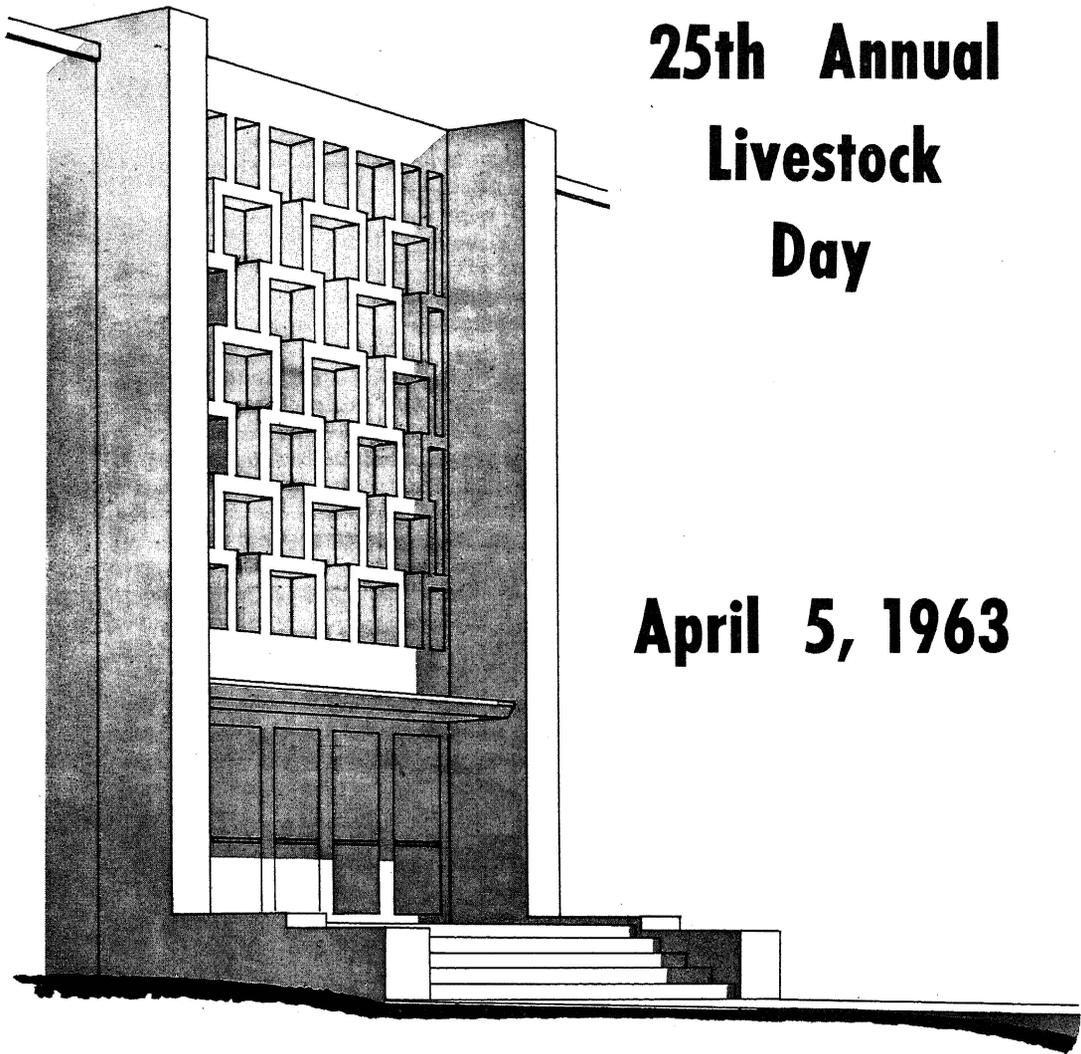


STUDIES WITH BEEF CATTLE, SHEEP AND SWINE

REPORTED AT

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DIVISION OF ANIMAL INDUSTRY

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## PROJECT 198

### THE CAUSES OF IMPROVEMENT IN THE WEANING WEIGHTS OF CALVES IN A GRADE HEREFORD HERD

Homer B. Sewell, James E. Comfort and John F. Lasley

The advent of performance testing for beef cattle has resulted in an increasing number of beef cattle men using adjusted weaning weight and post-weaning gain records in their beef cattle improvement program. Increases of 50 to 60 pounds or more in the average weaning weight of the calves in a herd are frequently reported after performance records have been used as a basis of selection for five or more years. It would be of value to know the respective proportion of this increase that could be attributed to inherited and to environmental factors. This was the objective of the study the results of which are reported here.

This report is based on the records of the grade Hereford herd of Mr. Morris DeWitt of Newburg, Missouri. The records were kept from 1951 through 1961 and included the weaning weights of 1,066 calves. The number of calves weaned ranged from 90 to 112 each year, except for 38 in 1951.

#### RESULTS

The average adjusted 180-day weaning weights of all calves by different years is given in Table 1. These data show that the average weaning weight of calves in this herd was 315 pounds in 1951. The average weaning weight of the calves increased steadily to a peak of 444 pounds in 1956 which was 129 pounds higher than in 1951. After 1956 there was a slight decline in the average weaning weights of calves in this herd to approximately 400 pounds with an average value of 409 pounds in 1961. This was an increase of 94 pounds over that of the 1951 average.

Several different factors were found to have a highly significant influence ( $P < .005$ ) on the weaning weights of calves in this herd. Steer calves averaged 24.2 pounds heavier than heifer calves during the 10-year period. The age of the dam had an important influence on the weaning weights of their calves with 8-year old cows weaning the heaviest calves and older and younger cows weaning those which were lighter. The season of birth also significantly affected weaning weights with calves born in February and March being the heaviest and those born from June through November the lightest. The average weaning weights of calves within the herd varied greatly from year to year.

Data in Table 1 show the yearly variations in weaning weights of the calves before and after adjustments were made for each of the factors significantly affecting this trait.

The adjustment of weaning weights for sex did not reduce the range from the highest to the lowest year, but from the overall standpoint it reduced the coefficient of variation (a measure of variation) from 16.6 to 14.8 percent. A further adjustment of the records for age of dam reduced the range in weaning weights from the high to the low year to 101 pounds with a coefficient of variation of 13.2. The adjustment of the records for season of birth resulted in a further decrease to 84

TABLE 1-THE 180-DAY WEANING WEIGHTS OF CALVES BY YEARS BEFORE  
AND AFTER ADJUSTMENTS FOR VARIOUS FACTORS

| YEAR         | No.<br>CALVES | 180 - day weights adjusted for: |                          |             |                          |              |                          |                   |                          |             |                          |
|--------------|---------------|---------------------------------|--------------------------|-------------|--------------------------|--------------|--------------------------|-------------------|--------------------------|-------------|--------------------------|
|              |               | 180 Day Weight                  |                          | + Sex       |                          | + Age of Dam |                          | + Season<br>Birth |                          | + Year*     |                          |
|              |               | Mean<br>lb.                     | Co. of<br>Varia-<br>tion | Mean<br>lb. | Co. of<br>Varia-<br>tion | Mean<br>lb.  | Co. of<br>Varia-<br>tion | Mean<br>lb.       | Co. of<br>Varia-<br>tion | Mean<br>lb. | Co. of<br>Varia-<br>tion |
| 1951         | 38            | 315                             | .238                     | 327         | .240                     | 250          | .221                     | 380               | .191                     | 425         | .191                     |
| 1951         | 98            | 337                             | .153                     | 347         | .155                     | 359          | .143                     | 394               | .145                     | 448         | .146                     |
| 1953         | 111           | 369                             | .140                     | 379         | .139                     | 388          | .126                     | 417               | .127                     | 417         | .127                     |
| 1954         | 106           | 404                             | .124                     | 415         | .109                     | 418          | .101                     | 422               | .123                     | 446         | .101                     |
| 1955         | 105           | 433                             | .111                     | 445         | .106                     | 441          | .088                     | 460               | .099                     | 442         | .099                     |
| 1956         | 112           | 444                             | .116                     | 457         | .113                     | 451          | .101                     | 464               | .099                     | 417         | .099                     |
| 1957         | 102           | 395                             | .135                     | 406         | .131                     | 402          | .124                     | 417               | .119                     | 438         | .119                     |
| 1958         | 93            | 409                             | .120                     | 420         | .113                     | 419          | .086                     | 431               | .085                     | 427         | .086                     |
| 1959         | 105           | 394                             | .103                     | 407         | .103                     | 414          | .104                     | 429               | .096                     | 421         | .096                     |
| 1960         | 106           | 351                             | .115                     | 382         | .115                     | 394          | .119                     | 408               | .115                     | 433         | .115                     |
| 1961         | 90            | 409                             | .109                     | 421         | .105                     | 438          | .096                     | 449               | .102                     |             |                          |
| <b>TOTAL</b> | <b>1066</b>   | <b>393</b>                      | <b>.166</b>              | <b>405</b>  | <b>.148</b>              | <b>410</b>   | <b>.132</b>              | <b>429</b>        | <b>.129</b>              | <b>431</b>  | <b>.117</b>              |
| Range        |               | 129                             |                          | 130         |                          | 101          |                          | 84                |                          | 31          |                          |

\*1961 calf weights not adjusted for year effects.

pounds from the high to the low year and when year adjustments were made this difference was further reduced to 31 pounds between the high and low years with a coefficient of variation of only 11.7 percent.

A further study was made of the records from the genetic standpoint taking into consideration the effect of culling cows which weaned lighter than average calves and the selection of replacement heifers from those with heavier 180-day weaning weights. It was estimated that the practice of culling cows which weaned light calves should have increased the average weaning weights of calves in the herd by about 0.76 pounds per year. The expected yearly improvement in weaning weights through the selection of heavier replacement heifers was estimated to be 0.51 pounds per year. Thus, the data indicated that of the 94 pounds increase in average weaning weight from 1951 to 1961, 15 pounds could have been attributed to improvements in heredity whereas 79 pounds could have been due to an improvement in environment.

### Practical Application of Results

Results of this study show that considerable improvement can be made in the weaning weights of calves on the farm by proper attention to both hereditary and environmental factors. However, most of the rapid or immediate improvement would probably come through proper attention to environmental factors, whereas improvement over a long period of time could be due more to improvements in inheritance of the herd for weaning weights.

From the environmental standpoint, several factors may increase weaning weights, some of which the livestock man can control and some he cannot. Steer and bull calves weigh an average of 25 to 40 pounds heavier at weaning than heifer calves but this cannot be controlled by the producer. Cows wean their heaviest calves, on the average, when they are between 5 and 8 years of age. Thus, if too large a proportion of heifers enter the herd each year to replace older and more mature cows which are near their peak production, the average weaning weight of the calves in the herd could drop even though the heifers kept for replacement might possess a greater genetic potential for the production of heavy calves than the mature cows. Likewise, when a cow passes her peak performance at 9 to 11 years of age and begins to wean lighter than average calves each year, she would be culled unless she has had an outstanding lifetime record and there is a desire to retain her offspring in the herd for replacement purposes because of this record.

January, February and March calves often weigh more at 180 days of age than calves born later in the year. These early calves have the advantage of being old enough to consume considerably more forage during the summer than younger calves and will weigh more at market time than calves born later in the year if all calves are sold as feeder calves on the same date in the fall. Thus, the livestock man has more pounds of calf to market per cow from early calves.

Very large year to year variations in weaning weights were observed in this study. The environmental factors within each year responsible for these fluctuations were not definitely determined. However, the available feed supply which is no doubt dependent upon the amount and distribution of rainfall could be important. Supplying creep rations to calves especially in times of drought and small grain pastures during the early spring and late fall months could result in heavier weaning

weights because of a direct influence on the calves that consume them or indirectly through a favorable effect on the fertility and milk producing ability of the dam.

From the genetic standpoint, a slow but gradual improvement in weaning weights over the years could be brought about by culling cows which wean calves in a given year which are lighter than the average of cows in their age group; selecting replacement heifers which are as far above the average as possible for all heifers in that calf crop but still possess desirable type and conformation; and by selecting herd bulls of good type which themselves had weaning weights far above the average of the calf crop from which they were selected.

## PROJECT 237

### WINTER MANAGEMENT OF BEEF STEERS WITH EMPHASIS ON CARCASS CHARACTERISTICS

G. B. Thompson, H. B. Hedrick, R. L. Preston, L. M. Schake and A. J. Dyer

Sound feeding and management systems for beef cattle must not only produce economical gains but also must produce beef carcasses that will yield a high percentage of edible beef of the kind demanded by consumers. Feeding and management practices as well as the breeding of beef cattle determine the kind of beef produced.

Winter feeding and management systems have been evaluated using feedlot performance and carcass characteristics as criteria. Three tests were conducted involving 129 good to choice steers handled under various winter feeding plans and then finished for slaughter.

The management plans were designed to produce choice steers at approximately 1000 pounds live weight. Yearling steers were used in the first test. Steer calves were used for the second and third test.

#### First Test

The first test was designed to determine if a low plane of winter nutrition would have any effect on quality of the carcass. The results of this test reported in 1955 indicated that cattle wintered on a ration which resulted in a loss of 0.4 pounds per head daily produced carcasses after finishing with considerably more outside fat cover and separable fat, yet much less fat in the rib eye (marbling) than cattle wintered to gain 1.5 pounds per day. The low plane of winter nutrition also appeared to retard the muscle development of the steers as indicated by smaller rib eye areas of their carcasses as compared to those of steers fed more liberal winter rations, even though the slow gaining steers were slaughtered 60 days later and at similar live weights. Subsequent finishing gains of steers fed the low plane of winter nutrition were rapid, but apparently much of the gain was fat.

#### Second Test

This test was designed to determine if the undesirable carcass effects of a low plane of winter nutrition were due to protein or energy or a combination of both.

A second objective was to evaluate the winter feeding systems with and without diethylstilbestrol. (DES)

The results of this test reported in 1961 indicated that the energy level of the winter ration may be one of the major factors which determined the amount of marbling in the rib eye after finishing. An adequate protein level of the winter ration was necessary to produce most efficient winter gains, regardless of the energy level of the ration. However, this winter treatment also produced carcasses after finishing with more outside fat cover regardless of energy level than low protein winter rations.

The gain response to 24 mg. DES implants in the wintering phase was greatest on rations adequate in protein. Low protein rations produced a slightly negative gain response to DES regardless of energy level.

The protein level of the winter rations had an influence on the gain response to DES during the subsequent finishing phase. Cattle fed adequate protein rations from December through April produced a 25 per cent increased gain response to DES while cattle fed low protein winter rations gained only 12% faster as a result of the DES treatment during the May to October finishing period.

Third Test

The third test reported in 1962 was designed to repeat certain treatments of the second trial and to compare these winter feeding systems with a finish immediately plan of management for 400 pound steer calves. The four winter treatments were adequate protein - adequate energy (AP-AE), low protein adequate energy (LP-AE), low protein low energy (LP-LE), and adequate protein - full fed (AP-FF). The levels of crude protein (CP) and energy (total digestible nutrients-TDN) fed per head daily are shown in the following chart.

Experimental Design of Winter Protein and Energy Levels

| AH-237-60B   |              |              |               |
|--------------|--------------|--------------|---------------|
| AP-AE        | LP-AE        | LP-LE        | AP-FF         |
| 1.6 lb. C.P. | 1.0 lb. C.P. | 1.0 lb. C.P. | 1.6 lb. C.P.  |
| 9 lbs. TDN   | 9 lb. TDN    | 7 lb. TDN    | 10-12 lb. TDN |
| 12 Steers    | 12 Steers    | 12 Steers    | 12 Steers     |

Rations were composed of corn silage, ground shelled corn, and soybean meal.

Daily gain and feed Efficiency - Winter Phase  
(147 days)

AH-237-60B

| AP-AE               | LP-AE               | LP-LE               | AP-FF               |
|---------------------|---------------------|---------------------|---------------------|
| ADG<br>1.93         | ADG<br>1.32         | ADG<br>0.77         | ADG<br>2.30         |
| TDN/lb gain<br>4.72 | TDN/lb gain<br>7.07 | TDN/lb gain<br>8.70 | TDN/lb gain<br>4.81 |

Steers full fed the finishing ration made fastest gains but were not more efficient than steers fed approximately 2 1/2 pounds less grain per head daily (AP-AE).

Adequate protein rations with sufficient energy to produce approximately 2 pounds daily gain were most efficient (TDN per unit gain).

Daily Gain and Feed Efficiency - Winter  
and Finishing Phases Combined

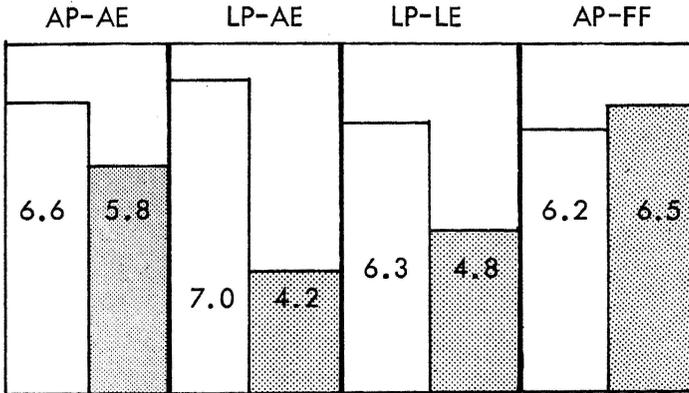
AH-237-60B

| AP-AE               | LP-AE               | LP-LE               | AP-FF               |
|---------------------|---------------------|---------------------|---------------------|
| ADG 2.08            | ADG 1.82            | ADG 1.57            | ADG 2.15            |
| TDN/lb gain<br>5.70 | TDN/lb gain<br>6.72 | TDN/lb gain<br>6.70 | TDN/lb gain<br>5.84 |

The liberal winter rations fed to steer calves produced faster gains with less TDN per pound gain.

### Carcass Grades

AH-237-60B



DES Implanted Steers 36 mg

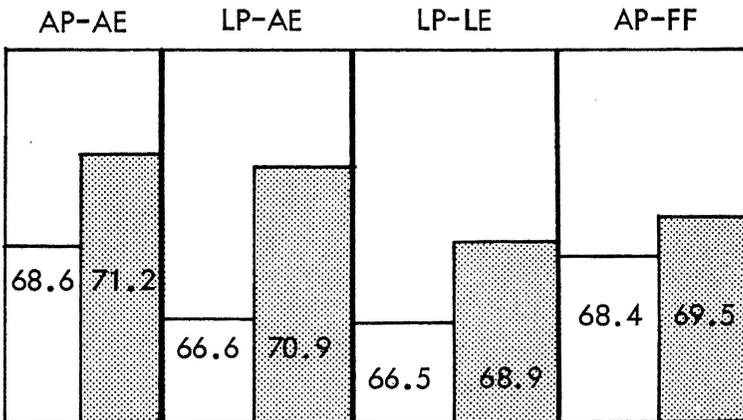
Control Steers

Low good 4, Average Good 5, High Good 6, Low Choice

Carcasses of steers fed liberal winter rations graded highest. This method of feeding was especially advantageous when cattle were implanted with diethylstilbestrol.

### Percent Retail Yield of Carcass

AH-237-60B



DES Implanted Steers 36 mg

Control Steers

Feeding liberal winter rations resulted in higher yielding carcasses than feeding less liberal winter rations.

Diethylstilbestrol increased retail yield regardless of winter ration fed.

## SUMMARY

Sound feeding and management systems for beef cattle must not only produce economical gains but also must produce beef carcasses that will yield a high percentage of edible beef with high consumer acceptance.

This can be done by wintering calves or yearlings on a ration with adequate protein and sufficient energy to produce 1.5 to 2.0 pounds daily gain. With this feeding system the use of diethylstilbestrol results in improved gain, feed efficiency and meatiness without effect on carcass grades.

### PROJECT 3

#### BREEDING PRINCIPLES FOR SWINE IMPROVEMENT

R. C. Gray, J. F. Lasley, B. N. Day, and L. F. Tribble

##### Summary

Selection for backfat thinness alone has resulted in about 0.2 inches less backfat in the pigs from the third as compared to the first generation.

##### Procedure and Results

The main objectives are (1) to study the effectiveness of selection for thinner backfat in swine, (2) to gain further information on the genetic correlation between traits and possibly genetic environmental interactions affecting them, (3) to study further the physiology of reproduction as related to growth, reproduction and gene expression.

The project began in 1958 from sows of an inbred Poland line and 4 unrelated boars. The same matings were made in the spring and fall for the formation of the two lines which have since remained closed.

The pigs are raised in confinement from birth to 175 pounds and are fed by litters. All pigs are probed for backfat thickness at 175 pounds and those with the thinnest backfat are selected as replacements for the next generation. The cull gilts are used in ovulation and embryonic mortality studies and along with littermate barrows are slaughtered to obtain carcass data.

Three years of data have been completed and are shown in Table 2. By selecting for backfat thinness and ignoring all other traits, the other traits do not appear to have been greatly affected. Sow performance is remaining about the same. Rate of gain has declined slightly but this may be due to the increase in inbreeding or to disease. During each season the selected pigs have had a higher average daily gain than the average of all pigs produced during that season. Feed efficiency has varied greatly within season and year and no definite trend has been established.

The average backfat thickness at 175 pounds as determined by the probe technique has declined approximately 0.2 of an inch in 3 years. Selected boars now

TABLE 2-DATA FROM 3½ YEARS OF SELECTING FOR BACKFAT THINNESS

| Year<br>Season<br>Farrowed              | 1959   |      | 1960   |      | 1961   |      | 1962   |
|---|--------|------|--------|------|--------|------|--------|
|   | Spring | Fall | Spring | Fall | Spring | Fall | Spring |
| No. of litters                          | 30     | 30   | 30     | 29   | 20     | 28   | 28     |
| Avg. live pigs/litter                   | 8.2    | 8.5  | 7.1    | 7.8  | 6.2    | 7.0  | 7.9    |
| Avg. birth weight                       | 2.9    | 3.0  | 2.7    | 2.9  | 3.0    | 3.0  | 2.8    |
| Weaned (42 days)                        |        |      |        |      |        |      |        |
| Avg. weaned/litter                      | 5.9    | 6.0  | 5.4    | 6.5  | 5.8    | 5.3  | 5.6    |
| Avg. weight/pig                         | 16.5   | 19.2 | 15.9   | 17.8 | 18.4   | 20.8 | 17.4   |
| Per cent weaned                         | 68     | 70   | 76     | 80   | 94     | 78   | 80     |
| Avg. daily gain (weaning to 175 pounds) |        |      |        |      |        |      |        |
| All boars                               | 1.27   | 1.41 | 1.25   | 1.25 | 1.12   | 1.16 | 1.15   |
| All gilts                               | 1.26   | 1.35 | 1.24   | 1.22 | 1.09   | 1.10 | 1.09   |
| Replacement boars                       | 1.33   | 1.37 | 1.27   | 1.24 | 1.16   | 1.23 | 1.16   |
| Replacement gilts                       | 1.30   | 1.32 | 1.24   | 1.24 | 1.12   | 1.13 | 1.10   |
| Feed/100 lb. gain                       |        |      |        |      |        |      |        |
| All pigs                                | 320    | 330  | 307    | 350  | 320    | 354  | 324    |
| Backfat probe (adjusted to 175 pounds)  |        |      |        |      |        |      |        |
| All boars                               | 1.07   | 1.05 | 0.96   | 0.96 | 0.91   | 0.89 | 0.99   |
| All gilts                               | 1.18   | 1.13 | 1.04   | 0.99 | 0.97   | 0.89 | 1.02   |
| Replacement boars                       | 0.92   | 0.81 | 0.79   | 0.77 | 0.76   | 0.72 | 0.84   |
| Replacement gilts                       | 1.07   | 1.04 | 0.97   | 0.91 | 0.94   | 0.85 | 0.96   |

average about 0.75 inches of backfat and gilts between 0.85 and 0.9 inches. It is of interest that as the pigs are getting thinner there appears to be less difference between the boars and gilts. This study will continue for at least 2 more years.

PROJECT 141

SOURCE OF PROTEIN AND PREPARATION OF RATIONS  
FOR GROWING-FINISHING SWINE

L. F. Tribble

Thirty-two purebred Hampshire and Duroc barrows were fed in concrete floored pens during the summer of 1961 according to the following design:

- Lot 1 Corn-soy ration in meal
- Lot 2 Same as 1 in pellet
- Lot 3 Corn-complex protein ration (Test Station) in meal
- Lot 4 Same as 3 in pellet

Pigs fed the more complex rations which are fed at our testing station (lots 3 and 4) made faster gains than pigs fed the corn-soy rations (lots 1 and 2). These pigs also had a lower requirement for feed per pound of gain but there was some variation between lots. Pigs fed the complex ration in pellet form gained faster and

required less feed than pigs in any other lot. However pigs fed the corn-soy ration in the pellet did not gain as fast nor as efficiently as pigs fed this ration in the meal form. The corn-soy pellets crumbled rather badly and it is possible that this is related to the poorer performance of this group of pigs. The pigs in this pen (lot 2) were observed to be wasting feed to a greater extent than pigs in the other lots. Total feed consumption including feed wastage was lowest in the lot of pigs fed the corn-soy pellets indicating that these crumbled pellets were not as palatable as the meal ration.

Although no exact cost figures for the feeds were calculated in this trial, the corn-soy ration would have produced cheaper gains than was obtained from the complex pelleted ration fed to pigs in lot 4.

Since pigs at the University of Missouri Boar Testing Station has developed ulcers when fed rations the same as lots 3 and 4, a sample of pigs from each of these lots was slaughtered in order to examine their stomachs for ulcers. Thirteen pigs were slaughtered and no ulcers were found in any of these pigs.

TABLE 3-COMPARISON OF MEAL VS. PELLETS AND A COMPLEX RATION  
VS. CORN-SOY RATIOS FOR GROWING-FINISHING PIGS

| Lot             | 1    | 2      | 3    | 4      |
|-----------------|------|--------|------|--------|
| Form            | Meal | Pellet | Meal | Pellet |
| No. of Pigs     | 8    | 8      | 8    | 8      |
| Initial Weight  | 60   | 60     | 60   | 60     |
| Final Weight    | 204  | 194    | 208  | 215    |
| Avg. Daily Gain | 1.74 | 1.63   | 1.79 | 1.88   |
| Feed/lb. Gain   | 3.48 | 3.58   | 3.56 | 3.19   |

#### PROJECT 141

#### THE PROTEIN SUPPLEMENTATION OF BARLEY AS A SUBSTITUTE FOR CORN IN GROWING-FINISHING RATIOS

L. F. Tribble

#### Summary

Barley may be used to replace corn in a ration for growing finishing pigs but gains will be slower and less efficient.

A higher protein ration may be required with barley than with corn as pigs fed 18-14 per cent (lot 2) protein gain faster than those fed 16-12 per cent protein (lot 3).

In terms of feed required per pound of gain barley would be worth about 89 per cent the value of corn.

#### Procedure and Results

Forty purebred Hampshire and Duroc pigs were divided as uniformly as possible into 4 lots and fed according to the following design:

- Lot 1 Corn ration
- Lot 2 Barley replaced corn pound for pound in ration in lot 1
- Lot 3 Barley ration to contain same protein as ration in lot 1
- Lot 4 Equal parts corn and barley to contain same protein as ration in lot 1

The pigs were fed in concrete floored pens under roof. Water was supplied by an automatic waterer.

The results are given in Table 4. Pigs fed on the corn ration gained 0.2 pounds per head per day faster than pigs fed on any of the barley rations. They also required approximately 40 pounds less feed per 100 pounds gain than was required by pigs fed barley. There was very little difference between the pigs fed barley although those in lot 2 gained a little faster. In terms of feed required per pound of gain barley would be worth about 89 per cent the value of corn as a feed for hogs.

TABLE 4-VALUE OF BARLEY AS A SUBSTITUTE FOR CORN  
AND PROTEIN SUPPLEMENTATION REQUIREMENT

| Lot             | Corn | Barley | Barley | Mixed |
|-----------------|------|--------|--------|-------|
| No. of Pigs     | 10   | 10     | 10     | 10    |
| Initial Weight  | 94   | 94     | 94     | 94    |
| Final Weight    | 201  | 200    | 194    | 197   |
| Avg. Daily Gain | 1.74 | 1.53   | 1.41   | 1.44  |
| Feed/lb. Gain   | 3.59 | 3.95   | 4.17   | 4.13  |

\*Ration was changed from 16 to 12 per cent protein when pigs in lot averaged 125 pounds except lot 2.

## PROJECT 141

### AMINO ACID SUPPLEMENTATION OF PRACTICAL RATIONS FOR SWINE

N. H. A. Schnarre and L. F. Tribble

#### Summary

The addition of the amino acids lysine or lysine and methionine to corn-soybean soil meal was of little value in improving the rations as measured by the gains of the pigs. However in one trial, the pigs fed a 14 per cent protein ration plus 0.1 per cent lysine made faster and more efficient gains than pigs fed 14 or 16 per cent protein unsupplemented.

Pigs fed 14 or 16 per cent protein from weaning to 125 pounds gained faster and more efficiently than pigs fed 12 per cent protein. However, from 125 to 200 pounds, pigs fed 12 per cent protein made faster and more efficient gains than pigs fed higher levels of protein.

#### Procedure

Corn-soybean oil meal rations were fed at different levels of protein with and without lysine supplementation to pigs from weaning to 200 pounds in two trials. In the second experiment, the effects of lysine or lysine and methionine additions to 12 and 14 per cent protein rations were studied with pigs from 50 to 125 pounds. The

value of adding different levels of lysine to 12 per cent protein rations for pigs from 125 to 200 pounds were studied in the third experiment. All tests were conducted in confinement on concrete floors.

## Results

The results of the first experiment are shown in Table 5. Pigs fed rations supplemented with lysine made slower and less efficient gains than pigs fed the unsupplemented rations. This difference was greater during the period up to 125 pounds. Pigs fed 16 per cent protein to 125 pounds made faster and more efficient gains than those fed 12 per cent but from 125 to 200 pounds, pigs fed 12 per cent gained faster and more efficiently. The best performance was made by pigs fed 16 per cent protein to 125 pounds and then 12 per cent protein to 200 pounds.

The results of the second experiment are given in Table 6. Pigs fed a 14 per cent protein ration plus 0.1 per cent lysine made the fastest gains of any pigs in this test. The addition of methionine to this ration was of no benefit and the performance of the pigs was poorer than on the unsupplemented ration. The addition of lysine to a 12 per cent protein ration produced the same results as was obtained in the first test but the addition of both lysine and methionine resulted in an improved feed efficiency of the pigs. Pigs fed 14 per cent protein gained as fast and efficiently as those fed 16 per cent protein.

The results of the third test are found in Table 7. There was no difference in the gains of pigs fed 12 per cent protein without lysine and with .05 and 0.1 per cent added lysine for the period from 125 to 200 pounds. Pigs fed 14 per cent protein during this period gained about 0.1 pounds per head per day slower but at the same level of efficiency as those fed 12 per cent protein.

TABLE 5-LYSINE AND METHIONINE SUPPLEMENTS FOR PRACTICAL SWINE RATIONS

| Lot              | 1    | 2    | 3    | 4      | 5    | 6    | 7       |
|------------------|------|------|------|--------|------|------|---------|
| Per Cent Protein | 16   | 14   | 14L* | 14LM** | 12   | 12L* | 12LM*** |
| No. of Pigs      | 10   | 10   | 10   | 10     | 10   | 10   | 10      |
| Initial Wt.      | 50.3 | 50.2 | 50.5 | 50.6   | 50.1 | 50.1 | 50.5    |
| Final Wt.        | 124  | 125  | 133  | 121    | 114  | 107  | 116     |
| Avg. Daily Gain  | 1.32 | 1.34 | 1.48 | 1.27   | 1.14 | 1.02 | 1.17    |
| Feed/lb. Gain    | 3.21 | 3.23 | 3.18 | 3.28   | 3.70 | 3.73 | 3.30    |

\* 0.1% added lysine

\*\* 0.1% added lysine and 0.05% methionine

\*\*\* 0.25% added lysine and 0.1% methionine

TABLE 6-VALUE OF ADDING LYSINE TO PRACTICAL RATIONS FOR GROWING-FINISHING HOGS TWO TRIALS COMBINED

| Lot                        | 1     | 2    | 3    | 4*    | 5*   | 6*   |
|----------------------------|-------|------|------|-------|------|------|
| Per Cent Protein           | 16-12 | 16   | 12   | 16-12 | 16   | 12   |
| No. of Pigs                | 20    | 20   | 20   | 20    | 20   | 20   |
| Phase I - 50 to 125 pounds |       |      |      |       |      |      |
| Avg. Daily Gain            | 1.41  | 1.44 | 1.18 | 1.30  | 1.30 | 1.04 |
| Feed/lb. Gain              | 3.08  | 3.08 | 3.58 | 3.21  | 3.20 | 3.63 |

Continued

TABLE 6-CONTINUED

|                              |      |      |      |      |      |      |
|------------------------------|------|------|------|------|------|------|
| Phase II - 125 to 200 pounds |      |      |      |      |      |      |
| Avg. Daily Gain              | 1.64 | 1.43 | 1.71 | 1.64 | 1.57 | 1.53 |
| Feed/lb. Gain                | 3.81 | 4.09 | 3.56 | 3.77 | 3.98 | 3.83 |
| Combined 50 to 200 pounds    |      |      |      |      |      |      |
| Avg. Daily Gain              | 1.52 | 1.44 | 1.42 | 1.47 | 1.43 | 1.26 |
| Feed/lb. Gain                | 3.45 | 3.58 | 3.57 | 3.51 | 3.62 | 3.73 |

\*Rations fed in lots 4, 5 and 6 contained 0.1% added lysine.

TABLE 7-LYSINE SUPPLEMENTS TO PRACTICAL RATIONS  
FOR FINISHING HOGS

| Lot              | 1    | 2    | 3     | 4    |
|------------------|------|------|-------|------|
| Per Cent Protein | 12   | 12L* | 12L** | 14   |
| No. of Pigs      | 10   | 10   | 10    | 10   |
| Initial Wt.      | 123  | 125  | 124   | 135  |
| Final Wt.        | 202  | 205  | 203   | 199  |
| Avg. Daily Gain  | 1.59 | 1.59 | 1.59  | 1.47 |
| Feed/lb. Gain    | 3.86 | 3.98 | 3.97  | 3.98 |

\* .05% lysine added

\*\* .1% lysine added

## PROJECT 355

EFFECT OF LEVEL OF PROTEIN DURING GESTATION  
ON REPRODUCTION OF SOWS AND GILTS

L. F. Tribble and Andrew Monson

Summary

Two trials were completed during the past year on the effect of different levels of protein during gestation on sow performance.

Sows and gilts fed the lower level of protein in both trial performed as well or better than those fed the higher level of protein.

Procedure

Two trials have been completed on the effect of level of protein during gestation on reproduction of sows and gilts.

In the first trial conducted during the summer of 1961, sows and gilts were fed  $1\frac{1}{4}$  and  $\frac{1}{2}$  pounds of a 43% protein supplement plus shelled corn to make a total of 4 pounds of feed per head per day. In the second trial conducted during the winter of 1961-62, a complete mixed ration was fed. Rations containing 12 and 15 per cent crude protein were compared. The ration was fed at the rate of 5 pounds per head per day. In trial 1, red clover pasture was available during the first  $\frac{2}{3}$  of the gestation period. Dry lot was used the last  $\frac{1}{3}$  of the gestation for trial 1 and for all of trial 2.

All sows were taken to the farrowing barn on the 109th day of the gestation period. Treatment from this point until the pigs were weaned was the same for all sows and their litters. Sows and litters were moved to pasture when the pigs were 10-14 days of age. The complete ration containing 15 per cent protein was fed during lactation.

### Results

The results of trial 1 are shown in Table 8 while those for trial 2 are shown in Table 9.

The results do not indicate any difference in sow performance between those fed different levels of protein during gestation in either of the two trials. In both trials sows or gilts fed the lower level of protein performed as well or better than those fed the higher level of protein. There was large variation in performance of the sows within lots and with the small number of sows per lot, it is difficult to draw any conclusions on the results. Sows had received a complete 15 per cent protein ration during the previous lactation and gilts had been fed the same ration prior to breeding and the beginning of the experimental treatment.

TABLE 8-EFFECT OF LEVEL OF PROTEIN DURING GESTATION  
ON SOW PERFORMANCE, TRIAL 1, SUMMER, 1961

| Age                       | Sows            |               | Gilts           |               |
|---------------------------|-----------------|---------------|-----------------|---------------|
|                           | 1 $\frac{1}{4}$ | $\frac{1}{2}$ | 1 $\frac{1}{4}$ | $\frac{1}{2}$ |
| Supplement/Head/Day lbs.  | 1 $\frac{1}{4}$ | $\frac{1}{2}$ | 1 $\frac{1}{4}$ | $\frac{1}{2}$ |
| Number of Sows*           | 8               | 7             | 5               | 5             |
| Avg. Pigs Farrowed/Litter | 9.6             | 10.9          | 8.6             | 10.4          |
| Avg. Birth Wt./Pig        | 3.2             | 2.9           | 2.7             | 2.6           |
| Avg. Pigs Weaned/Litter   | 6.4             | 8.1           | 6.0             | 6.6           |
| Avg. 8 Wk. Wt./Pig        | 38              | 37            | 27              | 27            |

\*Sows farrowing

TABLE 9-EFFECT OF LEVEL OF PROTEIN DURING GESTATION  
ON SOW PERFORMANCE, TRIAL 2, WINTER, 1961-62

| Age                       | Sows |      | Gilts |       |
|---------------------------|------|------|-------|-------|
|                           | 15   | 12   | 15    | 12    |
| Per Cent Crude Protein    | 15   | 12   | 15    | 12    |
| Number of Sows*           | 9    | 8    | 9     | 5     |
| Avg. Pigs Farrowed/Litter | 13.8 | 11.1 | 9.2   | 9.4   |
| Avg. Birth Wt./Pig        | 2.7  | 3.2  | 2.4   | 2.9   |
| Avg. Pigs Weaned/Litter   | 9.2  | 8.5  | 5.8   | 7.2** |
| Avg. 8 Wk. Wt./Pig        | 35   | 38   | 30    | 38.5  |

\*Sows farrowing

\*\*Average of 4 gilts

PROJECT 355

VALUE OF FURAZOLIDONE FOR BROOD SOWS AT FARROWING

L. F. Tribble

Summary

The addition of 300 grams of furazolidone per ton of sow feed did not result in a greater per cent of pigs weaned as compared to sows on the basal ration.

Pigs from sows fed furazolidone at farrowing weighed an average of 3 pounds more at 8 weeks of age and those from gilts fed furazolidone weighed 2 pounds more than pigs from sows and gilts on the basal ration at farrowing.

Baby pig scours were not a problem during the test period.

Procedure

In the spring of 1962 farrowing season alternate sows were placed on feed containing 300 grams of furazolidone per ton at the time they were brought to the farrowing barn on the 109th day of the gestation period while the remainder of the sows received the basal ration. The treatment was continued for 10-14 days after farrowing until sows and pigs were moved to pasture. Sows were turned out of farrowing crates twice daily after farrowing for a 2 hour period and were fed from a self feeder. A total of 27 sows and gilts were used in the trial.

Results

The results are shown in Table 10. Scours were not a problem during this farrowing season thus the effect of furazolidone could not be fully evaluated. There did not appear to be any beneficial effect of the treatment on the livability of the pigs. Pigs from sows fed furazolidone were heavier at weaning at 8 weeks than pigs from sows on the basal at farrowing.

The total benefit from feeding furazolidone were small and more work needs to be done to evaluate this material for brood sows.

TABLE 10-VALUE OF FURAZOLIDONE FOR SOWS AT FARROWING

| Treatment                   | <u>Basal</u> |             | <u>Furazolidone</u> |             |
|-----------------------------|--------------|-------------|---------------------|-------------|
|                             | Sows         | Gilts       | Sows                | Gilts       |
| Number of Sows              | 7            | 6           | 9                   | 5           |
| Avg. Pigs Farrowed/Litter   | 12.8         | 8           | 12.1                | 10.6        |
| Avg. Pigs Weaned/Litter     | 9.6          | 6.2         | 8.5                 | 7.2         |
| <u>Avg. Weaning Wt./Pig</u> | <u>34.6</u>  | <u>32.6</u> | <u>37.5</u>         | <u>34.6</u> |

PROJECT 142

COMPARISON OF ANTHELMINTICS FOR GRAZING LAMBS

C. V. Ross, J. G. Riley, and James Heitmeyer

Three experiments were conducted during the summer of 1962 with the objective of comparing Anthelmintics for grazing lambs under various conditions.

Experiment I

Thiabendazole, Ruelene and fine particle phenothiazine were compared in the first experiment conducted in Carroll County. Texas lambs which has been on pasture for 7 weeks were used in the test. The 1001 lambs weighing approximately 58 pounds were divided at random into three groups and assigned to treatments. All lambs were identified by treatment group with paint brands on their backs and by hog rings used as ear tags at different locations in the ears.

All lambs grazed together on two improved mixed grass-legume pastures. The lambs were rotated between the two fields each time they were treated. Commercial mineral mixture was available free choice to lambs at all times. During the last period, lambs were being started on a complete self fed ration while still on pasture.

Initially all lambs were inspected on the scales when they were being weighed. A group of lambs obtained by taking a random few lambs from several drafts was carefully examined for apparent anemia. Fecal and blood samples were taken from each lamb to obtain an estimate of the level of infection among the lambs.

Since physical appearance, hematocrits and worm egg counts all indicated that there was a high level of infection among the lambs all were drenched at two week intervals throughout the test.

On the day lambs were to be drenched they were sorted into lots, examined carefully, weighed in drafts of 30-40 lambs and approximately 30 lambs sorted off at random from each treatment group. Individual fecal and blood samples were then taken from each of the 30 lambs.

Treatments are shown in Table 11. Results of Experiment I are shown in Table 12.

TABLE 11-TREATMENTS BY GROUPS

| Date Treated | Lot No. | Anthelmintic               | Dosage per Lamb                  |
|--------------|---------|----------------------------|----------------------------------|
| July 23      | 1       | Thiabendazole              | 50 mg/kg body weight             |
|              | 2       | Ruelene                    | 125 mg/kg body weight            |
|              | 3       | Phenothiazine <sup>1</sup> | 1 oz. 40% concentrate per lamb   |
| August 3     | 1       | Thiabendazole              | 50 mg/kg body weight             |
|              | 2       | Ruelene                    | 125 mg/kg body weight            |
|              | 3       | Phenothiazine <sup>1</sup> | 1.5 oz. 40% concentrate per lamb |
| Continued    |         |                            |                                  |

TABLE 11-CONTINUED

|           |   |                            |                                   |
|-----------|---|----------------------------|-----------------------------------|
| August 16 | 1 | Thiabendazole              | 50 mg/kg body weight              |
|           | 2 | Ruelene                    | 125 mg/kg body weight             |
|           | 3 | Phenothiazine <sup>1</sup> | 1 oz. 40% concentrate<br>per lamb |

<sup>1</sup> Particle size guaranteed to pass through a 3-micron screen

TABLE 12-COMPARISON OF ANTHELMINTICS FOR GRAZING LAMBS

| Lots                     | I             | II      | III           |
|--------------------------|---------------|---------|---------------|
| Treatments               | Thiabendazole | Ruelene | Phenothiazine |
| No. of Lambs             | 303           | 360     | 338           |
| <u>Initial</u>           |               |         |               |
| Av. Live Weight (lbs)    | 57.1          | 58.5    | 58.2          |
| Av. Hematocrit (%)       | 28.2          | 26.3    | 25.6          |
| Av. Worm eggs/gm. Feces  | 6500          | 7570    | 7400          |
| <u>Results - 2 Weeks</u> |               |         |               |
| Av. Live Weight (lbs)    | 62.3          | 63.2    | 61.4          |
| Av. Hematocrit (%)       | 31.5          | 34.8    | 28.4          |
| Av. Worm Eggs/gm. Feces  | 1053          | 160     | 1933          |
| Death Loss to Date       | 3             | 5       | 5             |
| <u>Results - 4 Weeks</u> |               |         |               |
| Av. Live Weight (lbs)    | 64.1          | 65.9    | 62.7          |
| Av. Hematocrit (%)       | 29.9          | 34.7    | 26.9          |
| Av. Worm Eggs/gm. Feces  | 2100          | 480     | 1660          |
| Death Loss to Date       | 4             | 7       | 22            |
| <u>Results - 6 Weeks</u> |               |         |               |
| Av. Live Weight (lbs)    | 70.5          | 73.5    | 69.1          |
| Av. Hematocrit (%)       | 24.7          | 34.7    | 22.8          |
| Av. Worm Eggs/gm. Feces  | 1873          | 273     | 2586          |
| Death Loss to Date       | 4             | 8       | 36            |

#### Observations and Discussion

1. In spite of the fact that the pastures had not been used for years for sheep, the infestation apparently was complete in an incredibly short time. By the time the lambs had been on pasture 3 weeks, many lambs were evidently wormy. At the end of 7 weeks many were in critical condition.
2. Lambs in lots treated with Thiabendazole and Ruelene both appeared to be thriftier than those drenched with Phenothiazine. Ruelene lambs appeared to be somewhat the thriftiest of all.
3. Hematocrits of lambs treated with Ruelene at the end of 2 weeks were significantly higher than those treated with Phenothiazine ( $P < .01$ ) and approached significance over those treated with Thiabendazole ( $P = .10$ ). Lambs treated with Thiabendazole and Phenothiazine did not differ significantly.
4. At the end of 4 weeks hematocrits of lambs treated with Ruelene were significantly ( $P < .01$ ) higher than either of the other two treatments. Hematocrits of Thiabendazole lambs were significantly ( $P < .01$ ) higher than those treated with Phenothiazine.

5. Hematocrits of lambs treated with Ruelene were significantly higher ( $P = .025$ ) at 6 weeks than those treated with Thiabendazole and significantly higher ( $< .01$ ) than those treated with Phenothiazine. Thiabendazole and Phenothiazine lambs did not differ significantly.
6. Death loss of lambs treated with Thiabendazole was lowest of any group. Only one lamb died after the first two weeks. A loss of only 4 lambs (1.3%) was considered extraordinary considering the infection level.
7. Ruelene lambs were noticeably cleaner about the nostrils through the test. At the end of the experiment all lambs were examined for purent discharge from their nostrils. The following numbers of lambs had a discharge; Thiabendazole lot -94, Ruelene -36, and Phenothiazine -122.
8. On August 16 at the end of 4 weeks on test, 11 lambs from the Phenothiazine group, which were very anemic and unthrifty, were treated with Ruelene. These lambs were given special marks and were examined at the end of 2 weeks. Nine of the 11 were still alive and most appeared to be much less anemic.
9. Reaction of lambs to the drugs during the after drenching appeared to be much less in lambs drenched with Thiabendazole than to either of the other two. Thiabendazole appears to have an extremely low toxicity.

### Experiment II

Standard Phenothiazine, Thiabendazole, and Ruelene were compared in Experiment II with 32 clipped native lambs. They were placed in outcome groups based on body weights and hematocrits and assigned at random to the three treatments.

The initial hematocrit readings were low and fecal worm egg counts were high indicating the lambs were heavily infected with parasites.

The lambs grazed together for 75 days on newly seeded lespedeza pasture. They were weighed and hematocrits determined biweekly. Fecal worm egg levels were determined at the end of each four weeks. Lambs were drenched initially, at two weeks and at six weeks. Results are shown in Table 13.

TABLE 13-A COMPARISON OF THREE ANTHELMINTICS  
FOR GRAZING LAMBS

| Treatments                     | Standard<br>Phenothiazine <sup>1</sup> | Ruelene <sup>2</sup> | Thiabendazole <sup>3</sup> |
|--------------------------------|--|----------------------|----------------------------|
| No. of Lambs                   | 11                                     | 11                   | 10                         |
| <u>Initial</u>                 |  |                      |                            |
| Av. Weight (lbs)               | 45.7                                   | 44.2                 | 45.6                       |
| Av. Hematocrit (%)             | 21.1                                   | 23.2                 | 21.3                       |
| Av. No. Worm Eggs/gm. of Feces | 3245                                   | 2990                 | 4610                       |
| <u>Results at 4 Weeks</u>      |  |                      |                            |
| Av. Daily Gain (lbs)           | .280                                   | .460                 | .440                       |
| Av. Hematocrit (%)             | 24.5                                   | 33.8                 | 32.1                       |
| Av. No. Worm Eggs/gm. of Feces | 6727                                   | 1644                 | 2210                       |

Continued

TABLE 13-CONTINUED

| <u>Results at 10 Weeks</u> |      |      |      |
|----------------------------|------|------|------|
| Av. Daily Gain (lbs)       | .220 | .370 | .306 |
| Av. Hematocrits (%)        | 24.5 | 28.6 | 30.9 |
| Alive at End of Trial      | 11   | 9*   | 10   |

\*Two lambs died due to accidents.

<sup>1</sup>Treatment initially, at 2 weeks and at 6 weeks, 1 oz. 40% conc. phenothiazine per lamb.

<sup>2</sup>Treatment initially, at 2 weeks and at 6 weeks,  $\frac{1}{2}$  oz. Ruelene (227 mg. active material/cc) per lamb.

<sup>3</sup>Treatment initially, at 2 weeks and at 6 weeks,  $\frac{1}{2}$  oz. Thiabendazole.

#### Observation and Discussion

1. All except one lamb in each group improved in physical appearance and showed an increased hematocrit reading after two weeks on test. Many readings were as much as 10 percentage points higher than initially.
2. The average weight of each group increased throughout the test period indicating all treatments were beneficial.
3. Ruelene lambs had the highest average daily gain followed fairly close by Thiabendazole. Both Ruelene and Thiabendazole were superior to Phenothiazine in average daily gain.
4. In the past hematocrits have been the most sensitive indicator of parasite loads. All three groups showed increased readings after 75 days on test. Phenothiazine lambs increased 3.4%, Ruelene 5.4%, and Thiabendazole increased 9.6%.
5. No deaths resulting from parasitism occurred even though at least one lamb in each group was very weak and anemic at the start of the test. This indicates all three methods of treatment were successful in curbing the parasite infection and halting death losses.
6. At the beginning of the test the lambs were moved from a pasture which had been grazed by sheep for several years to a newly seeded lespedeza pasture which had not been grazed by any sheep at least in the last few years. This data indicates that the change in pasture may also have helped in reducing the level of parasite infection.

#### Experiment III

The objective of the experiment was to compare standard and fine particle Phenothiazine, Ruelene, and Thiabendazole, and one control group which received no treatment for worms at any time during the trial.

One hundred clipped Texas lambs were placed in outcome groups based on body weight and hematocrits. They were then assigned at random to the ten groups of ten lambs each. One group was assigned at random to each of the treatments and turned on a pasture plot where lambs from all treatments grazed together. The common pasture used by the lambs had an area of 4 acres of Sudan Grass. The other groups were assigned at random to the same treatments and put on paddocks by



TABLE 14-COMPARISON OF ANTHELMINTICS FOR GRAZING LAMBS (GROUP)<sup>1</sup>

| Treatments                      | Control        | Standard<br>Phenothiazine   | Fine<br>Phenothiazine       | Thiabendazole | Ruelene       |
|---------------------------------|----------------|-----------------------------|-----------------------------|---------------|---------------|
| No. of lambs                    | 10             | 10                          | 10                          | 10            | 10            |
| dosage                          |                | 1 oz. 40% conc.<br>per lamb | 1 oz. 40% conc.<br>per lamb | 50 mg/kg wt.  | 125 mg/kg wt. |
| <u>Initial</u>                  |                |                             |                             |               |               |
| Av. Wt. (lbs)                   | 60.7           | 62.2                        | 61.2                        | 61.1          | 61.6          |
| Av. Hematocrit (%)              | 37.1           | 37.2                        | 34.3                        | 38.7          | 34.5          |
| Av. No. Worm Eggs/gm. of Feces  | 2910           | 1830                        | 1650                        | 1990          | 1580          |
| <u>Results at 2 weeks</u>       |                |                             |                             |               |               |
| Av. Hematocrits (%)             | 26.6           | 32.8                        | 29.0                        | 33.1          | 31.8          |
| <u>Results at 4 weeks</u>       |                |                             |                             |               |               |
| Av. Daily Gain (lbs)            | .26            | .28                         | .10                         | .20           | .17           |
| Av. Hematocrits (%)             | 28.0           | 27.9                        | 25.9                        | 29.6          | 28.5          |
| Av. No. Worm Eggs/gm. Feces     | 10,860         | 5120                        | 4110                        | 5150          | 3140          |
| <u>Results at 6 weeks</u>       |                |                             |                             |               |               |
| Av. Hematocrits (%)             | 26.0           | 25.3                        | 24.1                        | 30.0          | 29.5          |
| <u>Results at 8 weeks</u>       |                |                             |                             |               |               |
| Av. Daily Gain to Date (lbs)    | .20            | .16                         | .16                         | .18           | .18           |
| Av. Hematocrits (%)             | 22.8           | 26.5                        | 24.3                        | 28.0          | 27.4          |
| Av. No. Worm Eggs/gm. of Feces  | 7360           | 3430                        | 2820                        | 1830          | 1600          |
| No. Lambs Alive at End of Trial | 8 <sup>3</sup> | 10                          | 9 <sup>2**</sup>            | 10            | 10            |

<sup>1</sup>All lambs on all treatments grazed together on a 4 acre sudan pasture.

<sup>2</sup>One lamb died August 28. Diagnosis by Veterinary Clinic showed death due to internal parasites.

<sup>3</sup>Two lambs died in this group. One died on July 29 and one died on August 22. Both were found to be parasite infected and also with evidence of coccidiosis.

TABLE 15-COMPARISON OF ANTHELMINTICS FOR GRAZING LAMBS (PADDOCK)<sup>1</sup>

| Treatments                         | Control | Standard<br>Phenothiazine | Fine<br>Phenothiazine | Thiabendazole | Ruelene |
|------------------------------------|---------|---------------------------|-----------------------|---------------|---------|
| No. of lambs                       | 10      | 10                        | 10                    | 10            | 10      |
| <u>Initial</u>                     |         |                           |                       |               |         |
| Av. Wt. (lbs)                      | 60.1    | 61.2                      | 61.1                  | 61.5          | 60.8    |
| Av. Hematocrits (%)                | 37.4    | 37.4                      | 39.6                  | 37.6          | 35.8    |
| Av. No. Worm Eggs/gm. of Feces     | 1990    | 2260                      | 1370                  | 1520          | 2760    |
| <u>Results at 2 weeks</u>          |         |                           |                       |               |         |
| Av. Hematocrits (%)                | 33.2    | 32.4                      | 32.7                  | 32.3          | 32.5    |
| <u>Results at 4 weeks</u>          |         |                           |                       |               |         |
| Av. Daily Gain (lbs)               | .15     | .07                       | .05                   | .27           | .28     |
| Av. Hematocrits (%)                | 28.3    | 29.9                      | 27.6                  | 28.2          | 32.4    |
| Av. No. Worm Eggs/gm. of Feces     | 4880    | 3880                      | 4000                  | 2000          | 1260    |
| <u>Results at 6 weeks</u>          |         |                           |                       |               |         |
| Av. Hematocrits (%)                | 25.3    | 24.0                      | 25.4                  | 26.9          | 32.5    |
| <u>Results at 8 weeks</u>          |         |                           |                       |               |         |
| Av. Daily Gain to Date (lbs)       | .19     | .09                       | .11                   | .19           | .15     |
| Av. Hematocrits (%)                | 26.6    | 24.9                      | 26.0                  | 27.4          | 31.19   |
| Av. No. Worm Eggs/gm. Feces        | 4060    | 4200                      | 3820                  | 2450          | 1900    |
| No. of Lambs Alive at End of Trial | 10      | 10                        | 10                    | 10            | 10      |

<sup>1</sup>Lambs grazed by group on .8 acre Sudan paddocks.