently exert about the same growth stimulatory effect in drylot. When fed orally or implanted at the 36-mg. level, gains were increased from 14.7 to 16%, feed consumption was increased by 10% and feed requirements per unit of gain were reduced by 7.4 to 8.5%.

Most work has shown that stilbestrol is quite effective in stimulating gains and improving feed efficiency. Burroughs et al. (1955) in a summary of the early research reported that 9 different experiment stations using 548 head of cattle in 19 experiments showed that liveweight gains were stimulated by the use of the compound in 18 of the 19 trials. A Kansas trial where steer calves were fed a high roughage ration was the only exception. Average stimulation in daily gains for the many different types of rations and cattle was 16% when stilbestrol was used. Also, average feed costs were reduced by 12% with a 3% increase in feed consumption for the treated steers. Little difference was shown in dressing percent and carcass grades between treated and untreated animals.

Radabaugh (1958) summarized the results obtained in 92 trials (1357 animals) where drylot steers on fattening rations were fed stilbestrol orally. The average increase in daily gains of the treated animals over the controls was 14.3%. Feed efficiency was improved by

9.8% in 82 trials where feed requirements were reported. There was essentially no difference shown in carcass grades between treated and untreated animals. When implants were used (919 treated steers), daily gains of the treated steers were increased 18.3% over the controls. Feed requirement per 100 lb. of gain was reduced an average of 10.3% in 38 trials. Carcass grade was reduced by one-sixth of a grade when implants were used.

Results show that maximum gain increases with a minimum amount of side effects will result from implanting stilbestrol at levels somewhere between 24 and 48 mg. If implanted at these levels, fattening steers will consume a little more feed daily, require somewhere between 10 and 18% less feed to produce 100 lb. of gain and will gain from 12 to 20% faster. Carcass grades and dressing percent should be similar between treated and untreated animals if fed the same length of time in a feeding trial of adequate duration.

# METHOD OF PROCEDURE

## Design of the Experiment

The experiment was designed to study the value of different levels of dynafac in rations for fattening cattle when fed in combination with added animal fat and with stilbestrol implants. Dynafac was fed at 0, 2, 3, 4 and 5 gm. per head daily. These levels of dynafac were fed with and without 3% added animal fat in the rations. The dynafac and fat treatments were administered to cattle with and without stilbestrol implants. The design of the experiment is shown in Figure I.

| | No Added Fat | | 3% Added Fat | |
|---|---|---|---|---|
| Level of Dynafac | No DES Implants | DES Implants | No DES Implants | DES Implants |
| gm./head daily | | | | |
| 0 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |

Figure I. Design of experiment

## Cattle and Preliminary Treatments

Two hundred yearling steers were used in the experiment. One group of 161 head was purchased from one herd in western South Dakota. Another 39 head of similar weight and condition were purchased at a feeder cattle sale. All the steers came directly off range pasture.

The cattle were trucked to Brookings and placed into two large lots and held for about 1 month until construction of the new feeding pens was completed. While in the holding pens, the cattle were fed alfalfa-brome grass hay on the ground. The amount of hay was restricted somewhat to prevent excessive waste and the daily consumption was approximately 12 lb. per steer. The cattle were ear tagged and vaccinated for malignant edema and blackleg during this preliminary period.

Allotment to Treatments

A filled weight was taken on all steers on the afternoon of November 20. These weights were used in allotting to the different treatments and for calculating periodic gains during the course of the trial. The cattle were stratified on basis of the filled weights and randomly allotted to the 20 treatments with 10 per lot.

After obtaining the initial filled weights, feed and water was withheld over night (16-18 hr.) for initial shrunk weights on the experiment. The next morning the cattle were weighed and sorted into the lots for the trial. Inclement weather with blizzard conditions had prevailed for 4 days preceding the initial weighing and had resulted in an apparent loss in weight by the cattle. It was decided, therefore, to use the initial filled weights as the starting weight on the experiment and for calculating the gains at the close of the trial.

The lots used in this feeding trial measured 24 ft. x 56 ft. and were equipped with fence-line feed bunks. The only pavement was an 8-ft. concrete slab at each feed bunk that extended the full length of each lot. The cattle were watered from large tanks equipped with electric tank heaters.

## Rations and Feed Preparation

The rations used in the experiment consisted of a grain-hay mixture and protein-mineral supplement. The basal grain-hay mixture contained 78% rolled shelled yellow corn and 22% ground alfalfa hay. For the rations with the added fat, 3% animal fat replaced an equal weight of corn grain in the grain-hay mixture.

The corn was rolled moderately coarse. The alfalfa hay was ground with a hammer mill using a 1 in. screen. The hay and corn were mixed in a twin spiral mixer in 3000-lb. batches and stored in bins at the feedlots for feeding.

The animal fat used in the rations was obtained from a local packing plant periodically during the experiment. It was an inedible product known as "prime yellow grease" and was a mixture of about 40% beef, 20% sheep and 40% swine fat which had been stabilized with Tennox 7. The fat was liquified by heating in a steam-jacketed kettle to a temperature of 160-180 degrees F. The proper quantity for the rations was then poured slowly into the grain-hay mixture while being mixed in the vertical twin spiral mixer.

The basic protein supplement consisted of 70% soybean meal, 18% ground shelled corn, 6% trace mineral salt and 6% dicalcium phosphate. It was fed in meal form at rates of 2 lb. per head daily. Vitamins A and D were added to the protein supplements to furnish 20,000 I.U. of vitamin A and 2,000 I.U. of vitamin D per head daily. Dynafac was added to the protein supplements to furnish the appropriate treatment level in 2 lb. of the supplement.

Representative samples of the rations fed were taken weekly throughout the trial and composited for analyses. The analyses showed the basal grain-hay mixture without the added fat contained an average of 10.58% protein while the one with the added fat contained 10.48% protein on a 12% moisture basis. Gross energy value of the two mixtures on a moisture free basis was 4281 and 4518 calories/gm., respectively, for the one without and with the 3% added fat.

The protein content for the supplements with the different levels of dynafac was very similar and averaged 30.8% on a 12% moisture basis. The rate of consumption of the grain-hay mixtures with the 2 lb. of protein supplement resulted in rations containing slightly over 12% protein. This amount of protein is considered in excess of the need of fattening cattle.

The cattle receiving the stilbestrol treatment were implanted with 36 mg. at the beginning of the experiment. One-half of the steers in each implanted lot were re-implanted with an additional 24 mg. of stilbestrol after 137 days on the experiment. This was 50 days prior to the end of the trial. Re-implanting within each lot was on the basis of gains up to that time, equalizing the rate of gain between those re-implanted and those not.

Management During the Experiment

The steers were started at a level of 4 lb. of the grain-hay mixture and 2 lb. of the protein supplement per head daily. The supplement was fed at this level throughout the trial. The grain-hay mixture was increased 1 lb. per head daily until a full feed was approached. Thereafter, the increases were reduced to 0.5 lb. daily until the cattle were on full feed. They were fed twice daily with the amount of the grain-hay mixture given at each feeding being regulated to keep feed before the animals at all times and to prevent excessive accumulation of feed in the bunks.

Some cases of foot rot occurred during the experiment. This condition was treated with sulfa compounds and the animals appeared to respond to the treatment rather rapidly. The dynafac in the rations did not appear to have any beneficial effect in preventing this condition.

The cattle were weighed at 28-day intervals during the trial to follow the progress of the performance.

## Termination of the Experiment

In order to obtain the desired carcass information, it was necessary to market the cattle over a period of 3 days. After 185 days on the trial, a final filled weight was taken on all steers and they were returned to their lots and kept on feed and water. In the early morning of the next 3 days, 3 or 4 steers were taken at random from each lot and trucked about 75 miles to market. Individual weights were taken at market for the final shrunk weight off the experiment. Sixty-six head were marketed on the first day and 65 head on the second and third days. Three steers had been removed during the experiment. Two had developed urinary calculi and one had an injured foot which did not respond to treatment. One other steer was not marketed because of a hip injury. Results for this steer were included in the feedlot performance.

Results for the other steers removed were not included in the performance for the lots, and an average amount of feed for one steer was deducted from that fed to the lot for the time each steer was in the lot in arriving at the feed consumption and feed efficiency.

At time of slaughter, a record was made of the cattle with abscessed livers. Each carcass was weighed after slaughter and the cold carcass weight was obtained by deducting 2.5% from the hot weight. The dressing percent was calculated by dividing the cold carcass weight by the market weight.

After 24 hr. in the cooler, the carcasses were ribbed and a carcass grade and degree of marbling assigned by a federal grader. Tracings were made of the loin-eye area and the fat covering over the loin eye. The size of the rib eye and the depth of fat covering were determined from these tracings.

Costs and returns for the experiment were calculated using the feed prices and carcass prices shown in Tables 1 and 2.

Table 1. Prices Used in Calculating Feed Costs

| Ingredient | Price per ton |
|---|---|
| Ground shelled corn | $ 40.00 |
| Ground alfalfa hay | 25.00 |
| Prime yellow grease | 140.00 |
| Soybean meal | 75.00 |
| Dicalcium phosphate | 100.00 |
| Trace mineral salt | 45.00 |
| Basal grain-hay mix | 36.80 |
| Grain-hay mix with 3% fat | 40.00 |
| Protein supplement | 69.00 |

Table 2. Carcass Prices Used in Calculating Selling Price

| Weight group | Carcass grade | |
|---|---|---|
| | Choice | Good |
| lb. | $ | $ |
| 500-600 | 44.75 | 43.00 |
| 600-700 | 44.00 | 42.75 |
| 700-800 | 43.00 | 42.00 |
| 800-900 | 42.50 | 41.50 |

The data collected from the 2 x 2 x 5 factorial experiment were analyzed by an analysis of variance using procedures as outlined by Cochran and Cox (1957).

## RESULTS AND DISCUSSION

The results of the trial are shown in Tables 3 through 6.

### Weight Gains

The average daily gains made by the steers on the different treatments are presented in Table 3. The inclusion of dynafac in the ration did not appear to be beneficial in improving rate of gain at any level used as shown by the average response with the different rations. Differences existed between individual lots; however, these were not consistent for any one level and the average gain made by the 4 lots on each level of dynafac was essentially the same.

Increasing the energy content of the basal ration by replacement of 3% of the shelled corn with inedible animal fat appeared to have only a small effect in improving daily gains with rations with and without stilbestrol. All of the steers fed rations with added fat gained an average of only 0.04 lb. more per day than those fed the rations without added fat. There was some indication that the fat had a lower value near the end of the trial. Daily gains on a filled weight basis showed that the steers fed the rations with added fat gained 4% more during the first 161 days. Thereafter, feed consumption was reduced in comparison to those fed rations without the added fat and gains were less. This resulted in the gains being nearly the same with and without the added fat for the 187-day experiment. The data are not adequate to determine if the length of the feeding period might have some effect on the value of the fat in the ration.

Table 3. Response of Fattening Steers to Dynafac, Fat and Stilbestrol (Nov. 20, 1958 to May 26, 1959 - 187 days) Weight Gains

| Dynafac level | No. of steers | Av. init. wt. | Av. final wt. | Av. gain | Av. da. gain | Change from control |
|---|---|---|---|---|---|---|
| gm./day | | lb. | lb. | lb. | lb. | % |
| | | | **Basal** | | | |
| 0 | 10 | 639 | 1110 | 471 | 2.52 | |
| 2 | 10 | 643 | 1116 | 473 | 2.54 | .8 |
| 3 | 9 | 640 | 1168 | 528 | 2.82 | 11.9 |
| 4 | 10 | 640 | 1122 | 481 | 2.59 | 2.8 |
| 5 | 10 | 641 | 1136 | 495 | 2.64 | 4.8 |
| Average | | 641 | 1130 | 489 | 2.62 | |
| | | | **3% Fat** | | | |
| 0 | 10 | 643 | 1143 | 500 | 2.68 | |
| 2 | 10 | 641 | 1154 | 513 | 2.74 | 2.2 |
| 3 | 10 | 641 | 1130 | 489 | 2.62 | - 2.2 |
| 4 | 10 | 640 | 1126 | 486 | 2.60 | - 3.0 |
| 5 | 10 | 641 | 1133 | 492 | 2.63 | - 1.9 |
| Average | | 641 | 1137 | 496 | 2.65 | 1.1[a] |
| | | | **Stilbestrol** | | | |
| 0 | 10 | 640 | 1214 | 574 | 3.08 | |
| 2 | 10 | 637 | 1206 | 569 | 3.04 | - 1.3 |
| 3 | 10 | 641 | 1208 | 567 | 3.05 | - 1.0 |
| 4 | 9 | 641 | 1175 | 534 | 2.86 | - 7.1 |
| 5 | 10 | 642 | 1183 | 541 | 2.89 | - 6.2 |
| Average | | 640 | 1197 | 557 | 2.98 | 13.7[a] |
| | | | **3% Fat + Stilbestrol** | | | |
| 0 | 10 | 641 | 1231 | 590 | 3.15 | |
| 2 | 10 | 641 | 1241 | 600 | 3.21 | 1.9 |
| 3 | 10 | 642 | 1180 | 538 | 2.88 | - 8.6 |
| 4 | 9 | 644 | 1194 | 550 | 2.94 | - 6.7 |
| 5 | 10 | 640 | 1194 | 554 | 2.97 | - 5.7 |
| Average | | 642 | 1208 | 566 | 3.03 | 15.6[a] |
| | | | **Dynafac levels** | | | |
| 0 | 40 | 641 | 1174 | 533 | 2.86 | |
| 2 | 40 | 641 | 1179 | 538 | 2.88 | .7 |
| 3 | 39 | 641 | 1172 | 531 | 2.84 | - .7 |
| 4 | 38 | 641 | 1154 | 513 | 2.75 | - 3.8 |
| 5 | 40 | 641 | 1162 | 521 | 2.78 | - 2.8 |
| Average | | 641 | 1168 | 527 | 2.82 | - 1.4 |

[a] Improvement over the average for the basal ration.

Stilbestrol implants resulted in a significant increase ($P<.01$) in daily gains. It was equally effective in promoting gains with the rations with or without the added fat. When no fat was added to the ration, daily gains were increased 0.36 lb. (2.62 lb. vs 2.98 lb.) or 13.7% by the implants. An increase of 0.38 lb. daily (2.65 lb. vs 3.03 lb.) resulted when stilbestrol was used with the rations containing added fat. The increase in rate of gain obtained from stilbestrol agrees closely with the average response reported by several other workers (Radabaugh and Embry, 1959).

Feed Requirements

Daily feed consumption and feed efficiency data are presented in Table 4. The grain-hay mixture is shown as one total. The mix contained 78% rolled shelled corn and 22% alfalfa hay except when 3% of the corn was replaced with inedible animal fat.

Daily feed consumption for the steers on the different levels of dynafac showed those fed the 3 gm. level ate the greatest amount. The cattle fed the 4 and 5 gm. levels consumed less feed than those fed no dynafac or 2 gm. daily. Even though there were some differences in daily feed intake, the feed requirements per unit of gain were similar for all levels of dynafac used.

When 3% inedible animal fat was included in the ration, there was little difference in daily feed consumption between steers fed the basal ration and those fed the basal ration plus fat (22.2 lb. vs 22.1 lb.). However, feed intake was reduced when fat was fed to the cattle implanted

Table 4. Response of Fattening Steers to Dynafac, Fat and Stilbestrol (Nov. 20, 1958 to May 26, 1959)
Feed Requirements

| Dynafac level | No. of steers | Av. da. ration Grain-hay mix | Av. da. ration Prot. suppl. | Feed per cwt. gain Grain-hay mix | Feed per cwt. gain Prot. suppl. | Feed per cwt. gain Total | Change from control | Feed cost/ cwt. |
|---|---|---|---|---|---|---|---|---|
| gm./day | | lb. | lb. | lb. | lb. | lb. | % | $ |
| | | | | Basal | | | | |
| 0 | 10 | 19.9 | 2.0 | 790 | 79 | 869 | | 17.26 |
| 2 | 10 | 20.0 | 2.0 | 790 | 78 | 868 | .1 | 17.23 |
| 3 | 9 | 20.6 | 2.0 | 728 | 70 | 798 | 8.2 | 15.82 |
| 4 | 10 | 19.9 | 2.0 | 772 | 77 | 849 | 2.3 | 16.86 |
| 5 | 10 | 20.7 | 2.0 | 782 | 75 | 857 | 1.4 | 16.98 |
| Average | | 20.2 | 2.0 | 772 | 76 | 848 | | 16.83 |
| | | | | 3% Fat | | | | |
| 0 | 10 | 19.7 | 2.0 | 737 | 74 | 811 | | 17.30 |
| 2 | 10 | 19.9 | 2.0 | 728 | 72 | 800 | 1.3 | 17.06 |
| 3 | 10 | 21.8 | 2.0 | 756 | 76 | 832 | - 2.5 | 17.74 |
| 4 | 10 | 19.6 | 2.0 | 755 | 76 | 832 | - 2.5 | 17.74 |
| 5 | 10 | 19.4 | 2.0 | 737 | 76 | 813 | - 0.2 | 17.34 |
| Average | | 20.1 | 2.0 | 743 | 75 | 818 | 3.6[a] | 17.44 |
| | | | | Stilbestrol | | | | |
| 0 | 10 | 21.7 | 2.0 | 708 | 65 | 773 | | 15.26 |
| 2 | 10 | 21.3 | 2.0 | 699 | 65 | 764 | 1.1 | 15.11 |
| 3 | 10 | 22.2 | 2.0 | 733 | 65 | 798 | - 3.4 | 15.75 |
| 4 | 9 | 20.6 | 2.0 | 721 | 69 | 790 | - 2.3 | 15.65 |
| 5 | 10 | 20.8 | 2.0 | 719 | 68 | 787 | - 1.9 | 15.58 |
| Average | | 21.3 | 2.0 | 716 | 67 | 783 | 7.7[a] | 15.47 |
| | | | | 3% Fat + Stilbestrol | | | | |
| 0 | 10 | 20.9 | 2.0 | 662 | 63 | 725 | | 15.40 |
| 2 | 10 | 21.6 | 2.0 | 675 | 62 | 737 | - 1.6 | 15.62 |
| 3 | 10 | 20.1 | 2.0 | 697 | 69 | 766 | - 5.8 | 16.33 |
| 4 | 9 | 19.8 | 2.0 | 673 | 68 | 741 | - 2.2 | 15.79 |
| 5 | 10 | 20.3 | 2.0 | 685 | 67 | 752 | - 3.8 | 16.01 |
| Average | | 20.5 | 2.0 | 678 | 66 | 744 | 12.3[a] | 15.83 |
| | | | | Dynafac Levels | | | | |
| 0 | 40 | 20.6 | 2.0 | 724 | 70 | 794 | | 16.30 |
| 2 | 40 | 20.7 | 2.0 | 723 | 69 | 792 | .3 | 16.26 |
| 3 | 39 | 21.2 | 2.0 | 729 | 70 | 799 | - .5 | 16.41 |
| 4 | 38 | 20.0 | 2.0 | 730 | 73 | 803 | - 1.1 | 16.51 |
| 5 | 40 | 20.3 | 2.0 | 731 | 71 | 802 | - 1.0 | 16.48 |
| Average | | 20.6 | 2.0 | 727 | 71 | 798 | - .5[a] | 16.39 |

[a] Improvement over the average for the basal ration.

with stilbestrol (23.3 lb. vs 22.5 lb.). There was no problem in getting the cattle to eat the ration containing the fat and they ate it readily from the start. Visually, it appeared to be the better of the two rations because of the reduced dustiness.

Average daily feed intake of the grain-hay-fat mix at a level of 20.3 lb. resulted in 0.61 lb. of added fat being ingested. This amount was well below the 1 lb. proclaimed as being the maximum optimum level for cattle by Matsushima et al. (1954). While there was some loosening of the feces noted at this level, there were no digestive disturbances encountered during the trial.

Feed requirements per unit of gain were reduced significantly ($P<.01$) by the added fat. The average reduction in feed required per 100 lb. of gain amounted to 34.5 lb. or 4.2%

Stilbestrol resulted in a 3.2% increase in daily feed consumption and significantly ($P<.01$) less feed was required per unit of gain for the implanted steers. The untreated animals required 833 lb. of feed per 100 lb. of gain compared to 763 lb. for the treated animals. The least amount of feed per 100 lb. of gain was required when the cattle were implanted with stilbestrol and fed the rations with 3% added fat. Average feed requirements for this treatment were 744 lb. per 100 lb. of gain in comparison to 818 lb. with the fat but no stilbestrol and 783 for stilbestrol without the added fat. The improvement in feed efficiency for the combination of fat and stilbestrol was slightly greater than the sum of the improvement obtained from each used singly. Several of the experiments reported in the Review of Literature also showed that added fat in the ration had a greater effect on feed efficiency than on rate of gain.

Carcass Characteristics

The data on carcass characteristics are presented in Table 5. While small differences are shown for the steers fed the different levels of dynafac, the average effects on the various carcass characteristics studied show essentially no difference for any of the levels used. A small but consistent improvement in carcass grade and marbling score was shown by the steers fed 3 gm. daily. However, no other beneficial effects were shown when this level of dynafac was fed.

When 3% fat was added to the basal ration there was a tendency for the steers to dress higher (61.9% vs 61.6%), have less marbling (6.1 vs 6.4) with a greater outside fat covering (2.6 cm. vs 2.4 cm.) and to grade lower (19.6 vs 19.9) than those not fed added fat. However, the differences were quite small and there was essentially no difference in the price received for carcasses between the two treatments.

Carcass grade and dressing percent were not affected by use of stilbestrol in this trial. The carcasses of the animals were marbled slightly less and had a greater fat covering over the rib-eye muscle. The rib-eye muscle of the implanted animals had 0.5 square inch or 4.5% greater area of lean than the animals not implanted. The ratio between the carcass weight and the area of the rib eye was essentially the same for both treatments. This would indicate that the greater size of the rib-eye muscle was a reflection of the greater weight of the steers

Table 5. Response of Fattening Steers to Dynafac, Fat and Stilbestrol (Nov. 20, 1958 to May 26, 1959 - 187 days) Carcass Characteristics

| Dynafac level | No. of steers | Cold carc. wt. | Dress-ing % | Carcass grade[a] | Mar-bling score[b] | Rib eye Area of lean | Rib eye Depth of fat | Selling price/ cwt. |
|---|---|---|---|---|---|---|---|---|
| gm./day | | lb. | | | | sq. in. | cm. | $ |
| | | | | Basal | | | | |
| 0 | 10 | 683 | 61.5 | 19.5 | 6.4 | 11.2 | 2.35 | 43.55 |
| 2 | 10 | 691 | 61.9 | 19.9 | 6.3 | 11.1 | 2.56 | 43.51 |
| 3 | 9 | 713 | 61.1 | 20.2 | 7.0 | 11.1 | 2.41 | 43.42 |
| 4 | 10 | 693 | 61.8 | 19.8 | 6.1 | 10.9 | 2.27 | 43.55 |
| 5 | 10 | 700 | 61.7 | 20.3 | 6.9 | 11.0 | 2.40 | 43.37 |
| Average | | 696 | 61.6 | 19.9 | 6.5 | 11.1 | 2.40 | 43.48 |
| | | | | 3% Fat | | | | |
| 0 | 10 | 707 | 61.9 | 19.9 | 6.3 | 11.5 | 2.50 | 43.38 |
| 2 | 10 | 708 | 61.4 | 19.8 | 6.2 | 10.8 | 2.33 | 43.26 |
| 3 | 10 | 698 | 61.8 | 20.2 | 6.3 | 11.2 | 2.58 | 43.54 |
| 4 | 10 | 695 | 61.8 | 19.7 | 5.9 | 11.2 | 2.72 | 43.56 |
| 5 | 10 | 705 | 62.3 | 19.8 | 6.3 | 11.4 | 2.57 | 43.37 |
| Average | | 703 | 61.8 | 19.7 | 6.2 | 11.2 | 2.54 | 43.42 |
| | | | | Stilbestrol | | | | |
| 0 | 10 | 752 | 62.0 | 19.8 | 6.0 | 11.6 | 2.72 | 43.06 |
| 2 | 9 | 743 | 61.6 | 19.8 | 6.1 | 12.0 | 2.30 | 43.05 |
| 3 | 10 | 746 | 61.8 | 20.5 | 6.9 | 11.7 | 2.52 | 43.15 |
| 4 | 9 | 722 | 61.4 | 19.8 | 6.2 | 11.7 | 2.30 | 43.13 |
| 5 | 10 | 728 | 61.6 | 19.5 | 6.0 | 11.3 | 2.64 | 43.16 |
| Average | | 738 | 61.7 | 19.9 | 6.2 | 11.7 | 2.50 | 43.11 |
| | | | | 3% Fat + Stilbestrol | | | | |
| 0 | 10 | 766 | 62.3 | 19.7 | 6.2 | 11.9 | 2.63 | 43.03 |
| 2 | 10 | 772 | 62.2 | 19.6 | 6.0 | 11.8 | 2.91 | 42.88 |
| 3 | 10 | 724 | 61.4 | 19.9 | 6.3 | 11.5 | 2.63 | 43.31 |
| 4 | 9 | 743 | 62.2 | 19.0 | 5.8 | 11.7 | 2.48 | 42.94 |
| 5 | 10 | 738 | 61.8 | 19.4 | 5.9 | 11.2 | 2.47 | 43.14 |
| Average | | 749 | 62.0 | 19.5 | 6.0 | 11.6 | 2.62 | 43.06 |
| | | | | Dynafac Levels | | | | |
| 0 | 40 | 727 | 61.9 | 19.7 | 6.2 | 11.6 | 2.55 | 43.26 |
| 2 | 39 | 729 | 61.8 | 19.8 | 6.2 | 11.4 | 2.52 | 43.18 |
| 3 | 39 | 721 | 61.5 | 20.2 | 6.6 | 11.4 | 2.54 | 43.36 |
| 4 | 38 | 713 | 61.8 | 19.6 | 6.0 | 11.4 | 2.44 | 43.30 |
| 5 | 40 | 718 | 61.8 | 19.6 | 6.3 | 11.2 | 2.52 | 43.26 |
| Average | | 722 | 61.8 | 19.8 | 6.2 | 11.4 | 2.51 | 43.27 |

[a] Carcass grade based on numerical values: Choice - = 19, Choice = 20.
[b] Marbling score based on numerical values: Small = 5, Modest = 6 and Moderate = 7.

implanted with stilbestrol. The carcasses of the stilbestrol-treated animals were 44 lb. heavier than those of the untreated animals. Thirteen carcasses from the implanted steers weighed over 800 lb. while only one carcass from the control cattle weighed over this amount. The heavier carcasses of the implanted animals sold for less per cwt. ($43.09 vs $43.45) than the control steers. The differences in carcass weight could have been avoided by selling the stilbestrol treated cattle at lighter weights. This might have resulted in a reduction in grade and still a lower selling price per 100 lb. of carcass than for those not treated with stilbestrol.

## Cost and Returns

The cost and returns are shown in Table 6. The cattle were charged at an average initial value of $27.75 per cwt. on the basis of initial weight on trial. The selling price was based on the average carcass prices received for the different weights and grades when the cattle were sold (Table 2). Feed prices used are presented in Table 1.

The averages for each level of dynafac show that the steers had a slightly greater return when no dynafac was added to the ration. With few exceptions, the cattle fed no dynafac gained as well and as efficiently and showed a return as great as those fed any level of the compound with the different rations.

The average results for the trial showed that the substitution of 3% fat for an equal amount of corn was not an economical addition to the ration. Even though the carcasses from steers fed the added fat weighed

Table 6. Response of Fattening Steers to Dynafac, Fat and Stilbestrol (Nov. 20, 1958 to May 26, 1959 - 187 days) Cost and Returns

| Dynafac level | No. of steers | Initial cost per head | Feed cost per head | Selling price per head | Return over initial and feed cost | Return over control |
|---|---|---|---|---|---|---|
| gm./day | | $ | $ | $ | $ | $ |
| | | | Basal | | | |
| 0 | 10 | 177.32 | 81.26 | 297.42 | 38.84 | |
| 2 | 10 | 178.43 | 81.53 | 300.54 | 40.58 | 1.74 |
| 3 | 9 | 177.60 | 83.51 | 309.70 | 48.59 | 9.75 |
| 4 | 10 | 177.60 | 81.11 | 301.82 | 43.11 | 4.27 |
| 5 | 10 | 177.88 | 83.97 | 303.73 | 41.88 | 3.04 |
| Average | | 177.88 | 82.38 | 302.64 | 42.38 | |
| | | | 3% Fat | | | |
| 0 | 10 | 178.43 | 86.50 | 306.59 | 41.66 | |
| 2 | 10 | 177.88 | 87.45 | 306.51 | 41.18 | - 0.48 |
| 3 | 10 | 177.88 | 86.84 | 304.13 | 39.41 | - 2.25 |
| 4 | 10 | 177.60 | 86.16 | 302.82 | 39.06 | - 2.60 |
| 5 | 10 | 177.88 | 85.31 | 306.17 | 42.98 | 1.32 |
| Average | | 177.88 | 86.50 | 305.24 | 40.86 | - 1.52 |
| | | | Stilbestrol | | | |
| 0 | 10 | 177.60 | 87.53 | 324.02 | 58.89 | |
| 2 | 9 | 176.77 | 85.96 | 319.74 | 57.01 | - 1.88 |
| 3 | 10 | 177.88 | 89.37 | 322.08 | 54.83 | - 4.06 |
| 4 | 9 | 177.88 | 83.59 | 311.39 | 49.92 | - 8.97 |
| 5 | 10 | 178.16 | 84.26 | 314.30 | 51.88 | - 7.01 |
| Average | | 177.60 | 86.17 | 318.31 | 54.59 | 12.21 |
| | | | 3% Fat + Stilbestrol | | | |
| 0 | 10 | 177.88 | 90.83 | 329.85 | 61.14 | |
| 2 | 10 | 177.88 | 93.66 | 331.10 | 59.56 | - 1.58 |
| 3 | 10 | 178.16 | 84.95 | 313.80 | 50.69 | -10.45 |
| 4 | 9 | 178.71 | 86.75 | 318.84 | 53.38 | - 7.76 |
| 5 | 10 | 177.60 | 88.74 | 318.19 | 51.85 | - 9.29 |
| Average | | 177.88 | 89.63 | 322.36 | 54.85 | 12.47 |
| | | | Dynafac Levels | | | |
| 0 | 40 | 177.79 | 86.53 | 314.47 | 50.15 | |
| 2 | 39 | 177.77 | 87.15 | 314.47 | 49.55 | - .60 |
| 3 | 39 | 177.88 | 86.90 | 312.43 | 47.65 | - 2.50 |
| 4 | 38 | 177.96 | 84.40 | 308.72 | 46.36 | - 3.79 |
| 5 | 40 | 177.90 | 85.57 | 310.60 | 47.13 | - 3.02 |
| Average | | 177.86 | 86.11 | 312.14 | 48.17 | |

slightly more and sold for more per head ($313.80 vs $310.48), the feed cost per head was increased enough ($88.07 vs $84.28) to offset the greater selling price resulting in less return with the added fat. On basis of returns above initial cost of the cattle and feed cost, the fat appeared to have a greater value when fed to the cattle implanted with stilbestrol. The average return on this basis was $40.86 for the cattle fed the rations with the added fat but no stilbestrol and $42.38 when the fat was not included in the rations. When stilbestrol implants were used, the returns for the rations with and without the added fat were $54.59 and $54.85 per head respectively. Thus, on basis of returns above initial cost of the cattle and the feed cost, the fat was worth the 7 cents per pound charged for it in relation to the prices used for the other feeds (Table 1) when used with the stilbestrol implants but not without the stilbestrol. This price was 3.5 times the price charged for the corn grain.

On basis of feed efficiency for the cattle without stilbestrol implants, 100 lb. of the fat saved 205 lb. of corn grain and 32 lb. of alfalfa hay in producing 100 lb. of gain. If it is assumed that the hay had one-half the energy value of the corn, then 100 lb. of the added fat had a feed replacement value equal to 221 lb. of corn, or 2.21 times the value of the corn grain.

When the fat was fed to the cattle implanted with stilbestrol, 100 lb. of the fat saved 245 lb. of corn grain and 40 lb. of alfalfa hay in producing 100 lb. of gain. Using the same assumption as above, 100 lb. of the added fat had a feed replacement value of 265 lb. of corn, or

2.65 times the value of the corn grain.

The value of the fat on basis of the returns from the cattle was higher than on basis of feed efficiency. These values indicate that the added fat might be an economical addition to cattle fattening rations at prices that often exist between inedible animal fat and grain, especially when used in conjunction with stilbestrol and considering other beneficial effects that the fat would have in processing and handling the feed.

In the trial the stilbestrol was the most effective additive used. As shown previously, weight gains and feed efficiency were improved significantly and the carcasses of the stilbestrol treated cattle graded as well as those not treated. The implanted animals returned an average of $13.10 more per head ($54.72 vs $41.62) over initial and feed costs than did those fed similar rations and not implanted.

### Response of Steers to Stilbestrol Re-implantation

After 137 days on trial, one-half of the steers that had been implanted initially were re-implanted with 24 mg. of stilbestrol. The results of the re-implantation study are shown in Table 7.

A regular 28-day filled weight was taken on all steers 4 days before the re-implantation was made and these weights were used as the beginning weights for the study. Filled weights taken the afternoon before shipment of the animals to market was begun were used as the final weights for the study. The period between the two weights was 52 days.

Table 7. Response of Steers to Stilbestrol Re-implantation After 137 Days on Trial

| | No. steers[a] | Total steers days | Total gain | Av. gain per steer | Dressing percent | Carcass grade | Marbling score | Av. depth fat over loin eye |
|---|---|---|---|---|---|---|---|---|
| | | | lb. | lb. | % | | | cm. |
| Control | 99 | 5148 | 11372 | 115 | 61.7 | 19.9 | 6.36 | 2.47 |
| Implanted | 49 | 2548 | 6534 | 133 | 61.5 | 19.8 | 6.25 | 2.55 |
| Re-implanted | 49 | 2548 | 6932 | 141 | 62.1 | 19.6 | 6.04 | 2.56 |

[a] Carcass information from a total of 196 steers.

Results show that the initial implant was still effective in stimulating gains made by the animals. When compared to the non-implanted steers, 18 lb. greater gain per steer was made by the animals that had received only the initial implant. The difference of 0.35 lb. per steer daily for the 52-day period was about the same as the average response to the stilbestrol implants for the entire trial. Even though this comparison would not indicate any reduction in the effectiveness of the implants during the latter part of the trial, further stimulation was shown when the steers were re-implanted. An 8 lb. greater gain per head was made by the re-implanted steers than by those not re-implanted during this 52-day period.

Differences in feed efficiency could not be measured as the initially implanted and the re-implanted steers were fed together in their original pens. While the differences were small, it appeared that the tendency of the stilbestrol to decrease carcass grade and marbling score and increase outside fat covering may have been greater when the steers were re-implanted.

## Other Observations

No cases of bloat were observed during the trial. Three steers developed a stiffness of the legs as though they were slightly foundered. Of the affected animals, 2 were fed the ration containing 5 gm. of dynafac daily and the other was fed 2 gm. daily. The value of dynafac or added fat in reducing the incidence and severity of these conditions could not be evaluated with the absence or low incidence encountered.

The incidence of abscessed livers appeared to be increased by the inclusion of the added fat in the ration (Table 8). A total of 35 livers were condemned because of an abscessed condition. Of those condemned, 23 were from steers fed the 3% fat ration while only 12 were condemned from animals fed the ration containing no added fat.

When dynafac was fed at the 4 gm. and 5 gm. levels daily there were fewer liver condemnations. A total of 6 livers from 78 cattle were condemned when these two levels were fed compared to a total of 22 from 78 when the 2 gm. and 3 gm. levels were fed and 7 from 40 head when no dynafac was included in the ration. If dynafac was beneficial in reducing the incidence of this condition, it was at the higher levels.

Table 8. Incidence of Liver Abscesses in 196 Experimental Cattle on 187 Day Fattening Trial
Measurement: Number Livers Abscessed/Number of Cattle

| | Level of dynafac (grams) | | | | | |
|---|---|---|---|---|---|---|
| | 0 | 2 | 3 | 4 | 5 | Total |
| | | | No Stilbestrol | | | |
| No fat | 2/10[a] | 1/10 | 0/9 | 0/10 | 2/10 | 5/49 |
| Fat | 2/10 | 4/10 | 4/10 | 0/10 | 1/10 | 11/50 |
| Total | 4/20 | 5/20 | 4/19 | 0/20 | 3/20 | 16/99 |
| Percent | 20.0 | 25.0 | 21.0 | | 15.0 | 16.2 |
| | | | Stilbestrol | | | |
| No fat | 2/10 | 1/9 | 3/10 | 1/9 | 0/10 | 7/48 |
| Fat | 1/10 | 5/10 | 4/10 | 2/9 | 0/10 | 12/49 |
| Total | 3/20 | 6/19 | 7/20 | 3/18 | 0/20 | 19/97 |
| Percent | 15.0 | 31.6 | 28.6 | 16.7 | | 19.6 |
| | | Fat | | | No Fat | |
| Total | | 23/99 | | | 12/97 | |
| Percent | | 23.2 | | | 12.4 | |

Total livers condemned for abscesses - 35

Total number of cattle killed - 196

Percentage condemnation, % - 18.4

[a] The first figure represents the number of liver abscesses and the second number represents the number of animals.

## SUMMARY

Two hundred yearling steers were fed for 187 days in 20 lots in a 2 x 2 x 5 factorial experiment. The value of feeding dynafac at 5 different levels, replacing 3% corn with inedible animal fat and implanting the steers with 36 mg. of stilbestrol was tested in the fattening trial. In addition, one-half of the steers implanted initially were re-implanted after 137 days on trial with 24 mg. of stilbestrol and the benefits evaluated.

Dynafac was supplied to all lots of cattle at either 0, 2, 3, 4 or 5 gm. per head daily in 2 lb. of protein supplement. Each level was fed as the only additive to the ration and each level was fed in conjunction with 3% added fat, stilbestrol implants and the combination of the fat and stilbestrol.

The basal ration contained 78% rolled shelled corn and 22% ground alfalfa hay. When the fat was included, it replaced an equal weight of the corn grain.

In the experiment, the gains and feed efficiency of the steers did not appear to be improved by any level of dynafac fed. Only small differences in carcass characteristics were shown for the different levels of dynafac and the differences were not consistent for any of the levels used.

The addition of 3% fat to the ration increased daily gains slightly and significantly reduced ($P < .01$) the amount of feed required per unit of gain. The amount of feed saved by the fat was not adequate

to compensate for the higher cost of the ration except when fed to the steers that had been implanted with stilbestrol. When the fat was fed to the implanted cattle, 100 lb. of the fat saved 245 lb. of corn grain and 40 lb. of alfalfa hay in producing 100 lb. of gain. Assuming the hay had one-half the energy value of corn grain, 100 lb. of the added fat had a feed replacement value of 265 lb. of corn, or 2.65 times the value of corn grain.

The carcass characteristics were not altered appreciably by feeding the higher energy ration. When 3% fat was added to the basal ration there was a tendency for the steers to dress higher, have less marbling with a greater outside fat covering and to grade lower than those not fed fat. However, the differences were quite small and there was essentially no difference in price received for the carcasses between the two treatments. The carcasses were slightly heavier and sold for more per head when feeding the rations with added fat. On the basis of returns above initial cost of cattle and feed cost, the fat was worth the 7 cents per pound charged for it (3.5 times the price of corn) when used with the stilbestrol implants but not without the stilbestrol. The results of the experiment indicate that the added fat might be an economical addition to cattle fattening rations, especially when used in conjunction with stilbestrol and when the other beneficial effects that the fat would have in processing and handling the feed are considered.

The 36-mg. implants of stilbestrol resulted in significantly greater gains ($P < .01$) with a significant ($P < .01$) improvement in feed efficiency. Carcasses of the implanted cattle had a thicker outside fat covering and less marbling but these differences were small and they graded about the same as those cattle not implanted. These carcasses were 44 lb. heavier and brought less per cwt. because of the heavier weights, but returned $13.10 more per head than did the animals fed similar rations and not implanted.

Re-implanting the steers with 24 mg. of stilbestrol after 137 days on trial resulted in an 8 lb. increase in gain per head, for the 52 day period, over those implanted only at the beginning of the trial. Those implanted only the one time continued to show about the same rate of increase over those not implanted during this 52-day period as was shown during the entire trial.

It appeared that the added fat increased the incidence of liver abscesses for nearly twice as many livers were condemned because of the condition when the 3% fat was included in the ration. Twenty-three livers were condemned from this group compared to only 12 when the animals were fed no added fat. When dynafac was fed at the two higher levels it appeared to reduce the incidence. Of the 35 livers condemned with abscesses, only 6 of the animals had been fed the higher dynafac levels compared to 29 that had been fed the 0, 2 and 3 gm. levels.

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