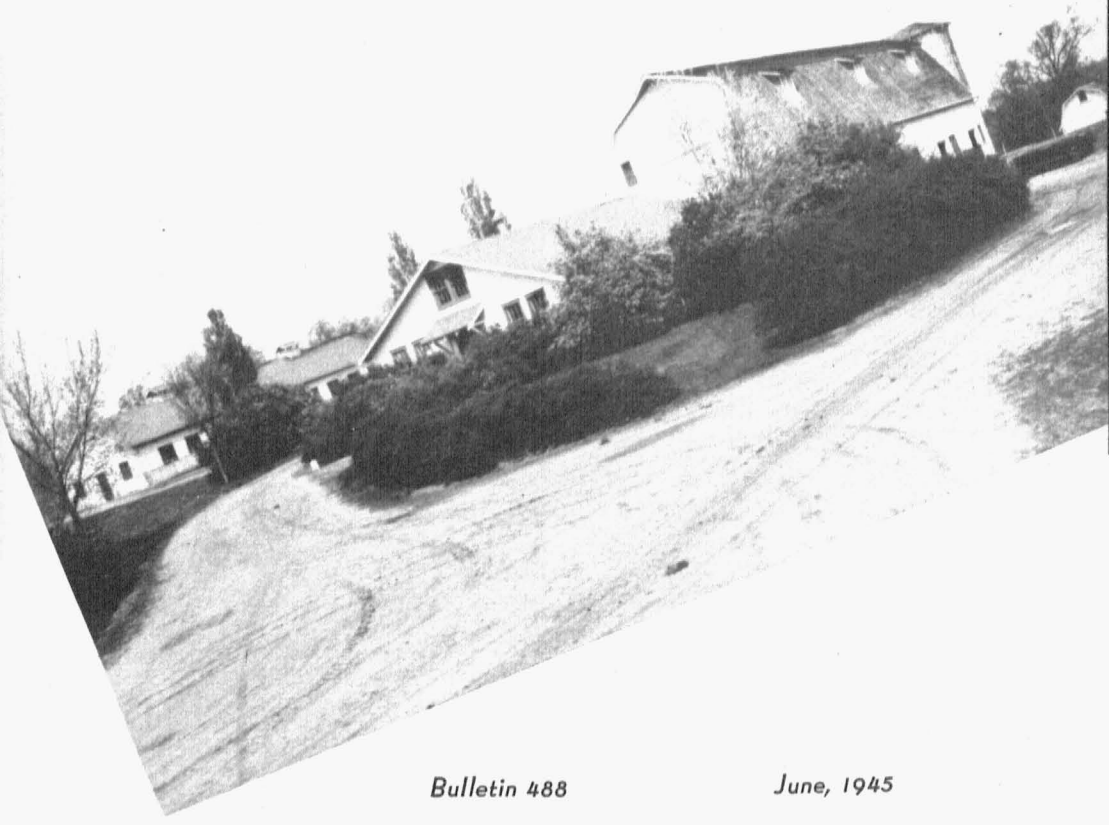
# The Hatch Dairy Experiment Station Farm

C. W. McIntyre and A. C. Ragsdale

M. F. MILLER, Director



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## THIS REPORT AT A GLANCE

# FOREWORD

The Hatch Dairy Experiment Station Farm is located on U. S. Highway 61 one mile south of its junction with U. S. Highway 36 near Hannibal, Missouri. It consists of 114 acres, is the property of the University of Missouri and is used for research and demonstration purposes by the Department of Dairy Husbandry of the College of Agriculture and the Bureau of Dairy Industry, Agricultural Research Administration, United States Department of Agriculture. It was the home of William Henry Hatch, Congressman from Missouri 1878 to 1894, and was bequeathed to the State of Missouri by his daughter, Sarah Rhodes Hatch, on her death in 1923. The development of this farm as a Dairy Experiment Station began in 1929, following appropriations by the Fifty-fifth General Assembly. In 1930 the Congress of the United States provided funds making possible the cooperative investigations conducted since that time.

Mr. Hatch was primarily responsible for the passage of the Federal Hatch Act providing for the establishment of Agricultural Experiment Stations in connection with Colleges of Agriculture. Because of his activity in securing the adoption of this legislation he is known as the "Father of Agricultural Experiment Stations". He was also chiefly responsible for legislation establishing the position of Secretary of Agriculture in the President's Cabinet, the Bureau of Animal Industry, the first national sanitary law to prevent the spread of infectious and contagious diseases of domestic animals, the first oleomargarine law, an act to prevent the adulteration of foods and drugs, the taking of the agricultural census, and more than 50 other bills of far-reaching importance to the agriculture of the United States. It is fitting, therefore, that his home farm be used to aid the improvement of agriculture.

The equipment on the farm includes the original residence of Mr. Hatch and a small cottage, a modern combination dairy house and milking barn unit, a 2-story pen type barn for 32 cows, a calf, young stock and maternity barn, a bull barn, a large hay barn, a machinery shed and other minor buildings. The foundation dairy herd consisted of 21 registered Jerseys, daughters of

three outstanding proved sires. The present herd consists of 75 females including 38 of milk producing age, two herd sires of proved superior merit, 12 young bulls and 35 bulls leased to cooperating farmers.

A. C. Ragsdale, Chairman, Department of Dairy Husbandry, Missouri Agricultural Experiment Station

# Dairy Husbandry Investigations at the Hatch Dairy Experiment Station Farm

A Report 1930-1944

C. W. McINTYRE AND A. C. RAGSDALE*

Research and demonstrations completed or in progress at the Hatch Dairy Experiment Station Farm include:

1. Dairy cattle breeding investigations
2. Feeding experiments
3. Pasture investigations
4. Crop production and cost records
5. Herd management practices
6. Disease prevention and control
7. Soil conservation practices

## DAIRY CATTLE BREEDING INVESTIGATIONS

Twenty-one daughters of three proved sires were selected as the foundation females. The breeding program has been based on the use of sires proved for high production. Complete records, testing under uniform conditions without selection and using the Jersey Herd Classification Program has been the policy with all females kept until at least one lactation record has been made. Sons of the proved herd sires from females of known producing or transmitting ability have been leased to cooperating farmers in order to test their ability to transmit production and type. Some of these young bulls are also offered for sale. The production records of daughters of the sires of foundation animals and of proved sires used in the herd are presented in Table 1.

Since 1933 the Station has leased bulls to cooperating dairy farmers and received breeding and production records on their herds. During the first 10 years, 68 bulls have been leased to 61 farmers with 1131 heifers dropped to the service of 43 of these bulls. Lactation records have been completed on 340 daughters. Seventeen of the leased bulls have 201 daughters with 350 lactation records averaging 6448 pounds of milk and

*A report of cooperative research conducted by the Department of Dairy Husbandry, College of Agriculture, University of Missouri, with the cooperation of J. R. Dawson and R. R. Graves representing the Bureau of Dairy Industry, Agricultural Research Administration, United States Department of Agriculture.

TABLE 1. HERD SIRES USED

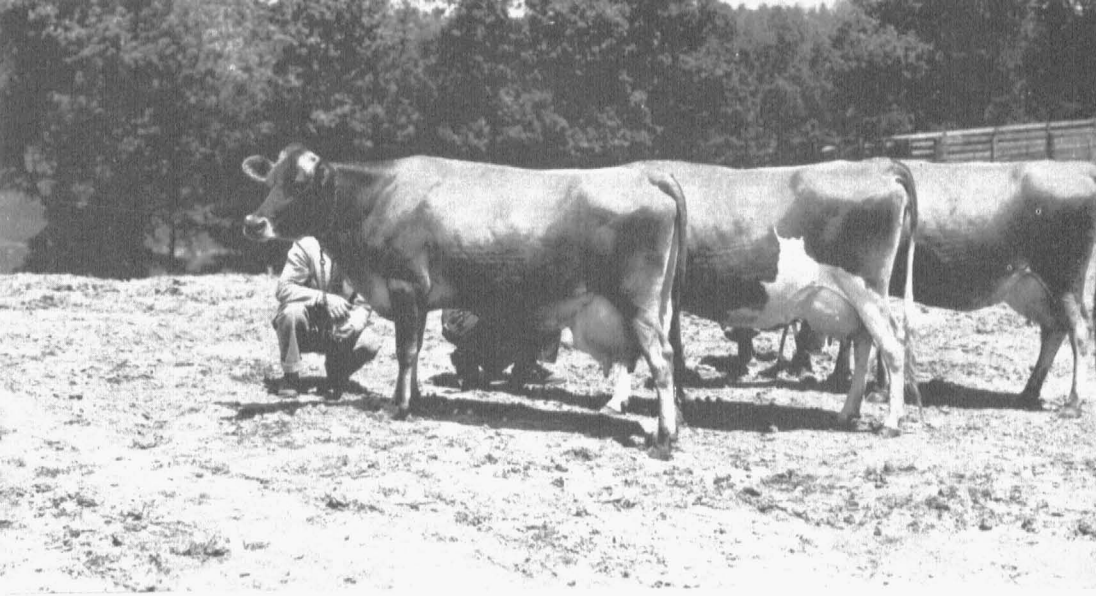
A Comparison of the Records of Their Daughters When Selected (Records Made in the Herd) and All Register of Merit and Herd Improvement Registry Daughters.

(All records calculated to mature equivalent basis for number of days and times milked)

| Sire | No. Daughters | No. Days | Maturity Milk | Maturity Fat | Fat | No. daily Milkings |
|---|---|---|---|---|---|---|
| | | | lbs. | lbs. | lbs. | |
| Fauvic Gamboge Knight 253701 (sire of foundation cows only) | | | | | | |
| Daughters' records when selected (1) | 9 | 299 | 7672 | 5.12 | 393 | 2x |
| Daughters in Hatch Farm herd | 10 | 300 | 8893 | 5.14 | 457 | 2x (2) |
| Daughters in 1942 A.J.C.C. (all in H. F. herd) | 10 | 365 | 11944 | 5.27 | 629 | 3x |
| Raleigh's Orlando 147016 (sire of foundation cows only) | | | | | | |
| Daughters' records when selected | 13 | 305 | 10552 | 4.75 | 501 | 2x & 3x |
| Daughters in Hatch Farm herd | 8 | 301 | 9326 | 4.87 | 454 | 2x (2) |
| Daughters in 1942 A.J.C.C. testing | 26 | 365 | 12138 | 4.66 | 565 | 2x & 3x |
| Avanelle's Forfarshire 220377 (sire of foundation cows & used in the herd) | | | | | | |
| Daughters' records when selected | 11 | 305 | 8692 | 5.92 | 515 | 2x & 3x |
| Daughters in Hatch Farm herd | 7 | 296 | 6881 | 5.86 | 403 | 2x (2) |
| Daughters in 1942 A.J.C.C. testing | 31 | 365 | 10002 | 5.82 | 582 | 2x & 3x |
| Ayredale's Exile 197339 | | | | | | |
| Daughters' records when selected | 6 | 305 | 9366 | 5.27 | 494 | 3x |
| Daughters in Hatch Farm herd | 4 | 301 | 5686 | 5.26 | 299 | 2x (2) |
| Daughters in 1942 A.J.C.C. testing. | 15 | 365 | 9444 | 5.29 | 499 | 3x |
| Lady's Rinda St. Mawes 226037 | | | | | | |
| Daughters' records when selected | 8 | 305 | 12023 | 5.52 | 664 | 3x |
| Daughters in Hatch Farm Herd | 2 | 305 | 7000 | 5.74 | 402 | 2x (2) |
| Daughters in 1942 A.J.C.C. testing | 13 | 365 | 12631 | 5.51 | 696 | 2x & 3x |
| Peggy's Majestic Duke 259690 | | | | | | |
| Daughters' records when selected (1) | 9 | 305 | 8925 | 5.54 | 494 | 2x |
| Daughters in Hatch Farm herd | 32 | 305 | 7596 | 5.42 | 412 | 2x (2) |
| Daughters in 1942 A.J.C.C. testing | 25 | 365 | 9984 | 5.69 | 568 | 2x & 3x |
| Progress Owl's Pilgrim 319668 | | | | | | |
| Daughters' records when selected | 11 | 305 | 10507 | 5.72 | 602 | 2x |
| Daughters in Hatch Farm herd | 37 | 295 | 6428 | 5.55 | 357 | 2x (2) |
| Daughters in 1942 A.J.C.C. testing | 32 | 365 | 9917 | 5.66 | 561 | 2x & 3x |
| Master Owl of Double Owl Hall 369049 | | | | | | |
| Daughters' record when selected (1) | 17 | 305 | 7223 | 5.73 | 414 | 2x |
| No daughters in Hatch Farm herd with completed records or in Register of Merit. | | | | | | |
| Forfarshire Fauvic Prize 381739 | | | | | | |
| Daughters' records when selected (1) | 10 | 305 | 8759 | 5.74 | 503 | 2x |
| All daughters to date (1) | 17 | 305 | 8450 | 5.56 | 470 | 2x |
| No daughters in the Hatch Farm herd with completed lactations. | | | | | | |

(1) Dairy Herd Improvement Association records
(2) Records made on 3x milking for some daughters, corrected to 2x.

Forfarshire Fauvic Prize, sired by Avanalle's Forfarshire and out of a daughter of Fauvic's Gamboge Knight was proved in a cooperator's herd and returned for use in the Station herd. Apparently there had been considerable selection in the daughters of Progress Owl's Pilgrim since only 11 of 38 daughters were tested.



Three daughters of Avanelle's Forfarshire 220377. These three foundation cows have Register of Merit records averaging at 4 years of age, 10,298 pounds milk containing 613.8 pounds of fat in 365 days. Thirty-one Register of Merit daughters in 365 days averaged 10,002 pounds milk and 582 pounds fat, milked twice and three times a day.

357 pounds of fat (test 5.52%). The 186 dams with 696 lactations averaged 6323 pounds of milk and 331 pounds of fat (test 5.21%). The daughters averaged 125 pounds milk and 26 pounds of fat more than their dams with an increase of 0.31 per cent in butterfat test. One hundred twenty-eight daughters exceeded their dams. Ten of the sires increased production, 5 showed small decreases and 2 lowered production materially.

The Station herd averaged 7181 pounds milk and 390 pounds fat with a 5.43% test, 1932 to 1944 inclusive. Register of Merit testing was started in December, 1931 and Herd Improvement Registry testing January 1, 1933.

## FEEDING EXPERIMENTS

### Milk Production on Roughage without Grain

A long time program has been established to compare various methods of feeding for milk production with emphasis on the production and utilization of high quality roughages.

Four cows with 10 lactations on a roughage ration of alfalfa hay, silage and pasture, with the cows having access to a mixture of equal parts of bonemeal and salt at all times, produced 85% as much milk and 80% as much fat as they averaged in 18 prior lactations on a full grain ration. On a 305 day mature equivalent, twice a day milking basis the production on full grain averaged

7897 pounds of milk and 400 pounds of fat, with an average test of 5.07%. On the roughage ration the average production was 6714 pounds milk and 321 pounds fat with a 4.78 per cent fat test. It will be observed that the fat test was slightly lowered on the roughage ration. The rate of decline in production with advancing lactation was more rapid in the roughage group. The loss in body weight of the cows on the roughage ration averaged 136 pounds per cow more than when on full grain ration. Breeding efficiency was not affected. The feed cost of producing milk was 60 per cent as much as when on a full grain ration. The rate of feeding grain was 1 pound for each 3 pounds of milk on the full grain ration.

**Milk Production on a Low Grain Ration**

Nine cows were fed a ration of alfalfa hay, silage and low grain. The rate of grain feeding was 1 pound for each 6 pounds of milk for the first two months of lactation, 1 to 8 for the third and fourth months, 1 to 10 for the fifth and sixth months, 1 to 12 for the seventh and eighth months, and no grain for the ninth to twelfth months. The average was 1 pound of grain for each 8.5 pounds of milk produced. The average production was 5669 pounds milk and 320 pounds of fat with an average test of 5.33 per cent. In 20 previous lactations these cows averaged 6688 pounds of 5.54 per cent milk and 371 pounds butterfat. The average production on the low grain ration was 84.8 per cent as much milk and 81.4 per cent as much fat as on the full grain ration. The fat test was lowered. The loss in body weight averaged 59 pounds more than when on full grain.

Two groups of six cows each were fed grain at different levels for one 305-day lactation. Group I received 1 pound of grain for each 6 pounds of milk during the lactation and produced 7057 pounds milk containing 385 pounds fat, which was 90 per cent as much as this group produced on the average in the preceding lactation. Group II received 1 pound of grain for each 3 pounds of milk during the first 100 days of their lactation; 1 pound to each 6 pounds of milk during the second 100 days and no grain during the remainder of the lactation. This group averaged 6503 pounds milk containing 371 pounds fat, which was 86 per cent as much as they produced during the preceding lactation. There was no significant difference in the total production of the two groups that could be attributed to the difference in the rate of grain feeding. Grain feeding at the Group I rate throughout the lactation was the more efficient.

## Corn vs. Mixed Grain Feeding

Eight cows were fed a basal ration of alfalfa hay and alfalfa-molasses silage. Four were fed yellow corn and the others a mixed grain feed, both at the rate of 1 pound of grain for each 6 pounds of milk produced. The corn was ground medium fine and 2.5 pounds of salt and 1.5 pounds of steam bone meal were added to each 100 pounds of corn. The mixed grain ration contained 1200 pounds of ground yellow corn, 900 pounds of ground oats, 600 pounds wheat bran, 300 pounds of lineseed oil meal, 100 pounds of cottonseed oil meal, 200 pounds of soybean oil meal, 60 pounds of salt and 60 pounds of steamed bone meal. It contained 13.6 per cent digestible crude protein and 75.9 per cent total digestible nutrients. Cows in each group received 6 pounds daily of a mixed grain during their dry periods preceding the experimental lactation.

The 8 cows were from 3 to 6 years of age and each had one or more previous lactations on the regular herd ration. The production and feed consumption records of the cows fed the mixed grain ration are given in Table 2 and the corresponding data for the single grain-corn group are presented in Table 3.

TABLE 2. MIXED GRAIN GROUP
(Lactations prior to experimental lactation)

| Cow No. | No. Lactations | Avg. Age | Avg. Days | Actual Milk | Actual Fat % | Actual Fat | Mature Equivalent 305 day 2x milking Milk | Mature Equivalent 305 day 2x milking Fat | Hay | Silage | Grain | Days Pasture | Milk-grain Ratio | Days Carried Calf |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Yr. mo. | | lbs. | | lbs. | lbs. | lbs. | lbs. | lbs. | lbs. | | | |
| 61 | 3 | 3-3 | 362 | 8428 | 5.98 | 504 | 7388 | 440 | ad lib. | 4826 | 2867 | 48 | 2.94 | 229 |
| 90 | 1 | 2-1 | 365 | 6943 | 5.51 | 424 | 6943 | 375 | " | 4676 | 2613 | 45 | 2.94 | 225 |
| 62 | 3 | 3-11 | 350 | 8000 | 6.07 | 484 | 6511 | 391 | " | 2828 | 2750 | 44 | 2.91 | 206 |
| 65 | 2 | 3-6 | 356 | 7632 | 6.05 | 462 | 6476 | 385 | " | 5065 | 2531 | 41 | 3.02 | 224 |
| Avg. | 9 | 3-2 | 358 | 7938 | 5.91 | 469 | 6830 | 398 | ad lib. | 4849 | 2690 | 44.5 | 2.95 | 219 |
| | | | | Experimental Lactation on Mixed Grain | | | | | | | | | | |
| 61 | 1 | 5-8 | 365 | 9705 | 5.74 | 557 | 7648 | 436 | 9305 | 6692 | 1673 | -- | 5.80 | 220 |
| 90 | 1 | 3-3 | 341 | 8021 | 5.75 | 461 | 7635 | 439 | 8610 | 6078 | 1401 | -- | 5.73 | 219 |
| 62 | 1 | 6-2 | 308 | 6074 | 5.75 | 349 | 6047 | 347 | 8165 | 3854 | 1061 | -- | 5.72 | -- |
| 65 | 1 | 5-8 | 365 | 8688 | 6.30 | 547 | 7139 | 397 | 9676 | 5812 | 1538 | -- | 5.65 | -- |
| Avg. | 4 | 5-3 | 345 | 8122 | 5.90 | 479 | 7117 | 405 | 8939 | 5609 | 1418 | -- | 5.73 | 110 |
| | | | | Lactation on full mixed ration following experimental lactation | | | | | | | | | | |
| 61 | 1 | 6-11 | 365 | 7841 | 5.74 | 450 | 7240 | 412 | ad lib. | 5030 | 2889 | 91 | 2.72 | 213 |
| 90 | 1 | 4-5 | 305 | 7544 | 5.61 | 423 | 7921 | 444 | " | 4994 | 2511 | 48 | 2.00 | 217 |
| 62 | | no record | | | | | | | | | | | | |
| 65 | | no record | | | | | | | | | | | | |
| Avg. | 2 | 5-8 | 335 | 7693 | 5.68 | 437 | 7581 | 428 | ad lib. | 5024 | 2700 | 70 | 2.85 | 215 |

The mixed grain group averaged 6830 pounds of 5.91% milk and 398 pounds of butterfat in 9 lactations prior to the start of this experiment. When fed mixed grain at the rate of 1 pound of grain for each 6 pounds of milk they averaged 7117

pounds of 5.90% milk and 405 pounds of fat, or 104.1% as much milk and 101.8% as much fat. Two cows had later lactations which averaged 7581 pounds milk and 428 pounds fat as compared with 7592 pounds milk and 438 pounds fat on the experi-

TABLE 3. SINGLE GRAIN (CORN) GROUP
(Lactations prior to experiment lactation)

| Cow No. | No. lactations | Avg. Age | Avg. Days | Actual Milk | Actual Fat % | Actual Fat | Mature Equivalent 305 day 2x milking Milk | Mature Equivalent 305 day 2x milking Fat | Hay | Silage | Grain | Days Pasture | Milk-grain Ratio | Days Carried Calf |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Lbs. | % | lbs. | lbs. | lbs. | lbs. | lbs. | lbs. | | | |
| 75 | 2 | 2-11 | 328 | 7449 | 5.53 | 412 | 6841 | 395 | ad lib. | 4092 | 2583 | 41 | 2.88 | 228 |
| 78 | 1 | 2-10 | 365 | 8890 | 5.48 | 487 | 7783 | 420 | ad lib. | 5000 | 3090 | 33 | 2.88 | 220 |
| 83 | 1 | 2-4 | 365 | 6477 | 6.16 | 399 | 5968 | 360 | " | 5050 | 2419 | 32 | 2.68 | 220 |
| 84 | 1 | 2-0 | 365 | 7429 | 5.38 | 400 | 6811 | 362 | " | 5068 | 2654 | 32 | 2.80 | 197 |
| Avg. | 5 | 2-6 | 356 | 7561 | 5.62 | 425 | 6851 | 384 | ad lib. | 4803 | 2687 | 35 | 2.81 | 216 |
| Experimental lactation, corn only grain at 1:6 | | | | | | | | | | | | | | |
| 75 | 1 | 4-6 | 327 | 7393 | 5.57 | 423 | 6922 | 386 | 9148 | 4704 | 1323 | -- | 5.74 | 219 |
| 78 | 1 | 4-1 | 357 | 7150 | 5.76 | 412 | 6114 | 357 | 9896 | 4792 | 1265 | -- | 5.65 | 219 |
| 83 | 1 | 3-7 | 365 | 5434 | 6.35 | 345 | 4602 | 292 | 9324 | 5520 | 972 | -- | 5.59 | 230 |
| 84 | 1 | 3-7 | 365 | 9486 | 5.44 | 516 | 8171 | 441 | 9235 | 5480 | 1659 | -- | 5.72 | 222 |
| Avg. | 4 | 3-11 | 354 | 7416 | 5.72 | 424 | 6452 | 369 | 9401 | 5124 | 1305 | -- | 5.68 | 223 |
| First lactation on full grain feed, mixed grain following single grain | | | | | | | | | | | | | | |
| 75 | 1 | 5-7 | 321 | 7353 | 5.32 | 391 | 7154 | 380 | ad lib. | 4517 | 2470 | 65 | 2.98 | 218 |
| 78 | 1 | 5-3 | 325 | 5536 | 5.69 | 315 | 5416 | 309 | " | 4307 | 2238 | 75 | 2.47 | 218 |
| 83 | 1 | 4-10 | 312 | 5068 | 6.16 | 312 | 5148 | 316 | " | 3471 | 1979 | 63 | 2.56 | 218 |
| 84 | 1 | 4-9 | 318 | 8482 | 5.04 | 427 | 8516 | 430 | " | 3575 | 2703 | 63 | 3.04 | 218 |
| Avg. | 4 | 5-11 | 319 | 6610 | 5.46 | 361 | 6559 | 359 | ad lib. | 3968 | 2370 | 66.5 | 2.79 | 218 |

mental ration, which compares with 7151 pounds milk and 408 pounds fat in their lactations prior to the experimental ration.

The four cows fed corn averaged 6851 pounds of 5.62% milk and 384 pounds of fat in five lactations prior to the start of the experiment. They averaged 6452 pounds of 5.72% milk and 369 pounds of fat, or 96.1% as much fat as when fed corn at the rate of 1:6. In their following lactations they averaged 6559 pounds of 5.46% milk and 359 pounds of fat or 93.4% as much as in their lactations prior to the experimental ration. The difference in the response of cows No. 83 and 84 cannot be explained by any external conditions of the experiment.

The actual protein intake by each group far exceeded their needs for maintenance and the amount of milk produced. The single grain group consumed a small amount more total digestible nutrients than they required but the mixed grain group consumed slightly less than enough to meet their requirements.

The single grain group lost 13 pounds body weight while on the experiment and the mixed grain group lost 82 pounds each. The butterfat test of each cow was slightly higher when fed the corn ration than during the previous lactations. The test dropped

again in the following lactations on full feeding of the mixed ration. The mixed grain group was not affected.

It is concluded that alfalfa hay, silage and yellow corn, supplemented with salt and bonemeal, will supply sufficient nutrients for relatively high milk and butterfat production. Under the conditions of this experiment, production was not significantly affected by the use of corn as compared with a mixed ration containing a variety of protein supplements.

### Condensed Whey in the Dairy Ration

Some trouble was experienced with ketosis in the dairy herd in 1941, which disappeared after 1 pound of molasses per cow per day was added to the legume silage fed. Condensed whey was substituted for molasses in the ration. One group of 15 cows received ¼ pound of whey solids daily; a second group of 13 cows ½ pound daily; and a third group of 14 cows was used as a check group. No ketosis appeared in any of the groups. There was an indication of slightly greater production in the whey fed groups but the differences were small and since the groups selected were not balanced for production the difference is not considered significant, but further investigation seems desirable.

### Condensed Whey Calf Feed

Four bull calves were placed on a ration of equal parts of condensed whey (60% solids) and soybean oil meal in addition to alfalfa hay and grain. Four others were used as a check group and received the same hay and grain but skim milk instead of the whey and soybean oil meal mixture. Skim milk was fed at the rate of 1 pound daily for each 10 pounds body weight, up to 15 pounds each day.

The calves were from 46 to 74 days of age when started on the whey feed, and averaged 60 days of age. The whey mixture was substituted for skim milk at the rate of 1 pound of the mixture for each 6 pounds of skim milk or 2.5 pounds daily to each calf above 150 pounds body weight. The whey was purchased in barrels. When removed from the barrels for feeding it was of a thick, mush-like consistency which mixed readily with the soybean meal. The mixture was dry when fed. Both groups were fed alfalfa hay and the calf grain *ad libitum*. Water was available in the calf pens at all times.

The whey fed calves averaged 97 pounds in weight at 60 days and 302 pounds at 180 days of age (Table 4) and gained 205 pounds in 120 days or 1.71 pounds daily. The check group aver-

aged 115 pounds at 60 days and 319 pounds at 180 days of age. They gained 204 pounds in 120 days, an average of 1.70 pounds daily. The average for all bull calves raised in the herd under similar conditions was a gain of 226 pounds from 111 pounds at 60 days to 327 pounds at 180 days of age, or 1.88 pounds daily.

The feed consumption of the two groups is shown below.

| | Whole milk | Skim milk | Grain | Whey feed | Hay | Cost* |
|---|---|---|---|---|---|---|
| | lbs. | lbs. | lbs. | lbs. | lbs. | |
| 4 calves on whey feed | 126 | 318 | 648 | 260 | ad lib. | $33.62 |
| 4 calves on skim milk | 144 | 1625 | 530 | -- | ad lib. | 46.12 |

*Feed cost does not include hay. Prices used are actual cost of feeds used.

Comparing the feed consumption of the two groups of calves, we find that 260 pounds of the whey feed and 116 pounds of grain replaced 1307 pounds of skim milk and 18 pounds of whole milk. Roughly, 1 pound of grain and 2 pounds of whey feed replaced 11 pounds of skim milk. Thus, if skim milk is not worth more than 78 cents per hundred pounds, with whey at 3:5 cents per pound, whey would not be more economical than skim milk.

The cost of feeding the check group was $46.12 each, exclusive of hay, for 180 days and the whey fed group, $33.62. The whey fed group cost $12.50 less for the 120 days of the experimental feeding period, or 10.4 cents per calf per day. The rations were the same prior to the experimental periods. The calves were in good condition at 6 months of age and brought $13.25 per hundred on the St. Louis market for veal. The top price for beef type veal calves that day was $15.75.

TABLE 4. AVERAGE WEIGHTS AND GAIN -- ALL BULL CALVES.

| Age | Whey Fed Calves (4) Weight | Gain | Check Group, Skim milk (4) Weight | Gain | All Calves, Skim milk (35) Weight | Gain |
|---|---|---|---|---|---|---|
| days | lbs. | lbs. | lbs. | lbs. | lbs. | lbs. |
| 0 | 57 | -- | 60 | -- | 59 | -- |
| 20 | 66 | 9 | 69 | 9 | 70 | 11 |
| 40 | 82 | 16 | 88 | 19 | 87 | 17 |
| 60 | 97* | 25 | 115 | 27 | 111 | 24 |
| 80 | 117 | 20 | 144 | 29 | 140 | 29 |
| 100 | 144 | 27 | 173 | 29 | 173 | 33 |
| 120 | 178 | 34 | 208 | 35 | 209 | 36 |
| 140 | 217 | 39 | 249 | 41 | 249 | 40 |
| 160 | 261 | 44 | 277 | 28 | 291 | 42 |
| 180 | 302 | 41 | 319 | 42 | 327 | 36 |

*Started feeding the whey-soybean oil meal mixture.

Condensed whey, 60 per cent solids, and soybean meal, equal parts by weight, when supplemented with alfalfa hay and grain, may be used as a substitute for skim milk for feeding dairy calves over 60 days of age and produces satisfactory growth. It will be economical to feed only when 22 pounds of whey is worth less than 100 pounds of skim milk.

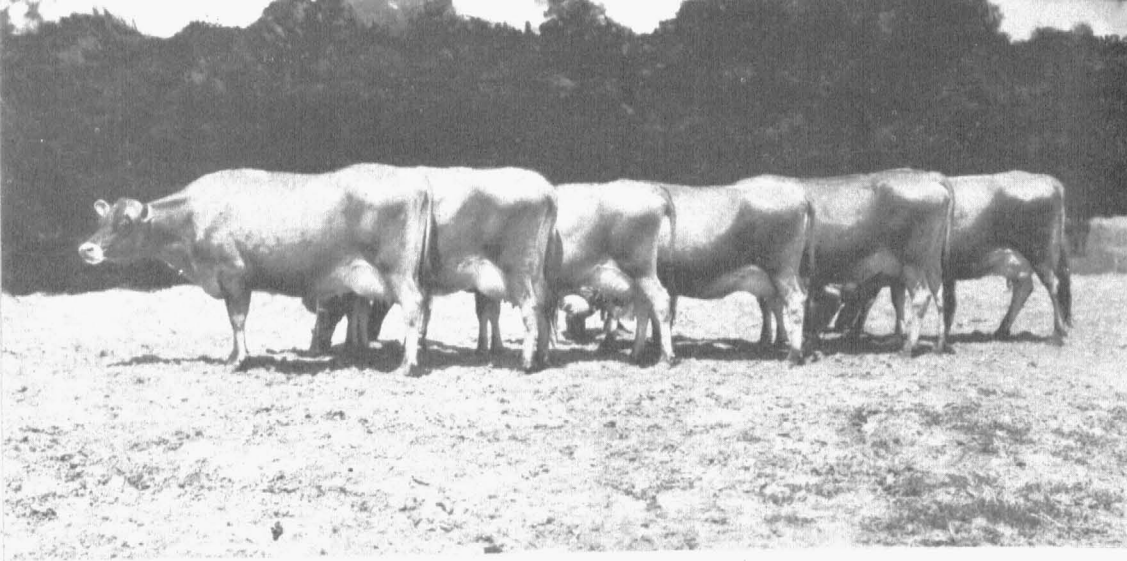
## PASTURE INVESTIGATIONS

### Pastures

The Station farm is located on rolling Menfro silt loam (formerly classified Memphis) soil which will grow excellent blue grass. In 1930 much of the blue grass pasture was overgrown with weeds and some berry vines, so that the yield was relatively small. This area was mowed two or three times annually and a heavy application of manure made each year. All pastures except in the wooded area were well sodded with blue grass by the spring of 1933. Some of the blue grass made a growth 30 inches in height. The pastures were cross fenced in 1935 to permit rotational grazing. Various seedings of legumes and other pasture crops were made in the blue grass pastures in an attempt to increase the pasture yield.

**Alfalfa-Blue Grass Pasture.**—In September, 1936, 8.2 acres of pasture were limed with 20 tons of hydrator tailings (screenings from quick lime) in one field where 75 per cent of the stand of blue grass was lost in the drouths of 1934 and 1936. This fine material is well disseminated in the soil, is quickly available and probably as effective as nearly double the amount of ground limestone. Alfalfa was seeded at the rate of 10 pounds per acre after the field was double disked and springtooth harrowed. The seeding was late and the crop winter killed. The field was reseeded on April 10, 1937. A 30 per cent stand was obtained from this seeding. The alfalfa lengthened the pasture season and the yield was 122 per cent as much as the yield of unseeded blue grass pasture in adjacent areas. The increase was due to greater growth of the blue grass as well as to the presence of the alfalfa. The alfalfa persisted in the field for six pasture seasons.

**Lespedeza.**—Korean lespedeza was sown at the rate of 10 pounds per acre on approximately 10 acres of blue grass pasture for three seasons. It has persisted and grown well in areas not covered with blue grass except it has not produced much pasturage in shaded areas.



Six daughters of Raleigh's Orlando 147016. Seven Register of Merit daughters in the Hatch Farm Experiment Farm herd, at 2 years, 6 months of age, averaged 10,295 pounds milk containing 514.88 pounds fat. Twenty-six daughters averaged 12,138 pounds milk and 565 pounds fat, milked twice and three times a day, mature equivalent.

**Sweet Clover.**—Sweet clover was broadcast in February in wooded and unsodded pasture in 1932 and 1933. There has been some sweet clover every year since but it has not produced any appreciable amount of pasture and has not increased the stand by reseeding itself.

**Orchard Grass.**—Orchard grass was broadcast in shaded and timbered areas of the pastures in 1932 and 1933. There has been a small but steady increase in the amount of orchard grass in the wooded pasture, but by 1944 was not yet producing enough feed to be measurable.

**Crimson Clover.**—Crimson clover was seeded with barley between corn rows in the fall of 1933. It made a good growth the next spring and was ensiled with the barley. Crimson clover was seeded in blue grass pasture with a disk drill in the fall of 1937, 1938 and 1939. There was not enough rainfall in the fall of 1937 to start the crop. A good stand was secured in 1938 and 1939 but dry weather late in the fall destroyed it.

**Ladino Clover.**—Approximately one-half acre of Ladino clover was seeded in August in one of the bull pastures. It persisted for two pasture seasons and produced a very heavy growth of clover. It was reseeded in April, 1943 and has persisted three pasture seasons.

**Cultivated Pastures.**—Barley or barley and wheat were seeded for pasture after the harvesting of corn for silage in 1934, 1935 and 1936. The cost of seed bed preparation and seeding varied from $1.91 to $2.61 per acre. Seeding was at the rate of 2.0 to 2.5 bushels per acre, either in September or early October. The

fields were manured during the winter. These crops yielded from 17 to 92 cow days (24 hours) of pasture per acre. The earlier seedings produced most. The crop was valuable as a cover crop to control erosion, particularly when double drilled. The value of the feed replaced by an acre of this pasture was over $15.00 when seeded in September but only $4.00 when seeded in October.

### Fertilization of Blue Grass Pastures

Forty plots of 0.01 acre each were permanently marked on a reasonably level, unshaded and well sodded portion of the blue grass pasture. The plots were in four rows or series of 10 plots each. The two center rows were fenced and the first and fourth rows left unfenced to permit grazing by cattle in the pasture. The 20 plots in the fenced area were clipped to determine yields and composition of the grass.

**The fertilizer treatment and layout of the experimental plots are shown in diagram on pages 16 and 17.**

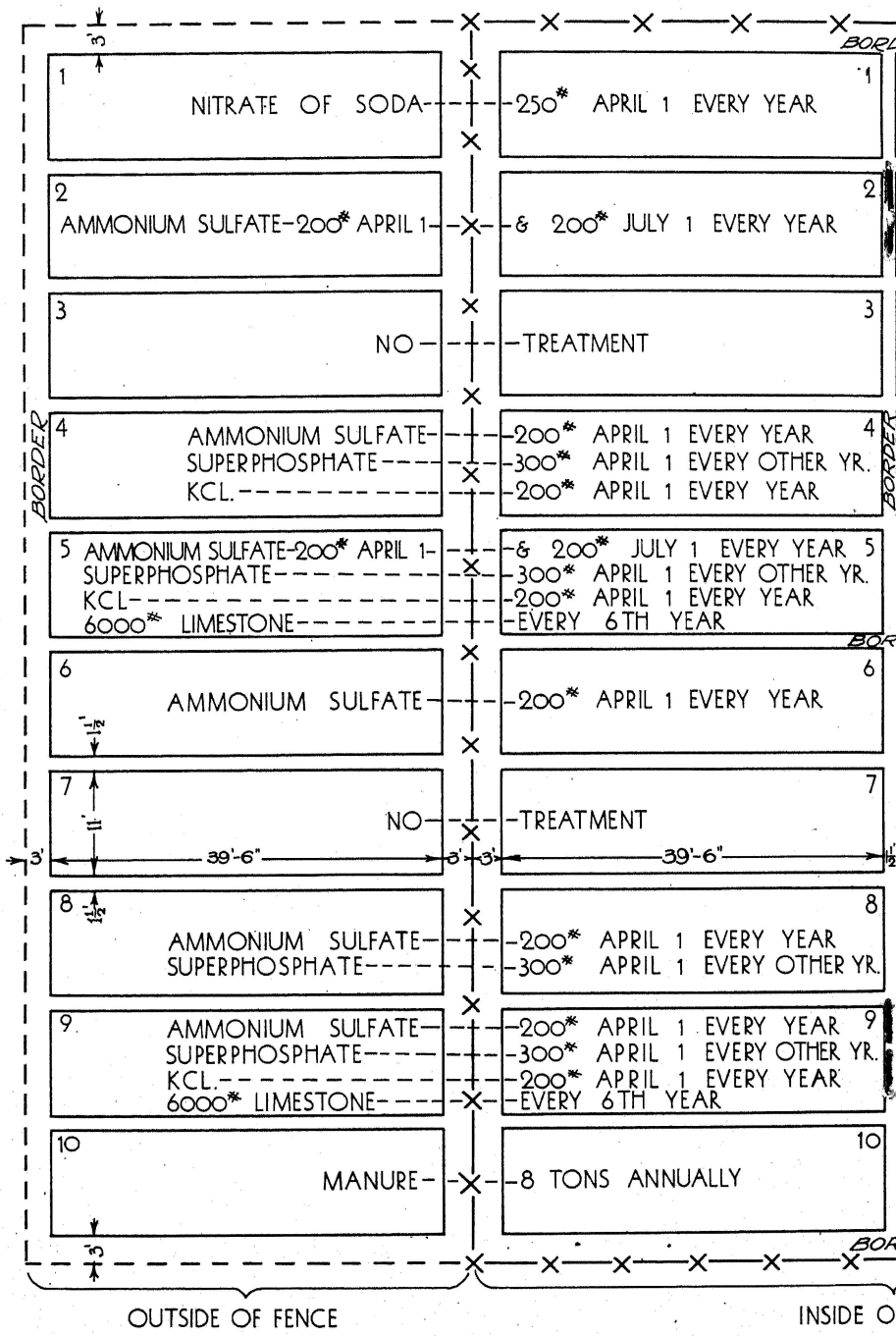
The treatments were made as outlined from 1933 to 1939, except that no ammonium sulphate was applied on July 1, 1938 and 1939. The manure was applied in April of 1933, 1934, 1935 and 1936 and during the early winter of 1937, 1938 and 1939.

**Weather Conditions.**—Normal rainfall for the county is 34.01 inches annually. The normal mean temperature varies from a low of 27.1° in January to 76.8° in July. Rainfall was deficient the last half of 1933 and the summer of 1934, very deficient in 1936 and low in 1937. It was above normal in 1935, 1938 and 1939. The temperature was above normal in 1933, 1936 and the winter and spring of 1939. The 1933, 1934, 1936 and 1937

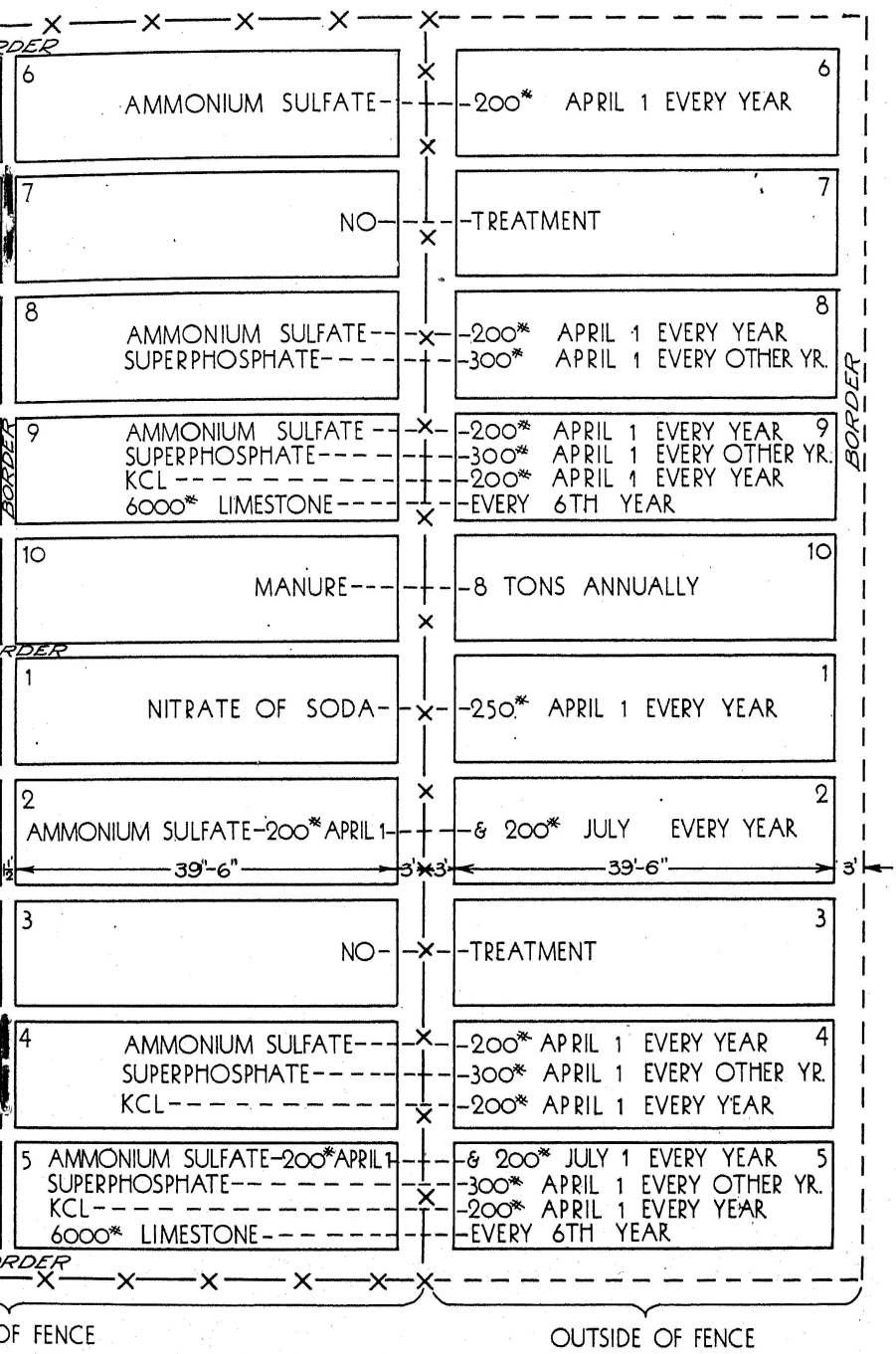
TABLE 5. ANNUAL YIELD (pounds per acre)

| Plot No. | 1933 | | 1934 | | 1935 | | 1936 | | 1937 | | 1938 | | 1939 | | Average Annual | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Green | Dry | Green | Dry | Green | Dry | Green | Dry | Green | Dry | Green | Dry | Green | Dry | Green | Dry |
| 1 | 7120 | 2455 | 2490 | 1005 | 10745 | 2590 | 2300 | 930 | 7400 | 1860 | 4305 | 1665 | 5105 | 2170 | 5638 | 1811 |
| 2 | 6770 | 2410 | 3645 | 1445 | 12265 | 2855 | 2900 | 1260 | 8870 | 1995 | 3960 | 1445 | 6135 | 2260 | 6364 | 1953 |
| 3 | 4025 | 2180 | 2015 | 895 | 7355 | 1925 | 1615 | 670 | 6280 | 1555 | 5155 | 2115 | 3585 | 1600 | 4290 | 1563 |
| 4 | 7305 | 2670 | 3315 | 1320 | 11470 | 2510 | 3135 | 1045 | 9625 | 1830 | 4600 | 1835 | 5415 | 2135 | 6409 | 1906 |
| 5 | 6280 | 2525 | 2740 | 1040 | 14190 | 2640 | 2915 | 1170 | 10065 | 2470 | 5395 | 2210 | 8020 | 2940 | 7086 | 2142 |
| 6 | 4820 | 2085 | 2620 | 1205 | 10365 | 2505 | 1930 | 980 | 6100 | 1715 | 3790 | 1570 | 4765 | 2160 | 4912 | 1746 |
| 7 | 3080 | 1790 | 2170 | 1155 | 7095 | 2170 | 1435 | 655 | 5090 | 1510 | 3690 | 1640 | 3800 | 1790 | 3766 | 1530 |
| 8 | 4795 | 1950 | 3135 | 1220 | 11480 | 2465 | 3200 | 1125 | 7540 | 1705 | 3215 | 1335 | 4725 | 2045 | 5442 | 1692 |
| 9 | 6660 | 2160 | 2265 | 970 | 11015 | 2365 | 3425 | 945 | 7010 | 1740 | 3665 | 1535 | 4280 | 1845 | 5466 | 1651 |
| 10 | 5630 | 3325 | 3595 | 1915 | 12510 | 2905 | 2220 | 1235 | 8560 | 2580 | 7455 | 2925 | 8825 | 3650 | 6971 | 2648 |
| Avg. All Plots | 5634 | 2355 | 2799 | 1217 | 10849 | 2493 | 2508 | 1002 | 7654 | 1896 | 4523 | 1828 | 5466 | 2260 | 5634 | 1864 |

# PLAN FOR FERTILIZER TREATM
# THE HATC



# MENT OF PASTURE PLOTS
# CH STATION



seasons were deficient in rainfall for the best growth of blue grass.

**Discussion.**—The yields of green and dry hay annually by each plot (Table 5) varied widely from year to year as well as between plots. The distribution and amount of rainfall greatly affected the yield of herbage. A summary of the chemical analyses is shown in Table 6.

TABLE 6. AVERAGE COMPOSITION OF AIR DRY HAY FROM EACH PLOT

COMPOSITION ON AN AIR DRY BASIS

| Plot No. | Moisture | Ash | Protein | Ether Extract | Crude Fiber | Nitrogen free Ext. | Phosphorus | Calcium |
|---|---|---|---|---|---|---|---|---|
| | % | % | % | % | % | % | % | % |
| 1 | 7.37 | 11.56 | 11.60 | 1.93 | 27.42 | 40.58 | 0.258 | 0.637 |
| 2 | 7.31 | 10.71 | 12.39 | 1.90 | 27.72 | 39.99 | 0.254 | 0.570 |
| 3 | 7.52 | 12.61 | 10.08 | 1.87 | 26.25 | 41.66 | 0.283 | 0.768 |
| 4 | 7.07 | 13.25 | 12.42 | 2.09 | 25.12 | 40.01 | 0.328 | 0.677 |
| 5 | 7.38 | 14.03 | 11.69 | 1.92 | 25.70 | 39.22 | 0.306 | 0.897 |
| 6 | 7.14 | 12.52 | 11.54 | 1.88 | 26.53 | 40.38 | 0.234 | 0.622 |
| 7 | 7.25 | 12.17 | 9.38 | 1.82 | 27.35 | 42.03 | 0.218 | 0.698 |
| 8 | 7.52 | 12.21 | 12.20 | 2.10 | 25.75 | 40.21 | 0.316 | 0.638 |
| 9 | 7.41 | 14.84 | 12.34 | 2.12 | 24.19 | 39.14 | 0.330 | 0.944 |
| 10 | 7.16 | 13.40 | 10.67 | 1.84 | 27.69 | 39.26 | 0.332 | 0.784 |

AVERAGE YIELDS PER ACRE

| Plot No. | Dry Hay | Dry Matter | Ash | Protein | Ether Extract | Crude Fiber | Nitrogen-free Extract | Phosphorus | Calcium |
|---|---|---|---|---|---|---|---|---|---|
| | lbs. | lbs. | lbs. | lbs. | lbs. | lbs. | lbs. | lbs. | lbs. |
| 1 | 1811 | 1678.4 | 209.3 | 210.1 | 34.87 | 496.6 | 734.7 | 4.677 | 11.527 |
| 2 | 1953 | 1810.2 | 209.1 | 242.0 | 37.17 | 541.4 | 780.9 | 4.956 | 11.130 |
| 3 | 1563 | 1445.3 | 197.1 | 157.6 | 29.16 | 410.3 | 651.1 | 4.419 | 11.997 |
| 4 | 1906 | 1771.3 | 252.6 | 236.9 | 39.77 | 478.9 | 762.7 | 6.253 | 12.904 |
| 5 | 2142 | 1983.9 | 300.6 | 250.4 | 41.21 | 550.4 | 840.1 | 6.553 | 19.219 |
| 6 | 1746 | 1621.0 | 218.6 | 201.4 | 32.81 | 463.1 | 705.0 | 4.083 | 10.859 |
| 7 | 1530 | 1419.1 | 186.1 | 143.6 | 27.80 | 418.4 | 643.0 | 3.330 | 10.677 |
| 8 | 1692 | 1564.9 | 206.6 | 206.4 | 35.50 | 435.7 | 680.4 | 5.353 | 10.800 |
| 9 | 1651 | 1529.0 | 244.9 | 203.7 | 35.09 | 399.4 | 646.4 | 5.443 | 15.589 |
| 10 | 2648 | 2458.4 | 354.9 | 282.1 | 48.84 | 733.1 | 1039.6 | 8.783 | 20.749 |

The monthly yields varied considerably due to conditions of temperature and moisture. Rainfall affected the yields of all plots and the moisture content of the grass. The largest yield of grass was obtained in May and the lowest in June when the grass matures seed and is dormant. The yield in July was heavier when there was ample rainfall. Production during the later months was less each succeeding month.

An average of 42.1 per cent of the green grass was produced in May and 74 per cent of the annual yield in May, June and July. The percentage of dry matter in the grass was highest during the dry seasons and in the fall and lowest in May and July.

The fertilization of blue grass with nitrogen fertilizer produced a large increase in green hay during the early season with the same or a smaller yield during the summer and fall. The plants were more susceptible to drouth injury and extreme heat than other plots. The grass was more palatable to dairy cattle and the protein was increased with little or no effect on other constituents. The use of a second application of nitrogen fertilizer late in the season gave the same general results as the one application, but with a higher moisture content and a larger yield late in the season. The effectiveness of nitrogen fertilizer on blue grass depends on an ample supply of soil moisture.

Superphosphate applied on blue grass with nitrogen fertilizer decreased the yield of pasture herbage. The dry matter content of the crop was lowered. The stand of grass was maintained better during adverse seasons. The phosphorus, protein and ether extract content and yield were increased and the ash content lowered.

Potash fertilizer with phosphate and nitrogen fertilizers increased the yield of pasture grass, both green and dry. The increase was well distributed during the season. The ash content was increased with no other significant change in the composition of the grass. The stand was not affected.

When limestone with a complete fertilizer was used on blue grass, the yield of green and dry grass was lowered. The percentage of dry matter was lowered during the early season and increased in the fall months. The calcium and ash content were both increased. The stand of grass was maintained better than on any other fertilized plot, but not as well as on the manured plots.

A second application of nitrogen fertilizer in July to blue grass treated with a complete fertilizer and limestone produced a large increase in the yield of green and dry grass. The yield was more affected by rainfall after this treatment than after any other treatment except nitrogen alone. The additional nitrogen increased the percentage of dry matter early and late in the season but lowered it in mid-season. The stand of blue grass was not maintained as well as when one application of nitrogen was used. There was no significant change in the composition of the dry hay.

Manure on the blue grass increased the yield of dry grass more than any other treatment. The increase was well distributed throughout the season. The percentage of dry matter in the grass from the manured plots was higher in dry years

and near that for the other plots in seasons of heavy rainfall. There was no significant change in the composition of the grass. The stand of grass was maintained nearly 100 per cent during the dry years and improved during normal seasons. Cattle did not graze manured pasture until 6 to 8 weeks after the application.

**Conclusions.**

1. Nitrogen increased early yield and palatability of blue grass, but adversely affected the stand in dry seasons.
2. Phosphate decreased the yield and dry matter content but conserved the stand.
3. Potash increased the yield of green and dry hay.
4. Limestone lowered the percentage of dry matter in the early season and decreased the yield for the entire season.
5. Additional applications of nitrogen increased the yield in seasons of normal rainfall but decreased the stand of grass in seasons of low rainfall. When used with a complete fertilizer and limestone, the increase was much greater.
6. Manure increased the yield more than other treatments and was beneficial to the stand of grass, particularly in dry seasons.

## CROP PRODUCTION AND COST RECORDS

### Alfalfa Hay

Alfalfa was seeded in the fall of 1935, 1936, 1937 and 1940. A late drouth killed the 1937 seeding but the field was reseeded in the spring of 1938. The average cost of seed, lime and fertilizer was $16.67 per acre. All labor, man, horse and machine, to prepare the land and seed the crop was $15.43, making a total cost of $32.10 per acre to secure a stand of alfalfa (including the reseeding). A cover crop of oats on the spring reseeding produced enough hay to reduce the net cost of a stand of alfalfa to $28.37 per acre. (Note: All seed, fertilizer, etc. charged at actual cost. Labor was hired at 20 to 30 cents per hour. Horse labor was charged at 10 cents per hour. The charge for truck use was 5 cents per mile and for tractor use 50 cents per hour).

The quantity of seed, lime and fertilizer used on each field is shown in Table 7.

Eight acres of this land was virgin sod which had been in pasture and was heavily manured each of five years preceding

the time it was plowed for alfalfa. The remainder was cultivated land which had been manured heavily for at least five years. All fields produced good stands of alfalfa with little or no sod.

TABLE 7. SEED, FERTILIZER AND LIME USED FOR EACH SEEDING OF ALFALFA

| Field No. | Acres | Seed per acre | Kind of Seed | Fertilizer per acre | Kind of Fertilizer | Lime per acre |
|---|---|---|---|---|---|---|
| | | lbs. | | lbs. | | tons* |
| 2 | 5.0 | 24 | Grimm Alfalfa | 400 | 4-12-4 | 4.07 |
| 1B | 8.1 | 23 | Utah Alfalfa | 296 | 4-12-4 | 4.20 |
| 1A | 14.0 | 20<br>5 | Kansas Grimm Alfalfa<br>Timothy | 375 | 4-12-4 | 3.75 |
| Reseeding 1A | | 22<br>1.5 bu. | Kansas Grimm Alfalfa<br>Oats | | | |
| 1B | 8.0 | 20 | Kansas Common Alfalfa | 375 | 2-12-6 | 4.02 |

*Hydrator "tailings" were used for lime, 105% calcium carbonate equivalent.

Each field was plowed in June or July, disked, harrowed, limed and harrowed again to produce a desirable seed bed. Seed and fertilizer were drilled at the same time, in late August or early September. All seed was inoculated.

The following labor was required to secure a stand of alfalfa on one acre: 30.4 man-hours, 26.7 horse-hours, 9.4 tractor-hours and 3.0 truck-hours. These are high as most of the plowing was done with horses—the fields being small and irregular and the land extremely rolling.

**Yields and Harvesting.**—These data cover a period of 7 years, during which the annual rainfall varied from extreme drouth in 1936 to well above normal in 1939. Wages paid for labor, the efficiency of the labor and the type of equipment used varied greatly. A summary of the data on yields and costs for producing alfalfa hay during this period, including the cost of handling but not the yield of hay lost in the field due to rain and unfavorable weather, follows:

SUMMARY OF ALFALFA YIELDS AND COSTS

| Field No. | Total Yield | Total per acre | No. Years | Avg. 1 acre 1 year | Total No. Cuttings | Total acres 1 cutting | Avg. 1 acre 1 cutting | Total Harvest cost | Avg. cost 1 acre 1 cutting | Avg. cost 1 ton |
|---|---|---|---|---|---|---|---|---|---|---|
| | tons | tons | | tons | | | tons | | | |
| 2 | 165.48 | 33.16 | 6.5 | 5.10 | 22 | 110.0 | 1.51 | $316.19 | $2.87 | $1.91 |
| 1B | 138.80 | 19.00 | 4.0 | 4.75 | 13 | 94.9 | 1.46 | 254.39 | 2.68 | 1.83 |
| 1B | 47.94 | 5.99 | 2.0 | 2.99 | 6 | 48.0 | 0.96 | 138.15 | 2.88 | 3.06 |
| 1A | 300.47 | 21.46 | 4.0 | 5.23 | 15 | 204.0 | 1.45 | 634.19 | 3.11 | 2.11 |
| | 652.69 tons * | | | 4.88 tons | | 456.9 | 1.43 | 1342.92 | 4.94 | 2.06 |

*Total yield of all acres and cuttings in 7 years.
Average number of cuttings per year 3.6

The average cost of hay produced was $3.57 per ton stored in the barn, exclusive of land use. It includes $2.06, the harvest cost of one ton plus $1.51 the cost of seeding for each ton of hay produced. If alfalfa hay is worth $10.00 per ton, the return for land use will be $6.43 for each ton of hay produced, or $31.38 for each year the crop is harvested. It will be approximately 10 per cent less or $28.24 per acre per year for the use of the land from the time it was plowed for alfalfa until it was plowed again.

Loose hay produced on the Station Farm cost $4.89 per ton including land rental. Land rental was estimated at 11 per cent annually of a $50.00 per acre valuation for the time the land was used (baling cost approximates $2.00 per ton). During the period covered by these data, baled alfalfa hay purchased by the Station ranged from $8.90 to $16.00 per ton, or an average of $13.63 in the barns at the farm.

Except for the drouth year of 1936, high yields were obtained. One 14-acre field produced 7.17 tons of hay per acre in 1939. Another produced 6.98 tons and 6.95 tons per acre in 1938 and 1939, respectively.

**Labor to Harvest.**—The labor required to harvest and store an acre of alfalfa or one ton of hay will vary greatly from season to season and from cutting to cutting, according to the yield per acre, weather conditions, machinery and methods, and many other factors. The average amount of labor for harvesting and storing hay at the Station from 1936 to 1942, inclusive, is as follows:

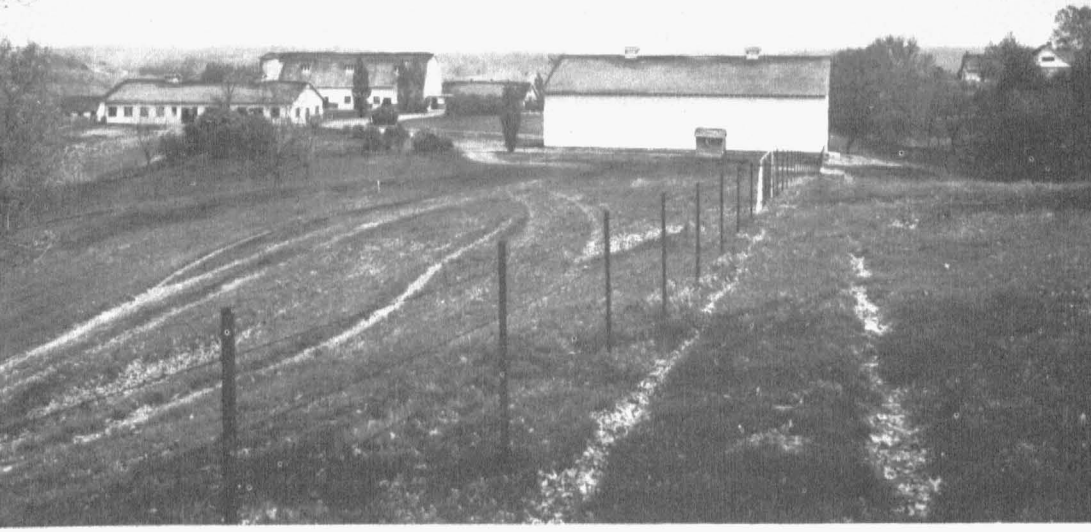
LABOR TO PRODUCE AND HARVEST ONE TON OF ALFALFA HAY

| Hours of labor for: | Man | Horse | Tractor | Truck |
|---|---|---|---|---|
| Average labor for seeding | 1.45 | 1.27 | 0.46 | 0.14 |
| Average labor for harvesting | 6.86 | 5.47 | -- | -- |
| Total for each ton of hay produced | 8.31 | 6.74 | 0.46 | 0.14 |

Small irregular fields, extremely rolling land, summer plowing with a team under unfavorable conditions and the impossibility of using hay loading equipment because of the topography of the land are some factors which increased the amount of labor. The labor requirements shown here should exceed the requirements on most dairy farms.

### Alfalfa-Brome Grass Pasture

One field of 5 acres, previously in alfalfa, was plowed and seeded to alfalfa and smooth brome grass on September 4, 1942, using 20 pounds alfalfa and 4 pounds brome grass per acre. The



Hatch Farm buildings (left to right): Bull barn, young stock and maternity barn, milking barn and dairy house, hay barn, and residence.

Hatch Dairy Experiment Station Farm with alfalfa field in foreground

total labor used to prepare and seed, exclusive of liming, was 12 man-hours, 9.2 tractor-hours and 5.6 horse-hours per acre. The labor cost $12.30 per acre and seed, lime and fertilizer cost $20.19 per acre, or $32.49 per acre for both.

This field yielded 107 cow days (24 hours) of pasture per acre in 1943 (June 12 to Sept. 8), an equivalent of 3918 pounds of alfalfa hay per acre. The yield was 157 cow days of pasture in 1944 (May 15 to Oct. 15), or alfalfa hay equivalent of 5695 pounds per acre. Alfalfa hay equivalents are based on an estimated saving of 35 pounds of hay per day when not on pasture.

A field of 23 acres was plowed in July, 1943 and seeded August 26-28, 1943, with alfalfa and brome grass. Preparing and seeding this field required 6.15 man-hours, 3.54 tractor and 5.13 horse-hours of labor at a cost of $5.13 per acre. Seed, lime and fertilizer cost $22.91 per acre, making a total cost of $28.04 per acre. In 1944 the first crop was ensiled. The field was then pastured from June 19 to October 30, except a part of the field which was mowed for hay on September 30. The per acre yield was 4.0 tons of silage, 52 cow days of pasture and 0.55 tons of hay.

## Ensilage

The average cost, over a 3-year period, of producing an acre of corn ready to cut for silage was $7.55, exclusive of land use. The cost of cutting and ensiling varied from $0.65 to $1.55 per ton. The yield, which varied from 2.6 to 8.3 tons per acre, caused most variation in the cost. (The low yield was in the drouth year of 1934). The total cost, exclusive of land use, ranged from $2.17 to $4.47 per ton in the silo.

Sweet clover, alfalfa, rye, barley have also been used for silage. These crops were purchased standing in the field and hauled from 8 to 12 miles. The cost of cutting, hauling and ensiling the alfalfa and sweet clover ranged from $1.61 to $3.20 per ton. The total cost ranged from $3.36 per ton, including molasses, in 1941, to $7.03 per ton in 1943. The variation was due to distance hauled, purchased price of the alfalfa and cost per man-hour of labor.

Molasses was used with the sweet clover and alfalfa in 1938, 1939, 1940 and 1941. Alfalfa ensiled in 1942, 1943 and 1944 without preservative has been the most satisfactory silage.

## HERD MANAGEMENT PRACTICES

The milking herd has been stabled in a 2-story pen type barn four cows to each pen. Each cow has received all the roughage, hay and silage she would clean up and grain in proportion to milk production, except as modified by experimental conditions. Calves have been fed whole milk the first few days, skim milk thereafter until six months of age, a limited grain allowance and hay *ad libitum*. Older heifers have received grain and hay and were placed on pasture as soon as possible after one year of age. All females have been retained in the herd for at least one and usually two lactations before any culling was practiced.

Birth weights, growth, production, herd classification, feed consumption, breeding, health and miscellaneous records have been kept on all animals bred in the herd. The herd records for 1932 to 1944 inclusive have averaged 7181 pounds of 5.43 per cent milk and 390.0 pounds butterfat. Milking is done in a modern combination milking barn and milk house unit. Grade A milk is produced for the St. Louis, Missouri market.

All calves, heifers and dry cows are housed in a modern straw loft type barn. A separate bull barn is provided. The herd is Federal Accredited as free from tuberculosis and is free of Bang's disease.

## DISEASE PREVENTION AND CONTROL

### Calf Pneumonia

A 9 per cent calf pneumonia loss was eliminated by the use of a straw loft calf, young stock and maternity barn. Calves are kept in individual pens until six weeks to two months of age. These pens have floors made with 2 inches of cement plaster on 5 inch unglazed hollow tile laid on 18 inches of cinders. Each pen has a floor drain and is provided with removable slatted wood floors, used from October to May. The pen walls are built of matched lumber. Older calves run in large pens with concrete floors. We have been able to prevent calf pneumonia in this type barn.

### Mastitis

Short-wave diathermy has been used since 1939 as an aid in the control of mastitis. A low-powered diatherm was first used and applications of one hour daily were given infected animals. Later a more powerful diatherm was used and treatments were reduced

to 30 minutes. Since hot applications have long been used in the control of mastitis, it was believed diathermy, reported to generate heat more evenly in practically all layers of tissue, might be especially beneficial.

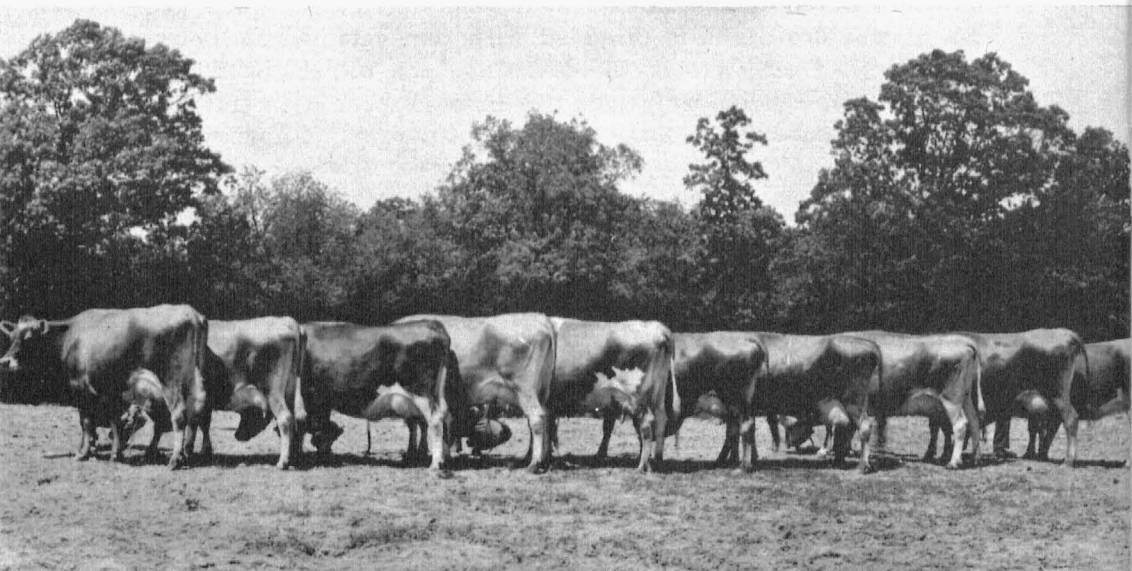
The Hotis test was selected as the most reliable with the available facilities at the Hatch Station farm. It was supplemented by microscopic examination of incubated milk in some instances. The Hotis tests were made by adding 9.5 cc. of milk to 0.5 per cent brom-cresol purple solution and incubating at 37° C. Samples were examined after 24 and 40 hours' incubation. Samples showing the characteristic canary yellow flakes, yellow sediment or yellow color, with or without the development of acid milk, were classed as positive. Samples showing slight color change or changes not typical were examined microscopically. Samples showing no color change of any kind were classed as negative.

The herd was hand milked and the udders washed with a chlorine solution before each milking. The milkers washed their hands with soap and water before milking each cow. Infected cows were milked last but were with the herd at all times. A strip cup was used regularly to detect cows which produced abnormal milk.

The results of the diathermy treatments are shown in Tables 8 and 9.

Nine cows (Table 8) infected for 6 months or more were positive in 31 quarters. They were infected for an average of 2 years and 11 months at the average age of 9 years and 1 month. Four cows were negative in all quarters after an average of 52

Ten daughters of Fauvic's Gamboge Knight 253701. Register of Merit records at the average age of 3 years, 3 months, average 9592.2 pounds of milk containing 513.1 pounds butterfat in 365 days. These daughters averaged 8893 pounds milk and 457 pounds fat, milked twice a day, 305 days.



treatments. One cow, No. 16, became actively infected 7 months later and received 57 additional treatments before becoming

TABLE 8. TREATMENT OF COWS INFECTED FOR MORE THAN SIX MONTHS

| No. of Cow | Age | Known Length Infection | Quarters Infected Prior to first treatment lf lr rr rf | No. Treatments | Last Treatment Mo. | Yr. | Test at Last Treatment lf lr rr rf | Last Test Mo. | Yr. | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| | | yrs. | | | | | | | | |
| 7 | 10 | 3 | + + + + | 75 | 3 | 40 | + + + + | 3 | 40 | Milk normal after treatment sold-sterility |
| 8 | 9 | 1 | - + - - | 56 | 3 | 40 | - - - - | 3 | 40 | Sold sterility 3-40 |
| 12 | 11 | 4 | + + + + | 27 | 11 | 39 | + + + + | 11 | 39 | Sold sterility 11-39 |
| 13 | 11 | 4 | + + + - | 74 | 10 | 39 | - - - - | 10 | 39 | Sold sterility 11-39 |
| 16 | 9 | 4 | + + + + | 60 | 8 | 40 | - - - - | | | |
| (3-41) | | | - + + - | 57 | 1 | 42 | - - - - | 1 | 42 | Flaky milk 3-41 |
| (12-42) | | | + + + - | 16 1/2 | 3 | 43 | - - - - | 3 | 43 | Sold 8-43, sterile |
| 19 | 11 | 6 | + + + + | 194 | 4 | 42 | + - + - | 4 | 42 | Milk & udder normal, sold old age, 0-42 |
| 20 | 9 | 3 | + + + + | 8 | 7 | 39 | + + - - | 7 | 39 | Sold, sterility 7-39 |
| 27 | 7 | 7 mo. | + + + + | 17 | 3 | 40 | - - - - | 3 | 40 | Milk normal Sold 8-40, surplus |
| 49 | 5 | 8 mo. | + + + - | 34 | 4 | 41 | + 0 + - | 4 | 41 | Sold, end of left rear teat severed in accident |

All treatments for one hour except those with "½" after the number of treatments.

"T" following the "Quarters Infected" indicates that the animal had no clinical symptoms of mastitis and that the laboratory tests were the only evidence of infection.

38 cows with 65 positive quarters. After an average of 28 treatments, 34 cows were negative in all quarters and four were positive in a total of 7 quarters.

negative again. Eleven months later she was positive again but was negative after 16 additional treatments. Six cows received an average of 68 treatments and four of 19 positive quarters changed to negative. All animals in this group were severely infected but their milk became normal after a few treatments and the condition of their udders improved.

Thirty-eight cows (Table 9) with known infections of less than 6 months, at an average age of 3 years and 3 months, were positive in 65 quarters. Sixteen had hard swollen udders and were producing flaky, watery or bloody milk when treatment began. The only evidence of infection in the other 22 was the laboratory tests. After an average of 28 treatments, 59 quarters on 35 cows became negative. One of these (No. 78) was infected 18 months later in a previously uninfected quarter and was negative after 22 treatments. Swelling left the udders and all milk from these cows was normal in appearance. Four cows were still positive

in 7 quarters, one becoming positive in an additional quarter, but were sold without further treatment.

The milking herd in September, 1939 consisted of 35 cows. Twenty-one of these were infected in 51 quarters, the remaining 14 were negative, while 4 later became infected. In 1940, eight

TABLE 9. TREATMENT OF COWS INFECTED FOR LESS THAN SIX MONTHS

| No. of cow | Age Yrs. | Known Length Infection Mos. | Quarters Infected Prior to first treatment lf lr rr rf | No. Treatments | Last Treatment Mo. Yr. | Test at last Treatment lf lr rr rf | Last Test Mo. Yr. | Remarks |
|---|---|---|---|---|---|---|---|---|
| 36 | 5 | 1 | - + - - | 2 | 6-39 | - - - - | 12-42 | Hard swollen quarter, bloody milk, no streptococcus, sold 6-43 |
| 46 | 8 | 1 | - - - + | 5 | 10-41 | - - - - | 10-41 | Sold 4-42, sterile |
| 51 | 5 | 1 | + + - - | 18 | 12-39 | - - - - | 3-40 | Sold 3-40, low production |
| 52 | 4 | 6 | + + - - | 33 | 1-40 | - - - - | 1-40 | 4-41 sold, sterile |
| (3-40) | | | - - - + | 23 | 3-41 | - - - - | 3-41 | test + - - - |
| 53 | 4 | 1 | + - - -T | 7 | 1-40 | - - - - | 3-40 | Sold 6-44, sterile |
| (9-41) | | | - + - - | 62 | 12-41 | - - - - | 12-42 | B. Coli, no streptococcus |
| 54 | 4 | 1 | + - - - | 2 | 2-39 | - - - - | 7-39 | Hard quarters, bloody milk, no streptococcus. Sold 7-40 surplus |
| 55 | 4 | 5 | - + + + | 83 | 1-40 | - - - - | 1-41 | Sold 7-41, surplus |
| 56 | 4 | 5 | - - + + | 20 | 2-40 | - - - - | 4-41 | Sold 7-41, surplus |
| 58 | 4 | 1 | - + - +T | 14 | 3-40 | - - - - | 3-40 | B. coli infection, 9-41 Sold 9-41, surplus |
| 60 | 6 | 1 | + + - - | 6 | 4-41 | - - - - | 5-43 | In herd, 4-45 |
| 62 | 4 | 1 | - - - + | 6 | 2-40 | - - - - | 1-41 | Hard quarter, bloody milk |
| (9-41) | | | + - - + | 30 | 10-41 | - - - - | 1-41 | but no streptococci until 9-41 sold 11-42, sterile |
| 63 | 4 | 5 | + - + -G | 11 | 2-40 | - - - - | 1-41 | Sold 9-41, surplus |
| 64 | 4 | 5 | - + - +T | 20 | 2-40 | - - - - | 3-40 | Flaky milk, 8-40 |
| (8-40) | | | - + - - | 13 | 3-41 | - - - - | 9-41 | Sold 11-41, surplus |
| 65 | 4 | 4 | - - - + | 21 | 2-40 | - - - - | 9-41 | Sold 8-42, sterile |
| 66 | 4 | 6 | - + + + | 12 | 2-40 | - - - - | 2-40 | Sold 7-40, sterile |
| 68 | 3 | 1 | - + - - | 6 | 2-40 | - - - - | 1-41 | Hard quarters, bloody milk, no streptococcus, sold 7-41, surplus |
| 70 | 4 | 1 | - - + - | 46 | 4-40 | - - - - | 3-41 | Sold 5-41, surplus |
| 71 | 3 | 1 | - + - -T | 6 | 2-40 | - - - - | 12-42 | In herd 5-45 |
| 78 | 4 | 1 | - ? - + | 5 | 9-41 | - - - - | 12-42 | |
| (3-43) | | | - - + ? | 22 1/2 | 4-43 | - - - - | 5-43 | Sold 2-28-44, surplus |
| 81 | 3 | 1 | - + + + | 62 1/2 | 4-42 | - + - - | 4-42 | Milk & udder normal, sold 9-42 injured |
| 83 | 4 | 1 | + - + -T | 9 1/2 | 3-41 | - - - - | 12-42 | Sold 9-44, surplus |
| 85 | 2 | 1 | + - - -T | 33 1/2 | 9-41 | - - - - | 12-42 | Sold 2-43, surplus |
| 86 | 2 | 1 | + + - +T | 25 1/4 | 10-41 | - - - - | 12-42 | Sold 11-43, surplus |
| 88 | 2 | 1 | + - - -T | 9 1/4 | 3-41 | - - - - | 12-42 | Sold 12-42, Bang's disease |

TABLE 9. (continued)

| No. of Cow | Age Yrs | Known Length Infection Mos. | Quarters Infected Prior to first treatment lf lr rr rf | No. Treatments | Last Treatment Mo. Yr. | Test at last Treatment lf lr rr rf | Last Test Mo. Yr. | Remarks |
|---|---|---|---|---|---|---|---|---|
| 90 | 3 | 1 | - + - -T | 28 1/2 | 10-41 | - - - - | 12-42 | In herd 5-45 |
| 92 | 2 | 1 | - o - +T | 27 1/2 | 10-41 | - o - - | 10-41 | Sold 12-41, surplus |
| 93 | 2 | 1 | - - + - | 29 1/2 | 11-41 | - - - - | 12-41 | In herd, 5-45 |
| 94 | 2 | 1 | - - + -T | 13 1/2 | 10-41 | - - - - | 10-41 | Sold, 3-42, surplus |
| 98 | 2 | 1 | - + + - | 45 1/2<br>58 1 | 1-42 | - - - - | 12-42 | Heavy B. coli infection<br>Sold 12-44, sterile |
| 105 | 2 | 1 | - - - + | 8 1/2 | 10-41 | - - - - | 12-42 | Sold 3-43, surplus |
| 106 | 2 | 1 | - - + -T | 28 1/2 | 11-41 | - - - - | 11-41 | Sold 6-42, surplus |
| 107 | 2 | 1 | - - ? +T | 94 1/2 | 4-42 | - - - + | 4-42 | Sold, 11-42, low prod. small reaction |
| 109 | 2 | 1 | + - - -T | 12 1/2 | 10-41 | - - - - | 10-41 | Sold 3-42, surplus |
| 110 | 2 | 1 | - + + -T | 6 1/2 | 10-41 | - - - - | 10-41 | Sold 8-42, surplus |
| 111 | 2 | 1 | - + - -T | 59 1/2 | 11-41 | - + + - | 11-41 | Dry, treatment discontinued sold 11-42, low production |
| 138 | 2 | 1 | - + - -T | 9 1/2 | 3-43 | - - - - | 3-43 | In herd 5-45 Normal udder & milk |
| 140 | 2 | 1 | - + - -T | 13 1/2 | 4-43 | - - - - | 4-43 | In herd 5-45 Normal udder & milk |
| 142 | 2 | 1 | + + + +T | 59 1/2 | 6-43 | + + + - | 6-43 | Sold 1-44, sterile |

All treatments for 1 hour unless indicated "½" for one-half hour treatments.

9 cows positive in 31 quarters, received an average of 67 treatments.

4 cows were negative in all quarters after an average of 66 treatments.

4 quarters of the remaining 5 cows became negative after an average of 68 treatments.

No abnormal milk from any of the cows after date of last treatment except No. 12.

heifers dropped their first calves, and of these eight heifers five were positive in one or more quarters. In 1941, 13 heifers were added to the milking herd and 10 were positive in one or more quarters. During 1942, 18 heifers were added and only two were positive in two quarters each. In 1943, 13 were added and 3 were positive in 6 quarters, although one cow was not tested. In 1944 no regular tests were run as there was no evidence that infection was present.

Ninety-three cows have been in the milking herd since September 1, 1939. Twenty-eight of these cows have been infected with mastitis and showed clinical symptoms of the disease, in addition to positive laboratory tests. Nineteen others have been

positive in one quarter or more as shown by laboratory tests of their milk. The remaining 47, 31 of which calved for the first time between January 1, 1941 and December 31, 1943, have been consistently negative and free of udder trouble.

Three years later, in April, 1942, 22 of 25 positive animals were in the herd. (The other 3 positive animals calved for the first time at a later date). Eighteen were negative in all quarters. Four were positive in a total of 6 quarters but were producing normal milk. These four animals were sold for reasons other than mastitis, without further treatment.

Six, or 16 per cent of the 38 cows which were negative after treatment, were later positive in a total of 9 quarters. Four of these quarters were previously uninfected quarters and 5 were previously positive. Seventy of the 96 positive quarters became negative after treatment and in only 5, or 7 per cent, did the infection reappear while the animal was in the herd. Positive cows which became negative in all quarters averaged 1 year and 7 months in the herd without further evidence of infection. Eleven continued negative over 2 years and three over 4 years while in the herd.

The data presented show the number of treatments for recently infected cows averaging 28 for animals that became negative and 69 for animals that remained positive. There was a definite improvement in the physical condition of the udder and the appearance of the milk of cows treated with diathermy under the conditions of this investigation. Ninety per cent of the recent infections and 44 per cent of the old infections were arrested by the treatments, judged by the test made at the time of last treatment and later observations in the case of animals retained in the herd.

## SOIL CONSERVATION PRACTICES

All land on the farm is in permanent pasture or alfalfa-brome. Blue grass supplemented with limited seedings of other grasses as previously referred to is the principal permanent pasture. Alfalfa-brome is pastured regularly. No row crops are grown.

### Terracing

One 5-acre field was terraced in 1942 using a tractor and a 4-foot fresno scraper. The fresno required a man to load and dump it in addition to the tractor driver. Terraces with a 6-foot channel and a 22-inch shoulder were built. A total of 2680 feet,

or 536 feet per acre, was built. It required an average of 32 man-hours, 14 tractor-hours and 4 horse-hours of work to build the terraces on one acre. The cost was 2.8 cents per foot of terrace, or $14.90 per acre.

A field of 23 acres was terraced in 1943. The same tractor as above and a 4-foot "tumble-bug" fresno scraper were used. The latter was operated by the tractor driver, who thus built 11,413 feet of terraces, or 496 feet per acre, at a cost of $1.76 per foot. The total labor required per acre was 9.4 man- and 7.35 tractor-hours. The cost of surveying was included in each case.