TRANQUILIZERS OR TRANQUILIZING TYPE COMPOUNDS IN BEEF CATTLE WINTERING AND FATTENING RATIONS

by

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B. S., Texas Technological College, 1955

A THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Animal Husbandry

KANSAS STATE UNIVERSITY
OF AGRICULTURE AND APPLIED SCIENCE

1959

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INTRODUCTION

Animal husbandmen who are engaged in the production or feeding of livestock are faced with an increased need for efficient production in order to produce more meat, milk, or wool at a lower cost. In an effort to satisfy this need, many chemical and pharmaceutical companies have developed various growth stimulants which may be fed to an animal or implanted under the skin to cause increased efficiency of production of milk, meat, or wool. Tranquilizers are one of the newest additions to the family of growth promotants.

In human medicine, tranquilizers are used to relieve various states of hypertension, anxiety, and to treat certain psychological and psychiatric disorders. Reserpine, for example, has been used with success in treating chronically disturbed psychotic patients, as stated by Campden-Main and Wegielski (7), as well as giving relief to the common headache as reported by Friedman (12).

In veterinary medicine, tranquilizers are being used to treat animals which are exceptionally nervous or vicious. Certain minor manipulations such as grooming or clipping, are more easily performed with the aid of certain tranquilizers.

Researchers conducting the first feedlot experiments with tranquilizers assumed that tranquilizers would reduce physical activity and thus diminish extraneous energy expenditure which would provide more energy for growth and fattening. Although subsequent experiments have shown that low levels of tranquilizers, when fed, have no effect on the amount of physical activity

or temperament. They do, apparently, cause an increase in rate of gain.

This report summarizes a series of studies designed to determine the effect of two tranquilizers on the rate of gain, feed efficiency, and carcass characteristics when fed to steers receiving wintering and fattening rations.

REVIEW OF LITERATURE

Schneider and Earl (24) stated that the use of tranquilizing agents dates to ancient times; however, only during recent years has a systematic and objective scientific investigation of these drugs been made. According to Karmin (15), reserpine, a pure active alkaloid isolated from the root of Rauwolfia serpentina Benth, was first identified in 1952. Earl (11) reported that Rauwolfia serpentina is one specie of a shrub which grows extensively in the humid areas of India.

Chlorpromazine hydrochloride, according to Dundee (10), is a tranquilizing type drug first synthesized in France by M. P. Charpentier in December, 1950. Many more compounds with tranquilizing properties have been synthesized in the past five years. Campden-Main and Wegielski (7), Schneider, et al. (25), Hale and Huber (13), Schaffer (22), and Borgman (4) stated that the bulk of the tranquilizers have been developed for and used in human and veterinary medicine to combat nervousness, hypertension, neuropsychiatric, neurological, and related clinical problems. The use of tranquilizers in human and veterinary medicine is

routine, with millions of dollars being spent annually on these calming compounds as stated by Krantz and Carr (18).

Beeson (1) indicated that the role of tranquilizers and related compounds in the livestock industry is still somewhat undetermined, although many tranquilizing agents are presently being used in veterinary medicine. It was reported (20) that only one compound, hydroxyzine, thus far has been approved by the Food and Drug Administration for addition to the rations of farm livestock. Other tranquilizers are under investigation by college and commercial researchers (Beeson, 1 and Koch, et al., 16) to determine their effect on livestock when included in the ration or when injected or implanted.

There are several possible uses for tranquilizing agents in livestock management as reported by Beeson (1). Some of these uses are:

1. Reduction of shipping shrinkage and shipping fever in livestock.

2. Reduction in incidence of dark cutting beef due to excessive excitement.

3. Elimination of the shock of weaning calves, pigs, and lambs.

4. Calming wild animals for ease of handling.

5. Increase milk production in nervous cows and other lactating animals.

6. Reduction of livestock losses by stress factors.

7. Blocking "mother instinct" of animals.

8. Relieving tension and anxiety during certain operations such as dehorning, clipping, castrating, and branding.

9. Getting a ewe to adopt a lamb.

10. To pacify animals at parturition, especially sows.

This list deals only with the possible uses of tranquilizers in relieving certain stress conditions. To this list can be added the possible use of tranquilizers to increase rate of gain, feed efficiency, and carcass grade according to Koch, et al. (17), Smith, et al. (27), Burroughs, et al. (5), and Matsushima, et al. (19).

This review is concerned primarily with the use of tranquilizers in the rations of wintering and fattening beef cattle; however, a classification and discussion of the pharmacology and the possible mode of action of representatives of each group of the classification follows. Tranquilizers can be classified in two ways, either by their pharmacologic action or by their chemical structure. Beeson (2) classified them according to their chemical structure as listed in Table 1.

Since a discussion of each tranquilizer listed in Table 1 would involve much repetition, only one representative tranquilizer from each classification is discussed.

Paxital

The following information about paxital was secured through a personal communication with Warner Chilcott Research Laboratories (30). Paxital, although not one of the first compounds

Table 1. Classification of tranquilizers.

Generic name	Chemical name
Phenothiazine derivatives	
Chlorpromazine	3-Chloro-10-(3-diamethylaminopropyl)-phenothiazine
Mepazine	10-(1-Methyl-3-piperidyl)-methyl)-phenothiazine
Perphenazine	2-Chloro-10-(3-(10(2-hydroxy-ethyl)-4-piperazinyl)propyl)-phenothiazine
Proclorperazine	2-Chloro-10-(3-(1-methyl-4-piperazinyl propyl)-phenothiazine
Promazine	10-(3-Dimethylaminopropyl)-phenothiazine
Thiopropazate	2-Chloro-10-(3-(1-(2-acetoxyethyl)-4-piperazinyl)-propyl)-phenothiazine
Paxital	N-Methyl-piperidyl-(3)-methyl phenothiazine
Trifluomeprazine	10-(3-Dimethylamino-2-methyl-propyl)-2-trifluoromethyl-phenothiazine hydrochloride
Rauwolfia alkaloids	
Reserpine	(Trimethoxybenzoyl methyl reserpate)
Deserpidine	11-Desmethoxyreserpine
Rescinnamine	Trimethoxycinnamoyl methyl reserpate
Diphenylmethane derivatives	
Azacyclonol	a,a-Diphenyl-4-piperidinemethanol
Benactyzine	2-Diethylaminoethyl diphenylglycolate
Hydroxyzine	1-(p-Chlorobenzhydryl-4-(-2-hydroxy-ethoxy)-ethyl)-diethylenediamine dihydrochloride
Phenyltoloxamine	N,N-Dimethyl-2(a-phenyl-o-toloxy)-ethylamine

Table 1 (concl.).

Generic name	:	Chemical name
Substituted propanediols		
Meprobamate		2-Methyl-2-propyl-1-3-propanediol dicarbamate
Phenaglycodol		2-(p-Chlorophenyl)-3-methyl-3,3-butanediol
Miscellaneous		
Etchlorvynol		b-Chlorvinyl ethyl carbinol

with tranquilizing effects to be developed, is typical of those compounds derived from a phenothiazine nucleus. Paxital has relatively low acute animal toxicity. The doses required to kill 50 per cent of injected animals (LD_{50}) are given below:

Mouse - i.v. - 70 mg./kg. when duration of injection is two minutes.

Rat - oral - 1200 mg./kg.

Rabbit - i.v. - 20 mg./kg.

The effects of lethal doses include CNS depression, reduced muscular tonicity, paralysis, and terminal convulsion.

In dogs at 5 mgs. and 25 mg./kg. there were no effects from paxital in any tissues. At 100 mg./kg. lymphocytic infiltration of the liver occurred in one dog, and active degeneration of the spermatogenic cells of the testis in the other dog. Only the change in the testis appears to be significant.

In studies with rats it has been shown that a 25 mg./kg. dose of paxital, a centrally effective amount, is rapidly absorbed and deposited by the blood in various tissues, chiefly

the brain, liver, spleen, kidney, and lung. It starts to appear in the urine three hours after the subcutaneous injection reaches its highest urinary concentration within 24 hours, and still may be detected after four days. The main effects of paxital appear to be, to produce sedation without hypnosis, and to potentiate narcotics, hypnotics, and analgesics. When given to intact animals, paxital produces mild sedation without hypnosis if small doses are used, whereas, in large doses it produces somnolence, but it does not produce true sleep. Paxital shows a relatively weak analgesic action when used alone, even though it is a potentiator of narcotics and also of certain non-narcotic analgesics. A marked fall of blood pressure of moderate duration can be detected from the use of paxital. It also reduces artificially induced fever. In hypothermia experiments, paxital apparently blocked those reflexes; increased metabolism, shivering, and contraction of vessels; which normally regulate body temperature.

Reserpine

Earl (11) reported that most Rauwolfia species contain reserpine along with related alkaloids whose precise nature varies from species to species. The best known species is Rauwolfia serpentina, preparations of which have been used in indigenous medical practice in India for the treatment of a variety of ills, apparently for centuries according to Drill (9). It is further recorded by Drill (9) that scientific studies

of Rauwolfia preparations were made by Indian pharmacologists in the 1930's, but only during the last decade has interest been aroused in these drugs in the Western World. Rauwolfia has been useful primarily as a tranquilizer in mental disease, stated Drill (9). Most Rauwolfia species contain reserpine, however, the only pure alkaloids other than reserpine which are being used in this country are rescinnamine and diserpidine, further stated Drill (9).

The structural formula representing reserpine is found in Fig. 1.

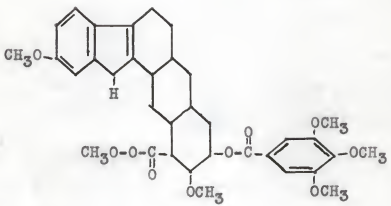


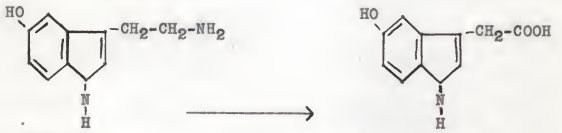
Fig. 1. Chemical structure of reserpine.

No proven theory has so far been given to explain the action of reserpine, according to researchers (21). Drill (9) stated that the most prominent theory of the mechanism of action suggests that reserpine exerts its action indirectly by causing some change which outlasts the physical presence of reserpine. In 1955 it was found, stated Drill (9), that reserpine administration leads to the reduction of 5-Hydroxytryptamine (Serotonin,

5-HT) in the brain, moreover, it was shown that the time course of the reduced 5-HT concentration paralleled in a general way the time course of the behavioral effects of reserpine. Drill (9) also reported that the ability of reserpine to reduce the concentration of 5-HT in brain tissue was confirmed and may be taken as established beyond doubt. Wikler (31), p. 120, confirmed this theory and stated:

> It appears to be within the realm of possibility that the functional effects of certain drugs may depend on two factors, namely their relative affinity for a given 5-HT receptor site, and their drug specific activities at that site after occupancy has been achieved. In other words, the ability of a particular agent to affect behavior at all may depend on its ability to compete with 5-HT (and other competitors) for various 5-HT receptor sites in neural tissue, but whether or not it acts as a tranquilizer, a psychotomimetic agent or neither of these may depend on other of its properties, and perhaps also, its concentration.

After the 5-HT is released, it is then metabolized as follows in Fig. 2, as given by Drill (9):



5-Hydroxytryptamine 5-Hydroxyindoleacetic acid

Fig. 2. Metabolism of 5-Hydroxytryptamine.

Drill (9) stated that the oxidative deamination is accomplished by the monoamine oxidase system. The 5-Hydroxyindoleacetic acid is pharmacologically inert and is excreted in the

urine. Drill (9) further stated, however, that the importance of the fact, the release of 5-HT, is not clear because, ". . . it is not yet established that it (5-HT) plays a physiologic role."

Reserpine is relatively non-toxic, having a minimum of side effects, Drill (9) reported. The sedation produced by reserpine is different from that caused by barbiturates. If multiple sedative doses are given, the animal can still be aroused, whereas, several doses of barbiturates make arousal difficult. Reserpine has no characteristic effect on normal E. E. G. in contrast to the consistent changes produced by sedative doses of barbiturates. Reserpine has no analgesic activity and may show some antagonism to the analgesic action of morphine.

Hydroxyzine

According to Hale and Huber (13) hydroxyzine has been used experimentally to determine its effect on rate of gain, whereas, other tranquilizers have been used largely as calming or sedating agents. It has been approved by the Food and Drug Administration as a feed additive (20). Hale and Huber (13) observed that since hydroxyzine has been used to the greatest extent to stimulate rate of gain, and not to calm or tranquilize animals, very little experimental data are available regarding its possible mode of action. They further stated that reasons for the growth-promoting action of these tranquilizers are not yet apparent. The early assumption that the drugs reduced physical activity and thus diminished energy expenditure was not sustained

by repeated observations of the activity of the experimental animals in the Pfizer trials. Sherman, et al. (26) found that low levels of hydroxyzine used to induce growth response may be mediated through mild effects on certain nerve centers to exert a protective effect against environmental stress without producing observable behavior changes.

A summary of college research on tranquilizers prepared by E. C. Charron (8) showed that in feedlot trials, hydroxyzine had no effect on the temperament of treated animals, however, Cartwright (6) indicated that temperament was improved noticeably when hydroxyzine was fed to Brahman type heifers and bulls. Gains were improved slightly.

Results from feeding hydroxyzine are quite variable. One review of research (8) revealed that out of 12 experiments with steers and calves, eight showed a favorable response, while four showed no benefit from feeding hydroxyzine. In another review by Hale and Huber (13), the growth increase resulting from administration of hydroxyzine ranged between a minus four per cent and a plus 26 per cent. Growth increase, with and without other stimulants, over controls was 7.7 per cent, and feed efficiency increase of 6.1 per cent in a summary of 17 trials by Hale and Huber (13). They further stated that toxicity tests on hydroxyzine indicate that there are no toxic effects resulting from the administration of hydroxyzine when fed at levels up to nine gms. per day for seven days to 1,000-pound animals. Steers also were fed at the rate of 0.5 gm. per day for 112 days with no

histopathology appearing in the liver or kidneys.

Meprobamate

Scheidy and McNally (23) stated that meprobamate is probably the most popular of the propanediol derivatives, and appears to be of use primarily as a muscle relaxant. Charron's review (8) gave results of tests with fowls that have shown no beneficial effect with meprobamate, and in some cases the drug has proven toxic. Scheidy and McNally (23) pointed out that only the voluntary skeletal muscles are affected by meprobamate so that the heart, disphragm, and respiration are not affected. The drug exerts a blocking action on the interneurones, but also has a selective action on the thalamus. He further stated that meprobamate must be given orally because of its slight solubility, and can be used in animals over extended periods of time. No published reports were found discussing the use of meprobamate as a growth promotant in connection with large animals.

Cartwright (6) reported that tetrahydrozoline (Tyzine) and ethyl isobutrazine (Diquel) have been used experimentally in an effort to reduce intransit shrinkage in which results indicate a reduction in shrinkage of 1.5 per cent to 2.0 per cent with increased docility and manageability.

METHODS AND DATA

Experimental Procedure

In order to evaluate the effect of certain tranquilizers on the performance of beef steers on wintering and fattening rations, an experiment was designed to compare the effect of two tranquilizers on rate of gain, feed efficiency, and carcass characteristics. Furthermore, one phase of the experiment also compared steers receiving a tranquilizer plus diethylstilbestrol with the control steers receiving only diethylstilbestrol. Forty-eight Hereford steer calves of good to choice quality, purchased near Clovis, New Mexico, and weighing approximately 550 pounds were selected for this experiment. The tranquilizers used in this experiment were paxital which was furnished by S. B. Penick and Company, and Tran-Q which is the brand name of hydroxyzine and was furnished by Charles Pfizer and Company, Inc. Both of these tranquilizers have been discussed at length in the review of literature. The steers were divided into lots on the basis of live weight so that the average weight of each lot was approximately the same.

The experiment was divided into three phases according to management: wintering, grazing, and fattening. Part of the cattle did not participate in the grazing phase, but were moved into the fattening phase immediately after the wintering phase. The two tranquilizers, paxital and Tran-Q, were mixed with the soybean meal portion of the ration in such a manner as to provide

the needed amount of the tranquilizer when the soybean meal was fed at the rate of one pound per day during the wintering and fattening phases. Each pound of soybean meal contained either 75 mgs. of paxital, 1.5 mgs. or 2.5 mgs. of Tran-Q, or no tranquilizer. The control group was fed the same basic ration without the tranquilizer. The steers were not treated during the grazing phase. Each phase of the experiment will be considered separately in the following discussion.

Wintering Phase. The entire group of 48 steers were used in the wintering phase which started on December 5, 1957, and lasted until March 25, 1958, a period of 110 days. The steers were divided into three treatment groups as follows:

Treatment	Control	Paxital	Tran-Q
Number	20	10	18

The daily ration per animal was as follows: sorghum grain, 4 pounds; soybean meal, 1 pound; sorghum silage, 15 pounds; and prairie hay, free choice. All animals had access to a mixture of salt and bonemeal. They also had access to salt alone. Water was provided by small automatic heated waterers. The cattle were in open lots without access to shelter. The steers were weighed at 28-day intervals during the test. Rate of gain and temperament were observed on the animals periodically, and at the conclusion of the test period. Weights were taken both at the beginning and at the conclusion of the test on two consecutive days. Records of weight gains were kept on each of the

individuals. Feed consumption was recorded on a lot basis.

Fattening Phase I. Three groups of ten steers which had been designated at the beginning of the wintering phase were used in this part of the experiment. The treatments and numbers per treatment are given below:

Treatment	Control	Paxital	Tran-Q
Number	10	10	10

The individual calves remained on the same experimental treatment as during the wintering trials, but the groups were moved from outdoor lots to concrete lots in which shelter was available. At the beginning of the fattening period the ration was gradually changed from the wintering ration to a high energy, fattening type ration. The steers were brought to a full feed of sorghum grain and alfalfa hay plus one pound of soybean meal per head per day during the first four weeks of the study. After the cattle were on a full feed, sorghum grain and alfalfa hay were available free choice. The proper amount of soybean meal was spread over the grain once each day. The tranquilizers for the treatment lots were mixed with the soybean meal.

The cattle were weighed on two consecutive days at the beginning of the experiment, and every 28 days thereafter until the conclusion of the test at which time they were again weighed on two consecutive days. Other data recorded included feed consumption by lots, and when the steers were slaughtered, the carcass grades, marbling score, fat thickness score, average

firmness score, and the area of ribeye in square inches.

Grazing Phase. Following the wintering phase, ten of the control cattle and eight of the cattle receiving Tran-Q were removed to university pastures northwest of Manhattan and were grazed on native bluestem pasture from April 23, 1958 to August 7, 1958, a period of 105 days. Initial weights, period weights, and daily gain were kept on the cattle while on pasture. The Tran-Q treatment was discontinued while the animals were on pasture because of the inconvenience of administering the drug.

Fattening Phase II. At the close of the grazing phase, both the control and the treatment groups were implanted with 24 mgs. of diethylstilbestrol on August 9, 1958. The cattle were started on grain while still on grass. After being moved to dry lots the cattle were brought to a full feed of sorghum grain which was self fed. Soybean meal was fed at the rate of one pound per animal per day. The treatment group received 2.5 mgs. of Tran-Q per pound of soybean meal. After the cattle were on full feed the alfalfa hay was given free choice. Salt was provided free choice, and water was available at all times in small automatic waterers. The cattle were fed in dry lot from August 7, 1958 to November 14, 1958, a period of 99 days. At the conclusion of the fattening phase the cattle were shipped to a central market. The following slaughter data were obtained: dressing percentage, carcass grade, and average marbling score.

Statistical Analysis. A statistical analysis was performed on the data collected on rate of gain in all phases of the

experiment using Snedecor's (28) analysis of variance.

RESULTS AND DISCUSSION

Each of the four phases of this experiment will be discussed separately.

Wintering Phase

Table 2 summarizes the results of the wintering phase.

Table 2. Results of the wintering phase. December 5, 1957 to March 25, 1958 - 110 days.

Treatment	Control	Paxital	Tran-Q
Lot number	22	18	19
Number of steers	20	10	18
Av. initial wt., lbs.	548	544	559
Av. final wt., lbs.	708	719	718
Av. total gain, lbs.	160	175	159
Av. daily gain, lbs.	1.46	1.59	1.45
Standard error	.07	.08	.06
Av. daily ration:			
Ground sorghum grain, lbs.	4.0	4.0	4.0
Soybean oil meal, lbs.	1.0	1.0	1.0
Prairie hay, lbs.	6.9	6.8	7.8
Sorghum silage, lbs.	13.1	13.1	12.4
Paxital, mgs.[1,2]			
Tran-Q, mgs.[1,3]			
Feed per cwt. gain:			
Ground sorghum grain, lbs.	274.00	251.60	276.00
Soybean oil meal, lbs.	68.50	62.90	69.00
Sorghum silage, lbs.	897.35	823.99	855.60
Prairie hay, lbs.	472.65	427.72	538.20
Feed cost per cwt. gain[4]	$14.22	$13.01	$14.59

[1] Mixed in the soybean oil meal.

[2] Paxital cost not available.

[3] Tran-Q cost estimated to be about $0.80 per gm. by Charles Pfizer and Company, Inc.

[4] Not including tranquilizer cost.

The data in Table 2 were analyzed using Snedecor's (28) analysis of variance. Table 3 summarizes the analysis of the data from the wintering phase.

Table 3. Summary of analysis of variance of data from the wintering phase.

Source of variation	D.F.	S.S.	M.S.	F
Total	47	45,881.25	976.19	
Between lots	2	1,650.20	825.10	.839[1]
Within lots	45	44,232.00	982.93	

[1] In order to be significant at the five per cent level the F value would have to be greater than 3.20.

Under the conditions of this phase of the experiment, the administration of tranquilizers had no significant effect upon the rate of gain, feed efficiency, or temperament. During the test period none of the animals showed evidence of tranquilization, calming, or sedation. This lack of reaction was not unexpected, based on observations made earlier in a pilot study which showed no tranquilization in steers when given much larger doses of tranquilizer. The administration of tranquilizers apparently had no ill effect upon the animals.

Fattening Phase I

The data presented in Table 4 are those obtained from cattle which were preselected at the beginning of the wintering phase and were started on the fattening phase immediately following the conclusion of the wintering phase.

Table 4. summarizes the data obtained from the fattening phase I including the slaughter data.

Table 4. Summary of data from fattening phase I. April 24, 1958 to August 22, 1958 - 120 days.

Treatment	Control	Paxital[1]	Tran-Q[2]
Number of steers per lot	9[3]	10	10
Av. initial wt. per steer, lbs.	738	739	737
Av. final wt. per steer, lbs.	947	965	964
Av. total gain per steer, lbs.	209	226	227
Av. daily gain per steer, lbs.	1.74	1.88	1.89
Standard error	.04	.07	.12
Daily ration per steer, lbs.:			
Ground sorghum grain	15.70	16.80	16.24
Soybean oil meal	1.00	1.00	1.00
Alfalfa hay	5.82	5.63	5.83
Salt	.04	.03	.03
Bonemeal-salt	.05	.04	.04
Paxital, mgs.[4]		75	
Tran-Q, mgs.[4]			2.5
Feed per cwt. gain, lbs.:			
Ground sorghum grain	902	864	859
Soybean meal	58	53	53
Alfalfa hay	334	299	308
Salt	2	2	2
Bonemeal-salt	3	2	2
Paxital, mgs.		3980	
Tran-Q, mgs.			133
Feed cost per cwt. gain[5]	$22.74	$21.54	$21.51
Carcass grades, U.S.D.A.:			
Av. choice	0	0	0
Low choice	1	3	2
High good	3	3	5
Av. good	3	0	2
Low good	1	3	1
High standard	1	1	0
Av. U.S.D.A. grade[6]	11.2	11.4	11.8
Av. marbling score[7]	8.0	7.2	7.0
Av. fat thickness score[8]	3.2	3.2	3.6
Av. firmness score[9]	4.5	4.1	4.2
Av. ribeye size, sq. in.[10]	10.46	9.96	10.07

[1] Paxital is the brand name of a tranquilizer furnished by S. B. Penick and Company, New York, N. Y.

[2] Tran-Q is the brand name of a tranquilizer furnished by Charles Pfizer and Co., Inc., Terre Haute, Indiana.

Table 4 (concl.).

[3] One animal died 47 days after test began.

[4] Mixed in the soybean meal.

[5] Not including tranquilizer cost or mixing cost.

[6] Average grade determined as follows: high choice, 15; average choice, 14; low choice, 13; high good, 12; average good, 11; low good, 10; high standard, 9.

[7] Visual marbling score determined as follows: moderate, 5; modest, 6; small amount, 7; slight amount, 8.

[8] Visual fat covering at 12th rib: moderate, 3; modest, 4; slightly thin, 5.

[9] Firmness of ribeye: firm, 2; moderately firm, 3; modestly firm, 4; slightly firm, 5.

[10] Measured at the 12th rib.

Using analysis of variance, the data from fattening phase I were analyzed. A summary of the analysis appears in Table 5.

Table 5. Summary of the analysis of variance of data from fattening phase I.

Source of variation	D.F.	S.S.	M.S.	F
Total	29	29,054	1,001.9	
Between lots	2	1,882	941.0	.935[1]
Within lots	27	27,172	1,006.0	

[1] In order to be significant at the five per cent level the F value would have to be greater than 3.33.

Results of this second trial with tranquilizers showed only a moderate, statistically non significant advantage in favor of the two tranzuilizer-treated groups for certain traits under observation. Rate of gain and feed efficiency were increased by about the same amount over controls in both lots fed a tranquilizer. Although there was a slight increase in average U.S.D.A.

grade in the Tran-Q treated lot, there was no significant difference between the carcass data of the treated cattle and that of the untreated cattle.

During fattening phase I, the widespread occurrence of foot rot had an undetermined effect on the results of this phase. Presumably, the occurrence was randomly distributed, thereby having an equal effect on each lot.

Grazing Phase

Following the wintering period preselected steers were moved to pastures for summer grazing. Only the steers from the control and the Tran-Q treated groups were moved to pastures. Tran-Q administration was discontinued during the 105-day grazing period. Table 6 summarizes the results from the grazing phase.

Table 6. Summary of data from the grazing phase. April 24, 1958 to August 7, 1958 - 105 days.

Treatment	: Control	: Tran-Q
Initial wt. per steer, lbs.	734	753
Gain per steer	89	117
Daily gain per steer	0.85	1.11
Standard error	.07	.12
Grazing cost per steer	$16.00	$16.00

Data collected from the grazing phase have been analyzed by analysis of variance. Table 7 summarizes that analysis.

The only data obtained from this phase of the experiment was rate of gain. Statistical analysis showed no significant difference in rate of gain between the control group and the Tran-Q

Table 7. Summary of the analysis of variance of data from the grazing phase.

Source of variation	D.F.	S.S.	M.S.	F
Total	17	185,034	10,884	
Between lots	1	3,454	3,454	4.131[1]
Within lots	16	13,387	836	

[1] In order to be significant at the five per cent level the F value would have to be greater than 4.45.

group; however, the actual data do show a difference of 0.26 pounds per day. This difference can possibly be explained on the basis of a carry-over effect from previous treatment inasmuch as the treatment was discontinued during this phase of the experiment. Feed efficiency data were not available for this phase.

Fattening Phase II

Following the grazing phase, all animals used in the grazing phase were implanted with 24 mgs. of diethylstilbestrol and placed in dry lot for a 99-day fattening period. Table 8 summarizes the data obtained from this phase of the experiment.

The data from fattening phase II were statistically analyzed using analysis of variance. Table 9 summarizes the analysis.

There was a statistically significant difference in rate of gain between the control and the Tran-Q treatment groups, with an actual difference of 0.53 pound in favor of the Tran-Q group. The tran-Q group ate more grain, therefore the feed efficiency level was the same for both groups.

Table 8. Summary of data from fattening phase II. August 7, 1958 to November 14, 1958 - 99 days.

Treatment	Control	Tran-Q[1]
Number of steers per lot	10	8
Initial wt. per steer, lbs.	823	870
Gain per steer, lbs.	297	349
Daily gain per steer, lbs.	3.00	3.53
Standard error	.17	.17
Daily ration per steer, lbs.:		
Sorghum grain, self-fed	20.0	23.5
Soybean meal	1.0	1.0
Alfalfa hay	5.2	5.4
Implanted with stilbestrol, 24 mgs.	Yes	Yes
Tranquilizer	No	Yes
Salt, free-choice[2]		
Feed per cwt. gain, lbs.:		
Sorghum grain	667	668
Soybean meal	33	28
Alfalfa hay	174	153
Feed cost per steer, this phase	$47.43	$53.68
Feed cost per cwt. gain	$15.97	$15.38
Sale price per cwt., live weight, based on carcass value[3]	$27.40	$27.13
Dressing per cent	60.2	59.6
Carcass grade:		
Average choice	1	1
Low choice	1	1
High good	2	2
Average good	2	1
Low good	3	2
Average grade[4]	17.1	17.4
Average marbling score[5]	7.2	7.5

[1] Tran-Q is the brand name of a tranquilizer (Hydroxyzine) supplied by Charles Pfizer and Co., Inc., Terre Haute, Indiana. It was fed at the level of two and one-half mg. per head daily during the wintering and fattening periods.

[2] Mineral was equal parts bonemeal and salt by weight and salt by itself, all free choice.

[3] Sale price per cwt. was based on the following carcass values per cwt.: Choice, $46.50; Good, $45.50; Standard, $43.50.

[4] The U.S.D.A. grade, low good, was assigned on a numerical value of 16; average good, 17.

[5] Degree of marbling: A score of 7 indicated small amount, 8 indicated slight amount. The higher the score, the less marbling.

Table 9. Summary of analysis of variance of data from fattening phase II.

Source of variation	D.F.	S.S.	M.S.	F
Total	17	53,250	3,132	
Between lots	1	11,902	11,902	4.606*
Within lots	16	41,348	2,584	

* Significant at the five per cent level.

It is possible that the Tran-Q could exert a protective action on the cattle against heat stress which would account for the increased rate of gain in this trial. Maximum summer temperatures occurred in the latter part of the summer during the fattening phase II. If the tranquilizer tended to protect the animals from heat, the difference in performance would not have been noted during the cooler season, but only would have been noted during the hottest part of the summer. According to Van Matre, et al. (29) chlorpromazine and reserpine were effective in prolonging survival of chicks at high temperatures, and afforded protection against decreased egg production and egg shell quality following heat stress. Although beef cattle and poultry are quite different physiologically, this may offer a clue to the variability of results with tranquilizers when fed to cattle at low levels.

Slaughter data collected during the final fattening phase II indicated no advantage in favor of the tranquilizer. These included dressing per cent, average carcass grade, and average marbling score.

It is quite apparent that results from feeding tranquilizers are unaccountably variable. Due to the variability, the author believes that more studies are needed in order to evaluate more fully the effect of tranquilizers when added to the rations of beef cattle for the purpose of increasing rate of gain or feed efficiency. It can be concluded that addition of small amounts of tranquilizer have no apparent ill effect on beef cattle, nor do they affect the temperament of treated animals.

SUMMARY

The tests reported herein were conducted to help evaluate the role of two tranquilizers in the wintering and fattening rations of beef steers. Paxital and Tran-Q were the two tranquilizers used in this study. The experiment was divided into four phases: wintering, fattening phase I, grazing, and fattening phase II. Paxital was administered at the rate of 75 mgs. per day. Tran-Q was administered at the rate of 1.5 mgs. per day during the wintering phase, but dosage was raised in the fattening and grazing phases to 2.5 mgs. per day at the manufacturer's suggestion. Both tranquilizers were mixed with the soybean meal portion of the ration. The steers in the experiment were initially wintered as a group. Following the wintering period preselected groups were fattened and pastured during the early summer. The group which was pastured was then implanted with 24 mgs. of diethylstilbestrol and placed in dry lot for a fattening period. At the conclusion of each fattening phase the cattle

were shipped to a central market packing plant and slaughter and carcass data were gathered.

Analysis of variance of the data obtained from the wintering and fattening phase I showed no statistically significant difference in rate of gain between treatments and control lots, however, data from the grazing phase did approach significance. There was a significant difference ($P<.05$) in rate of gain between treatment and control groups in fattening phase II. The administration of the two tranquilizers had no appreciable effect on dressing percentage or carcass characteristics measured. No ill or harmful effects were noted. No calming or tranquilization was effected by the administration of the tranquilizers.

ACKNOWLEDGMENTS

The author wishes to express his sincere appreciation to Dr. Berl A. Koch for his untiring effort and cooperation in planning and executing this experiment, and for his assistance in preparing and editing this thesis.

The cooperation of Charles Pfizer and Company, Inc. and Warner Chilcott Research Laboratories in supplying the necessary tranquilizers is appreciated.

Thanks are due Mr. Walter Hilliard for the care and feeding of the experimental cattle in this study.

The author is particularly grateful to his wife for her encouragement and invaluable assistance in preparing this manuscript.

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TRANQUILIZERS OR TRANQUILIZING TYPE COMPOUNDS IN BEEF CATTLE WINTERING AND FATTENING RATIONS

by

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B. S., Texas Technological College, 1955

AN ABSTRACT OF A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Animal Husbandry

KANSAS STATE UNIVERSITY
OF AGRICULTURE AND APPLIED SCIENCE

1959

Although roots of shrubs have been used to make preparations with tranquilizing properties for centuries in India, only during the last decade have intensive pharmacological investigations been made on natural and synthetic tranquilizers. Tranquilizers, first used in human medicine, have found application in veterinary medicine to calm animals and relieve various stress states.

The purpose of this study was to determine the effect of two tranquilizers on rate of gain, feed efficiency, and carcass characteristics when fed to steers receiving wintering and fattening rations. The experiment was divided into four phases: wintering phase, fattening phase I, grazing phase, and fattening phase II.

Wintering phase. Forty-eight steers were divided according to weight into a control group of 20, and two treatment groups of 10 and 18 animals. The group of 10 steers received 75 mgs. of paxital per animal per day, while the group of 18 received 1.5 mgs. of Tran-Q per animal per day. The control group received a basic ration. The tranquilizers were mixed with the soybean portion of the ration.

Fattening phase I. Following the wintering phase, three groups of 10 steers which had been designated at the beginning of the wintering phase were gradually changed to a fattening ration. The Tran-Q dosage was increased to 2.5 mgs. per animal per day. Paxital administration remained at 75 mgs. At the end of the fattening period the steers were slaughtered by a commercial concern and slaughter and carcass data were obtained.

Grazing phase. Following the wintering phase, 10 of the control cattle and eight steers receiving Tran-Q were removed to university pastures for grazing. Tran-Q administration was discontinued.

Fattening phase II. At the close of the grazing phase, both the control and the Tran-Q treatment groups were implanted with 24 mgs. of diethylstilbestrol and moved to dry lots for fattening. The Tran-Q treatment was resumed at the rate of 2.5 mgs. per animal per day. At the conclusion of this phase the cattle were slaughtered by a commercial concern and carcass and slaughter data were recorded.

No appreciable difference in data between treatment and control groups was noted with the exception of rate of gain. An analysis of variance of data on rate of gain approached significance in the grazing phase and was significant ($P<.05$) in fattening phase II. No significant differences were found in data on rate of gain or on slaughter and carcass data between the treatment and control groups during the wintering phase and fattening phase I. No ill effects were noted as a result of feeding tranquilizer at the levels used in this study, nor were any calming or tranquilizing effects detected.