December 7, 1951

To the Graduate Council:

I am submitting herewith a thesis written by Fred Gill Laine entitled "Wintering Dairy Heifers on Hay With and Without Pasture." I recommend that it be accepted for nine quarter hours of credit in partial fulfillment of the requirements for the degree of Master of Science, with a major in Dairy.

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Major Professor

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Accepted for the Council:

E. A. Watten
Dean of the Graduate School

# WINTERING DAIRY HEIFERS ON HAY

# WITH AND WITHOUT PASTURE

---

A THESIS

Submitted to
The Graduate Council
of
The University of Tennessee
in
Partial Fulfillment of the Requirements
for the degree of
Master of Science

---

by

Fred Gill Laine

December 1951

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F. G. L.

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TABLE OF CONTENTS


| CHAPTER | | PAGE |
|---|---|---|
| I. | INTRODUCTION . . . . . | 1 |
| II. | REVIEW OF RELATED STUDIES. . . . . | 3 |
| III. | EXPERIMENTAL PROCEDURE . . . . . | 8 |
| IV. | RESULTS AND DISCUSSION . . . . . | 11 |
| BIBLIOGRAPHY . . . . . | | 29 |
| APPENDIX . . . . . | | 31 |

# LIST OF TABLES


| TABLE | | PAGE |
|---|---|---|
| I. | Monthly Heifer Weights . . . . . | 13 |
| II. | Gains Made by Jersey and Holstein Heifers During the Feeding Trial. . . . . | 14 |
| III. | Monthly Weights During Summer Pasture Period . . . . . | 15 |
| IV. | Height at Withers (Inches) . . . . . | 18 |
| V. | Heart Girth of Heifers (Inches). . . . . | 19 |
| VI. | Amount of Hay Fed, Refused, and Consumed by Trial Heifers in Group I (Weekly Totals) . . . . . | 21 |
| VII. | Amount of Hay Fed, Refused, and Consumed by Trial Heifers in Group II (Weekly Totals). . . . . | 22 |
| VIII. | Summary of Data of Feeding Trial . . . . . | 27 |

LIST OF FIGURES


| FIGURE | | PAGE |
|---|---|---|
| 1. | Comparison of Growth Standards . . . . . | 5 |
| 2. | Comparison of the Growth Made by Jersey Heifer T-267 with the Average Growth of Jersey Heifers as Shown by the Missouri Standard . . . . . | 32 |
| 3. | Comparison of the Growth Made by Jersey Heifer T-268 with the Average Growth of Jersey Heifers. . . . . | 33 |
| 4. | Comparison of the Growth Made by Jersey Heifer T-270 with the Average Growth of Jersey Heifers. . . . . | 34 |
| 5. | Comparison of the Growth Made by Jersey Heifer T-282 with the Average Growth of Jersey Heifers. . . . . | 35 |
| 6. | Comparison of the Growth Made by Holstein Heifer 544 with the Average Growth of Holstein Heifers. . . . . | 36 |
| 7. | Comparison of the Growth Made by Holstein Heifer 550 with the Average Growth of Holstein Heifers. . . . . | 37 |
| 8. | Comparison of the Growth Made by Holstein Heifer 553 with the Average Growth of Holstein Heifers. . . . . | 38 |
| 9. | Comparison of the Growth Made by Holstein Heifer 556 with the Average Growth of Holstein Heifers. . . . . | 39 |
| 10. | Comparison of the Growth Made by Holstein Heifer 559 with the Average Growth of Holstein Heifers. . . . . | 40 |
| 11. | Comparison of the Growth Made by Jersey Heifer T-259 with the Average Growth of Jersey Heifers. . . . . | 41 |

FIGURE PAGE

12. Comparison of the Growth Made by Jersey Heifer T-264 with the Average Growth of Jersey Heifers . . . . . 42

13. Comparison of the Growth Made by Jersey Heifer T-269 with the Average Growth of Jersey Heifers . . . . . 43

14. Comparison of the Growth Made by Jersey Heifer T-275 with the Average Growth of Jersey Heifers . . . . . 44

15. Comparison of the Growth Made by Holstein Heifer 542 with the Average Growth of Holstein Heifers . . . . . 45

16. Comparison of the Growth Made by Holstein Heifer 546 with the Average Growth of Holstein Heifers . . . . . 46

17. Comparison of the Growth Made by Holstein Heifer 554 with the Average Growth of Holstein Heifers . . . . . 47

18. Comparison of the Growth Made by Holstein Heifer 555 with the Average Growth of Holstein Heifers . . . . . 48

19. Comparison of the Growth Made by Holstein Heifer 558 with the Average Growth of Holstein Heifers . . . . . 49

20. Comparison of the Average Growth Made by the Jersey Heifers in Group I Fed Hay Alone with the Average Growth of Jersey Heifers . . . . . 50

21. Comparison of the Average Growth Made by Holstein Heifers in Group I (Hay Alone) with the Average Growth of Holstein Heifers. . . . . 51

FIGURE PAGE

22. Comparison of the Average Growth Made by the Jersey Heifers in Group II Fed Hay and Pasture with the Average Growth of Jersey Heifers. . . . . 52

23. Comparison of the Average Growth Made by the Holstein Heifers in Group II (Hay and Pasture) with the Average Growth of Holstein Heifers. . . . . 53

# CHAPTER I

## INTRODUCTION

This study was undertaken to compare the efficiency of hay supplemented by pasture and hay alone for wintering dairy heifers. Actual feeding trials were used with the dairy heifers.

To reduce the cost of raising dairy heifers and at the same time secure good growth should be an objective of any dairyman. One of the most economical ways for dairymen to reduce cost and at the same time secure good growth is to provide pasture for both winter and summer. Good pasture reduces the cost of both roughages and concentrates. The actual amount of reduction in hay by furnishing winter pasture can be seen in the results of this experiment.

The expense incurred each year in raising dairy heifers to replace the discarded cows is a severe tax upon the dairy industry. Experience has shown that the period of usefulness, on the average, for a dairy cow is approximately five years (10). This means that a large number of dairy heifers must be kept for replacements; and since heifers are at least two years of age when they come into milk, about two heifers must be raised per year for each ten cows.

There are several important phases to the general question of raising dairy heifers. In addition to the important economic side suggested, the question is always before the owner as to a possible relation between the manner of raising the young animals and their milk producing abilities when mature.

Any attempt to give the cost of wintering heifers in terms of

dollars and cents is bound to be unsatisfactory and only of temporary value, since prices of feed vary extremely from year to year and from one locality to another. For this reason no attempt has been made to represent the cost of wintering the animals in this experiment in money values, but rather in the terms of amount of feed required.

This study was designed to winter heifers as economically as possible and still not impair their growth and gains.

# CHAPTER II

## REVIEW OF RELATED STUDIES

According to Morrison (7), rearing dairy heifers after they are a year old is an easy task because their digestive tracts are well developed. For this reason, they can be wintered satisfactorily on roughage with little or no concentrates, if the roughage is of satisfactory quality.

At Missouri, Eckles (2) found that overfeeding of concentrates to heifers often gave disappointing results. The overfeeding tended to produce a heavy coarse build and caused undue fat deposition in the udder. This condition often never disappears after the heifer freshens. The udder tends to be fleshy and meaty, instead of being composed almost entirely of milk secreting tissue (2). If a heifer is fed only moderately this condition is not likely to happen.

Morrison (7), Eckles (2), and Henderson and others (5) state that the growth of various parts of the animal proceeds in rather definite ratios. Therefore, growth may be measured by combining live weight and skeleton measurements. A combination of weight and size measurements in determining growth is more useful than either alone (4). Work along this line has been conducted by Ragsdale (11) at the University of Missouri. Growth standards published by the Missouri Station are based upon actual weights and measurements taken in the Missouri, Kansas, and Iowa Agricultural Experiment Station Herds. Other work of recording growth averages of dairy animals for the purposes of establishing "standards" has been conducted by Espe and co-workers at Iowa (4), Moseley and others of the U. S. Department of Agriculture (8), and Wylie

and Hinton at the University of Tennessee (12). Figure 1 graphically compares these averages.

The time of day that heifers are weighed does influence the daily weight average according to Allen (1). He found that morning was the best time of day for weighing in order to arrive at a daily average in weight, but since this trial was rather lengthy, it was not considered necessary to take into account variations within a 24-hour period.

There have been several trials conducted to determine the nutritive efficiency of alfalfa hay; both field cured and bin cured. Eckles (2), from a feeding project conducted at the Missouri Agricultural Experiment Station in 1918, concluded that heifers fed a ration of first-class alfalfa hay alone will make a daily gain of 0.65 to 0.90 pound, which is somewhat below normal.

Two feeding trials conducted at the University of Tennessee in 1938 and 1939 and reported by Weaver and Wylie (12) indicated that dairy heifers fed on alfalfa hay, which was supplemented with a concentrate mixture and corn silage made normal growth as determined by weight, height at withers, and heart girth. Both bin cured and field cured alfalfa hay were used but there was very little difference in the growth of the two groups.

A feeding trial conducted by Wylie and others (14) at the Middle Tennessee Experiment Station indicated that groups of heifers on field cured alfalfa hay, barn cured alfalfa hay and barn cured soybean hay all made close to normal gains in weight and height at withers. The heifers on the barn cured hay gained a little more weight on a little less hay

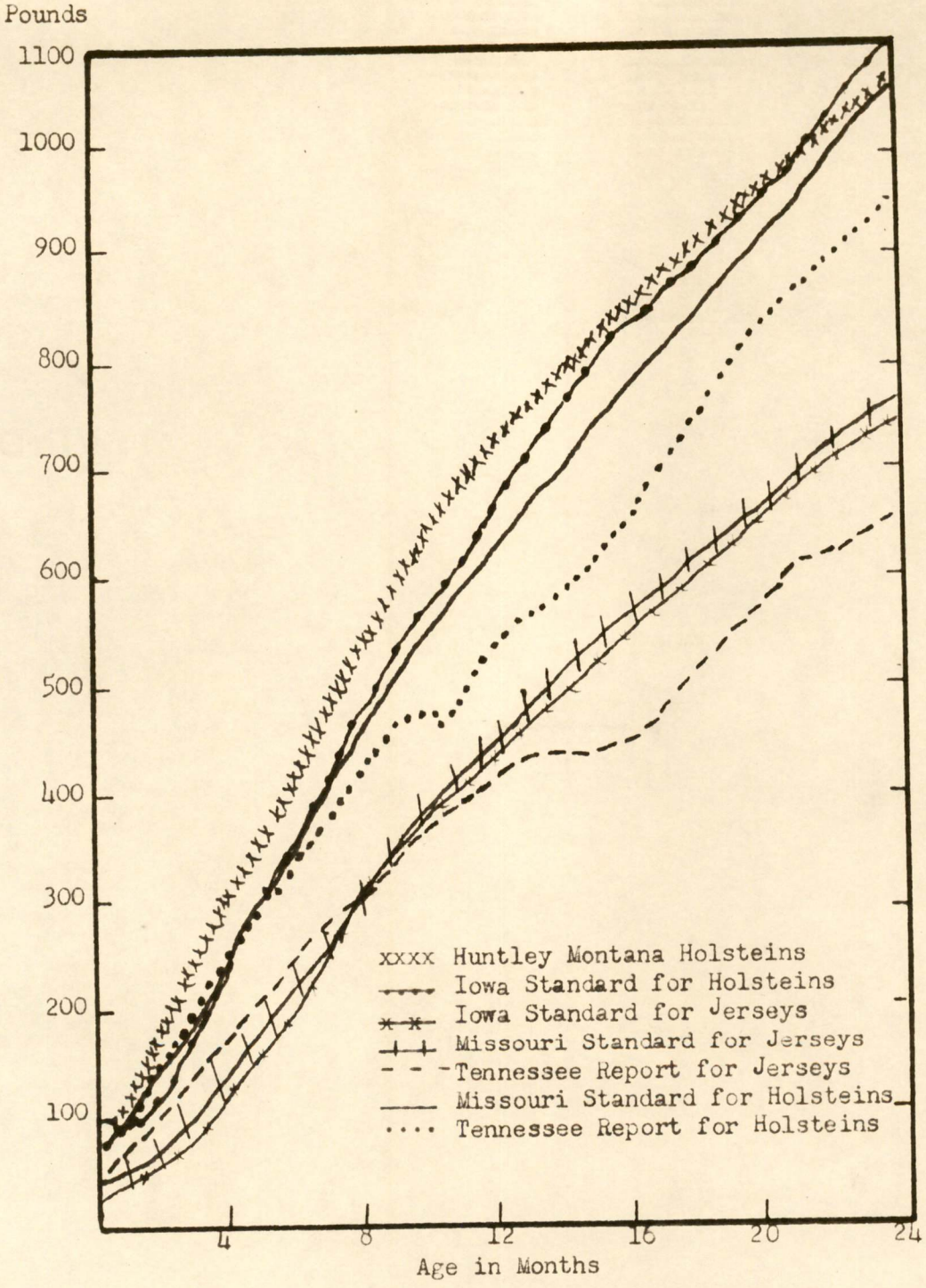



FIGURE 1

COMPARISON OF GROWTH "STANDARDS" AS DETERMINED BY RAGSDALE (11), ESPE AND OTHERS (4), MOSLEY AND OTHERS (8), AND WYLIE AND HINTON (12)

than did the heifers on the field cured hay. There was very little if any superiority of one hay over the other. Winton (13) found both field cured and bin cured alfalfa hay to be a satisfactory ration for wintering dairy heifers over 12 months of age. No ill effects or lowering of vigor or thriftiness was noted.

Eckles (2) found that heifers wintered on a ration of alfalfa hay at liberty and two pounds of corn daily made speedy gains. The average gain was 0.97 pound as compared to a normal gain of 0.83 pound for animals of this breed and age (2). In another experiment, Eckles (2) found that heifers wintered on silage and timothy hay made poor gains. He concluded that a ration of this sort was very much deficient in protein.

It is a recognized fact that a certain amount of protein is needed for growing animals. For practical purposes, it is sufficient to say that when a legume or a legume-grass hay is fed there will be little or no danger of retarded growth due to a protein deficiency, although the amount fed may be under that prescribed by the feeding standards (2).

Morrison (7) states that dairy heifers make satisfactory growth when fed silage as a part of the roughage along with legume or mixed hay. He also says that silage is not necessary if an abundance of good hay is fed. Heifers wintered on corn or sorgham silage alone should have a protein supplement added to get good growth (7).

According to Morrison (7), after heifers are a year old they can be wintered satisfactorily up to three or four months before calving without concentrates if fed either an abundance of good legume or mixed hay and silage or else all the well cured legume hay they will eat. They

may not carry so much fat as some breeders desire, but if well fed before calving and during their first lactation period, they will reach normal size and weight (7). When the ration is somewhat limited, the skeletal growth is retarded much less than the gains in weight. While skeletal growth can be influenced by the character of the ration, the tendency is for it to continue at or near a normal rate; and only a wide variation in ration exerts any marked effect upon it (2).

Eckles (2) found in his experiments that there is a negative correlation between winter gains and summer gains on pasture. If grain is fed liberally during the winter and rapid gains result, the summer pasture gains will be small or negative. A loss of weight often occurs when heifers are first put on pasture after being fed grain and roughage (2).

The relation of breed to winter gains on a particular ration vary (3). Most of the data available are on Jerseys and Holsteins. The Jerseys and Holsteins, however, represent the two extremes of the dairy breeds in size and other characteristics, and it is reasonable to assume that results for other breeds will be intermediate (3). Missouri experiments (2) showed that Holsteins are able to thrive better than Jerseys under limited feeding at the same conditions. Nevens (9) found in experiments conducted at the Illinois Agricultural Experiment Station that no one breed had any significant superiority over the other in making live-weight gains while on pasture under the same conditions.

# CHAPTER III

# EXPERIMENTAL PROCEDURE

## Animals

General. This study was undertaken to determine the comparative efficiency of hay and permanent pasture and hay alone for wintering dairy heifers. This feeding trial was conducted at the Tennessee Experiment Station at Knoxville. The trial started November 1, 1950, and continued through March 28, 1951. Eighteen heifers were used. These heifers were divided into groups of nine each. In selecting the heifers, consideration was given to breed, age, weight, and body measurements. Each group contained five Holsteins and four Jerseys ranging from 18 to 28 months of age.

The groups were designated as follows:

Group I. Hay ad lib.

Group II. Hay ad lib. and pasture ad lib.

Preliminary period. During a three-day preliminary period the heifers to be used were weighed and measurements were taken at height of withers and the heart girth. These measurements were averaged and that average was used as the starting measurements. The heifers were weighed for three consecutive days at the end of the trial and the averages of these three were used as the final weights.

Hay feeding period. The feeding trial started November 1, 1950, and continued through March 28, 1951, for a total of 148 days.

Housing. During the feeding period, both Group I and Group II were housed in an open shed at dairy barn No. 2 on the Cherokee Farm. Group II had access to a pasture of ladino clover, fescue, and orchard grass; Group I remained in the dry lot throughout the feeding period.

Feeding. The animals were fed twice daily. At each afternoon feeding the hay remaining in the feed rack was removed and weighed; the hay to be fed at each feeding was weighed and carefully placed in the hay rack. Feeding throughout was ad lib. Salt and steamed bone meal were supplied at liberty to both groups.

Water. Water was available in the shed for both groups. Even though the sheds were open, there was little or no freezing of the water even during the coldest weather.

Pasture period. The heifers in Group II were on pasture the entire feeding period except for five days during the first part of December when the pasture was covered with snow. The pasture was composed of ladino clover, fescue, and orchard grass. There were nine acres of this permanent pasture. Both groups were put on pasture after the feeding trial. Weight records were kept for 90 more days following the trial.

Weighing and measuring. The heifers were weighed and measured individually each month. The measurements included the height at the withers and the circumference of the chest or heart-girth. Body measurements were discontinued after March 28, when both groups were put on pasture.

## Hay

The hay used in this trial was of mixed lespedeza and grass (50 percent lespedeza and 50 percent grass). The hay was Sample Grade. The lespedeza was slightly over-ripe at harvest time, but the grass was in the ideal stage of maturity for hay. Crab grass was the most dominant grass in the hay. The hay was cured in the field and baled with a field pick-up baler.

Storage. The hay was stored in the mow of dairy barn No. 2 immediately above the sheds where the experimental animals were housed. Both groups of the heifers were fed the same kind of hay.

Sampling. A composite sample of the hay was obtained by taking frequent small samples at feeding time. These samples were deposited in bags until the analysis was made in the laboratory.

## Records Kept

During the feeding trial, records were kept of the hay consumption, salt and bone meal consumption, and the palatability of the hay as determined by the amount of hay refused; the chemical composition of the hay was also recorded. Growth records were kept as determined by the weight and body measurements.

# CHAPTER IV

## RESULTS AND DISCUSSION

### General Observations

Appearance of animals. During the entire feeding trial the appearance of the heifers in both groups was good. Throughout the winter months there was considerable rain and snow; all the heifers in Group I became dirty and manure covered due to the close confinement to the open shed and adjacent lot; but as soon as fair weather approached, the coats took on a more pleasing appearance. For the entire hay feeding period the heifers in both groups remained vigorous and thrifty. As soon as they were turned on pasture, long hair was shed and the coat took on a lustrous appearance.

Condition of open sheds. There was little difference in the condition of the sheds housing the two groups during the feeding trial. Both sheds were fairly well bedded with wood shavings. The feces produced by the pasture group was often looser than the dry lot group.

Eating habits. Since feed was before the heifers at all times, some of the animals in both groups were always eating. There was little or no overcrowding at the hay racks at feeding time. The heifers in both groups drank water about as well during the coldest weather when the temperature was well below freezing as they did when the weather was mild.

The salt and bone meal consumption for the pasture group was about half that of the dry lot group.

## Breeding Efficiency

No definite results could be recorded on breeding efficiency since several different bulls were used for breeding the heifers, and also the trial was too short to determine the effect on breeding efficiency. The heifers in Group I required fewer services per conception than did those in Group II. There was one heifer in each group that was bred before the feeding trial began. Three heifers in Group I were settled on the first service. All heifers in Group II required more than one service before conception. Three heifers in Group II settled on the second service. Holstein heifer 556 was not observed in heat during the entire feeding trial. She did come into heat during the summer pasture period and was settled on the first heat period.

Of the six heifers that have calved, all have done satisfactorily. The calves have been strong and thrifty.

Breeding efficiency in both groups was satisfactory even though the heifers in Group II required more services per conception than did the heifers in Group I.

## Growth

Weight. Gains in weight of each heifer in the trial are recorded in Table II. Both groups of heifers had a satisfactory appearance during the entire trial. There were only two heifers in Group I that gained weight, T-267 and T-270. All heifers in Group II gained weight except one Jersey, T-264. Group I which was fed hay alone lost an average of 25 pounds each during the entire feeding trial. This was a daily loss

TABLE I

MONTHLY HEIFER WEIGHTS

| Number | Nov. 1 | Dec. 1 | Jan. 1 | Feb. 1 | Mar. 1 | Mar. 28 |
|---|---|---|---|---|---|---|
| | | | Group I (No Pasture) | | | |
| T-267 | 737 | 735 | 780 | 745 | 735 | 795 |
| T-268 | 641 | 595 | 610 | 610 | 570 | 557 |
| T-270 | 629 | 635 | 600 | 605 | 610 | 697 |
| T-282 | 535 | 515 | 500 | 475 | 480 | 457 |
| Jersey average | 636 | 620 | 623 | 609 | 599 | 627 |
| 544 | 919 | 940 | 930 | 915 | 910 | 893 |
| 550 | 1067 | 1080 | 1020 | 1100 | 1085 | 1045 |
| 553 | 980 | 990 | 975 | 950 | 930 | 893 |
| 556 | 976 | 895 | 990 | 1010 | 1010 | 959 |
| 559 | 890 | 890 | 910 | 920 | 950 | 853 |
| Holstein average | 966 | 955 | 965 | 979 | 971 | 929 |
| Group average | 819 | 806 | 813 | 814 | 809 | 794 |
| | | | Group II (Pasture) | | | |
| T-259 | 893 | 915 | 920 | 855 | 900 | 913 |
| T-264 | 750 | 770 | 730 | 745 | 770 | 705 |
| T-269 | 613 | 655 | 630 | 615 | 625 | 625 |
| T-275 | 513 | 535 | 535 | 520 | 530 | 544 |
| Jersey average | 692 | 719 | 704 | 684 | 706 | 697 |
| 542 | 1163 | 1190 | 1205 | 1130 | 1200 | 1220 |
| 546 | 900 | 950 | 920 | 900 | 920 | 935 |
| 554 | 965 | 970 | 1000 | 970 | 930 | 977 |
| 555 | 937 | 970 | 995 | 920 | 960 | 970 |
| 558 | 928 | 980 | 1005 | 920 | 1000 | 998 |
| Holstein average | 988 | 1012 | 1025 | 968 | 1002 | 1020 |
| Group average | 851 | 882 | 882 | 842 | 871 | 876 |

TABLE II

GAINS MADE BY JERSEY AND HOLSTEIN HEIFERS DURING THE FEEDING TRIAL

| Heifer | Initial Weight | Final Weight | Gain | Daily Gain |
|---|---|---|---|---|
| | | Group I | | |
| T-267 | 737 | 795 | 58 | .398 |
| T-268 | 641 | 557 | -84 | -.567 |
| T-270 | 629 | 697 | 68 | .459 |
| T-282 | 535 | 457 | -78 | -.528 |
| Jersey average | 636 | 627 | - 9 | |
| 544 | 919 | 893 | -26 | -.179 |
| 550 | 1067 | 1045 | -22 | -.149 |
| 553 | 890 | 893 | -87 | -.588 |
| 556 | 976 | 959 | -17 | -.115 |
| 559 | 890 | 853 | -37 | -.250 |
| Holstein average | 966 | 929 | -38 | |
| Group total | | | -225 | -1.519 |
| Group average | 819 | 794 | -25 | -.168 |
| | | Group II | | |
| T-259 | 893 | 913 | 20 | .135 |
| T-264 | 750 | 705 | -45 | -.304 |
| T-269 | 613 | 625 | 12 | .081 |
| T-275 | 513 | 544 | 31 | .209 |
| Jersey average | 692 | 697 | 121 | |
| 542 | 1163 | 1220 | 57 | .385 |
| 546 | 900 | 935 | 35 | .237 |
| 554 | 965 | 977 | 12 | .081 |
| 555 | 937 | 970 | 33 | .223 |
| 558 | 928 | 998 | 70 | .479 |
| Holstein average | 988 | 1020 | 33 | |
| Group total | | | 225 | 1.520 |
| Group average | 851 | 876 | 25 | .168 |

TABLE III

MONTHLY WEIGHTS DURING SUMMER PASTURE PERIOD

| Heifer Number | May 1 | June 1 | July 1 |
|---|---|---|---|
| | Group I | | |
| T-267 | 755 | 710 | 750 |
| T-268 | 620 | 660 | 680 |
| T-270 | 640 | 640 | 740 |
| T-282 | 520 | 600 | 630 |
| Jersey average | 634 | 653 | 700 |
| 544 | 920 | 1010 | 1020 |
| 550 | 1020 | 1150 | 1150 |
| 553 | 940 | 1040 | 1040 |
| 556 | 1050 | 1090 | 1020 |
| 559 | 920 | 1032 | 1055 |
| Holstein average | 970 | 1064 | 1077 |
| Group average | 821 | 892 | 909 |
| | Group II | | |
| T-259 | 940 | 989 | 1010 |
| T-264 | 830 | 870 | 880 |
| T-269 | 659 | 740 | 730 |
| T-275 | 595 | 722 | 650 |
| Jersey average | 756 | 830 | 818 |
| 542 | 1240 | 1384 | 1320 |
| 546 | 990 | 1052 | 1040 |
| 554 | 960 | 1104 | 1100 |
| 555 | 1030 | 1058 | 1110 |
| 558 | 1140 | 1042 | 1150 |
| Holstein average | 1124 | 1128 | 1144 |
| Group average | 960 | 996 | 1000 |

of .17 pound. Group II which was fed hay and had access to pasture gained 25 pounds during the feeding trial. The average daily gains were .17 pound. The average daily gains for both groups were less than those reported by Eckles (2). The average daily gains compared with the gains of the Missouri Standard are shown for both groups in Figures 2--23. The heifers in Group I showed an average gain of 115 pounds each after the 90-day pasture period. Group II averaged a gain of 123 pounds each during the summer pasture period. The Jerseys in Group I averaged a nine-pound loss each in 148 days of hay feeding, and 74 pounds gain on summer pasture. The Holsteins in this group averaged 37.8 pounds loss in the 148 days and averaged 149 pounds gain each when turned on pasture. The Jerseys in Group II averaged 4.5 pounds gain during the 148 day trial. The Holsteins gained 33.4 pounds. During the pasture period after the feeding trial the Jerseys averaged a gain of 121 pounds; the Holsteins, 124 pounds each.

The Holsteins showed more gain in Group II than did the Jerseys in that group during the feeding trial. The Holsteins in Group I showed about the same loss as the Jerseys during the feeding trial. The two Jerseys that gained were further along in pregnancy than the other heifers. This suggests that Holstein heifers may be capable of better utilizing roughage than Jersey heifers. On the other hand, the rapid summer gains on pasture made by the Jersey heifers indicate that Jersey heifers are capable of eliminating some of the feeding superiority of Holsteins during the winter, when the two are turned on pasture. Figures 2 through 23 graphically compare the weight gains as compared to the Missouri Standard (2).

Height of withers. There is considerable individual variation throughout in both groups, but the total increases in height are about the same in each case. The measurements of height were taken only for the 148 day feeding period. No height measurements were taken during the summer pasture period. Figures 2 through 23 compare actual increases with the Missouri Standard (2). The Jerseys fed hay alone showed an average increase of .38 inch each. The Holsteins in this group showed an average increase of 1.40 inches each. The Jerseys in Group II averaged 1.88 inches increase in height during the 148 days. The Holsteins in this group increased 1.40 inches in height.

Heart girth. Figures 2 through 23 compare individual and group performance with the Missouri Standard (2).

The Jerseys in Group I lost an average of .74 inch in heart girth. The Holsteins in this group lost an average of .25 inch. Both Jerseys and Holsteins in this group did show an increase in heart girth until the last month of the feeding trial when a sharp decrease was evidenced. The Jerseys in Group II averaged .07 inch increase. The Holsteins in this group averaged an increase of 1.57 inches. Group II also showed a decrease in heart girth during the last month of the hay feeding trial. Heart girth measurements were not taken during the summer pasture period.

## Composition of Hay

The chemical analysis of the hay used in this trial was as follows:

| | |
|---|---|
| Crude protein | 7.54 percent |
| Ash | 5.00 percent |
| Moisture | 6.20 percent |

TABLE IV

HEIGHT AT WITHERS (INCHES)

| Number | Nov. 1 | Dec. 1 | Jan. 1 | Feb. 1 | Mar. 1 | Mar. 28 |
|---|---|---|---|---|---|---|
| | | | (No Pasture) | | | |
| T-267 | 46.50 | 45.50 | 46.00 | 46.00 | 46.75 | 45.75 |
| T-268 | 45.75 | 45.00 | 45.50 | 45.00 | 46.00 | 47.00 |
| T-270 | 45.50 | 47.00 | 46.25 | 45.75 | 46.75 | 47.00 |
| T-282 | 42.50 | 42.50 | 44.00 | 42.75 | 44.75 | 42.00 |
| Jersey average | 45.06 | 45.00 | 45.44 | 44.87 | 46.06 | 45.44 |
| 544 | 50.00 | 50.75 | 52.25 | 50.00 | 50.50 | 50.00 |
| 550 | 51.00 | 52.25 | 52.00 | 52.50 | 52.50 | 52.50 |
| 553 | 50.25 | 50.25 | 49.75 | 50.00 | 51.50 | 50.50 |
| 556 | 50.50 | 51.25 | 52.00 | 52.00 | 53.25 | 53.00 |
| 559 | 49.50 | 50.75 | 50.75 | 52.75 | 51.50 | 52.25 |
| Holstein average | 50.25 | 51.05 | 50.95 | 51.45 | 51.85 | 51.65 |
| Average | 47.94 | 48.36 | 48.50 | 48.52 | 49.27 | 48.88 |
| | | | (Pasture) | | | |
| T-259 | 47.50 | 48.75 | 48.50 | 48.75 | 49.00 | 49.00 |
| T-264 | 44.25 | 45.25 | 46.75 | 45.50 | 46.00 | 48.00 |
| T-269 | 44.00 | 44.00 | 46.26 | 45.50 | 46.25 | 45.75 |
| T-275 | 41.75 | 43.25 | 42.75 | 42.50 | 43.75 | 43.00 |
| Jersey average | 44.37 | 45.31 | 46.06 | 45.56 | 46.25 | 46.44 |
| 542 | 53.50 | 53.00 | 53.50 | 53.75 | 52.75 | 52.75 |
| 546 | 50.25 | 51.00 | 51.75 | 52.50 | 50.00 | 50.00 |
| 554 | 49.50 | 50.25 | 50.25 | 52.50 | 52.50 | 50.75 |
| 555 | 50.25 | 52.50 | 50.50 | 50.50 | 51.00 | 51.00 |
| 558 | 51.50 | 51.00 | 52.50 | 52.50 | 52.50 | 52.50 |
| Holstein average | 50.70 | 51.65 | 51.40 | 52.10 | 51.75 | 51.40 |
| Average | 47.89 | 48.83 | 49.02 | 49.19 | 49.30 | 49.19 |

TABLE V

HEART GIRTH OF HEIFERS (INCHES)

| Number | Nov. 1 | Dec. 1 | Jan. 1 | Feb. 1 | Mar. 1 | Mar. 28 |
|---|---|---|---|---|---|---|
| | | | (No Pasture) | | | |
| T-267 | 63.75 | 64.50 | 64.50 | 66.75 | 64.50 | 64.00 |
| T-268 | 58.75 | 60.00 | 60.00 | 61.75 | 60.50 | 58.00 |
| T-270 | 58.50 | 61.50 | 59.00 | 64.00 | 65.00 | 58.50 |
| T-282 | 55.75 | 55.00 | 55.25 | 56.25 | 56.50 | 53.25 |
| Jersey average | 59.81 | 60.25 | 59.69 | 62.19 | 61.37 | 58.44 |
| 544 | 68.75 | 71.00 | 70.50 | 70.50 | 70.00 | 68.00 |
| 550 | 70.00 | 73.00 | 70.75 | 74.50 | 74.50 | 73.00 |
| 553 | 69.00 | 70.50 | 70.00 | 71.75 | 70.50 | 67.00 |
| 556 | 69.00 | 72.50 | 69.75 | 70.75 | 70.75 | 68.50 |
| 559 | 68.00 | 71.00 | 69.00 | 69.50 | 70.00 | 67.00 |
| Holstein average | 68.95 | 71.60 | 70.00 | 71.40 | 71.10 | 68.70 |
| Average | 64.57 | 66.55 | 57.58 | 67.30 | 66.91 | 64.14 |
| | | | (Pasture) | | | |
| T-259 | 67.00 | 71.00 | 69.00 | 70.25 | 69.25 | 66.00 |
| T-264 | 63.00 | 64.50 | 63.75 | 65.75 | 65.00 | 62.00 |
| T-269 | 60.00 | 62.00 | 59.75 | 62.00 | 64.25 | 60.00 |
| T-275 | 54.75 | 57.50 | 56.50 | 59.00 | 58.00 | 57.00 |
| Jersey average | 61.18 | 63.75 | 62.25 | 64.25 | 64.12 | 61.25 |
| 542 | 72.50 | 75.50 | 74.50 | 76.50 | 75.50 | 74.00 |
| 546 | 68.50 | 71.50 | 70.50 | 73.50 | 72.00 | 70.50 |
| 554 | 67.50 | 70.00 | 71.00 | 74.00 | 70.00 | 68.25 |
| 555 | 69.25 | 72.00 | 72.50 | 74.00 | 73.50 | 70.00 |
| 558 | 66.50 | 71.50 | 69.00 | 71.00 | 68.50 | 69.50 |
| Holstein average | 68.88 | 72.10 | 71.50 | 73.80 | 71.90 | 70.45 |
| Average | 65.44 | 68.39 | 67.38 | 69.55 | 68.44 | 66.35 |

The hay was of very ordinary quality, being over-ripe and stemmy. The hay was field cured and was typical of much of the hay produced throughout the state. The hay was approximately 50 percent legume (lespedeza) and 50 percent grass. There were some weeds and debris in the hay.

## Palatability of Hay

Group I consumed 93.7 percent of the hay fed, while Group II consumed 90.0 percent. The refusal was greater with the group that was on pasture. During fair weather the pasture group stayed out much of the time and only ate the best part of the hay.

## Hay Fed and Consumed

The amount of hay fed, refused, and consumed is shown in Tables VI and VII.

The heifers in Group I and Group II were fed sufficient hay during the hay feeding period to have hay before them at all times. This is shown by the amounts of hay removed at each feeding period. During the entire hay feeding period both groups were fed a fairly constant amount of hay except during fair weather the heifers in Group II ate only moderately. For the period, Group I was fed 28,595 pounds of hay, refused 1,800 pounds, and consumed 26,795 pounds. On the average each heifer was fed 3,177 pounds, refused 200, and consumed 2,977 pounds. The average daily amount was 21.4 pounds fed, 1.35 pounds refused, and

TABLE VI

AMOUNT OF HAY FED, REFUSED, AND CONSUMED BY
TRIAL HEIFERS IN GROUP I
(WEEKLY TOTALS)

| Date | Fed | Refused | Consumed |
|---|---|---|---|
| November 7 | 1205 | 56 | 1149 |
| November 14 | 1313 | 120 | 1193 |
| November 21 | 1347 | 55 | 1292 |
| November 28 | 1370 | 103 | 1267 |
| December 5 | 1436 | 65 | 1371 |
| December 12 | 1425 | 23 | 1402 |
| December 19 | 1600 | 30 | 1570 |
| December 26 | 1367 | 49 | 1318 |
| January 2 | 1174 | 37 | 1137 |
| January 9 | 1295 | 118 | 1177 |
| January 16 | 1483 | 167 | 1316 |
| January 23 | 1388 | 210 | 1178 |
| January 30 | 1419 | 117 | 1302 |
| February 6 | 1452 | 74 | 1378 |
| February 13 | 1397 | 36 | 1361 |
| February 20 | 1432 | 80 | 1352 |
| February 27 | 1239 | 122 | 1117 |
| March 6 | 1484 | 123 | 1361 |
| March 13 | 1241 | 70 | 1171 |
| March 20 | 1268 | 64 | 1204 |
| March 27 | 1187 | 30 | 1157 |
| March 28 | 73 | 51 | 22 |
| Total | 28,595 | 1,800 | 26,795 |

TABLE VII

AMOUNT OF HAY FED, REFUSED, AND CONSUMED BY
TRIAL HEIFERS IN GROUP II
(WEEKLY TOTALS)

| Date | Fed | Refused | Consumed |
|---|---|---|---|
| November 7 | 205 | 0 | 205 |
| November 14 | 365 | 66 | 299 |
| November 21 | 372 | 17 | 355 |
| November 28 | 818 | 64 | 754 |
| December 5 | 1175 | 54 | 1121 |
| December 12 | 592 | 28 | 564 |
| December 19 | 828 | 26 | 802 |
| December 26 | 970 | 75 | 895 |
| January 2 | 699 | 111 | 588 |
| January 9 | 925 | 68 | 857 |
| January 16 | 949 | 108 | 841 |
| January 23 | 863 | 132 | 731 |
| January 30 | 1058 | 198 | 860 |
| February 6 | 927 | 144 | 783 |
| February 13 | 883 | 21 | 862 |
| February 20 | 1121 | 72 | 1049 |
| February 27 | 1130 | 73 | 1057 |
| March 6 | 596 | 23 | 573 |
| March 13 | 648 | 9 | 639 |
| March 20 | 670 | 41 | 629 |
| March 27 | 550 | 39 | 511 |
| March 28 | 38 | 38 | 0 |
| Total | 16,382 | 1,407 | 14,975 |

20.1 pounds consumed. Group II was fed 16,382 pounds, refused 1,407 pounds, and consumed 14,975 pounds. On the average each heifer was fed 1,820 pounds, refused 156.3 pounds, and consumed 1,664 pounds. The average daily amount for this group was 12.3 pounds fed, 1.05 pounds refused, and 11.2 pounds consumed.

# CHAPTER V

## SUMMARY

This study was conducted to compare the efficiency of hay supplemented by pasture and hay alone for wintering dairy heifers. Actual feeding trials were used with the heifers.

Group I. Nine heifers, four Jerseys and five Holsteins, were fed hay alone.

Group II. Nine heifers, four Jerseys and five Holsteins, were fed hay supplemented by permanent pasture.

Groups I and II were fed hay ad lib. for 148 days after which they were put on summer pasture. Monthly weights were kept for a period of 90 days.

The heifers in both groups remained thrifty and vigorous throughout the feeding trial, even though gains were not as high as those reported in the Missouri Standard. While on the hay ration, Group I averaged 25 pounds loss per heifer. The average daily loss was .17 pound per heifer. For the same period Group II averaged 25 pounds gain per heifer. The average daily gain was .17 pound each. Group I on pasture gained an average of 115 pounds each. The average daily gain was 1.21 pounds each. Group II on pasture gained daily an average of 1.29 pounds each. In Group II the Holstein heifers made greater gains than did the Jerseys. In Group I the Jerseys averaged less loss in weight than did the Holsteins during the feeding trial.

The heifers that were fed hay and had access to pasture increased

more in height at withers than did the heifers that were fed hay alone. For the hay feeding period, the Jersey heifers averaged an increase of .38 inch each; the Holsteins in this group increased 1.40 inches each. The Jerseys in Group II averaged 1.88 inches increase in height during the 148 days. The Holsteins in this group averaged an increase of 1.40 inches, the same as in Group I.

The heifers in Group II increased slightly in heart girth, while the heifers in Group I decreased in heart girth. Actual average losses for heifers in Group I were .74 inch each for the Jerseys and .25 inch for the Holsteins. The Jerseys in Group II averaged an increase of .07 inch each. The Holsteins in this Group each averaged an increase of 1.57 inches.

The heifers consumed hay as follows:

Group I was fed daily 21.4 pounds per heifer, refused 1.35 pounds and consumed 20.1 pounds.

Group II was fed 12.3 pounds per heifer, refused 1.05 pounds, and consumed 11.2 pounds.

The heifers in Group I consumed 93.7 percent of the hay. Group II consumed 90.0 percent of the hay fed. The two groups were fed the same kind of hay throughout the experiment. The hay (half lespedeza and half grass) was of ordinary quality and overripe. The palatability of the hay was satisfactory according to the percentage consumed of the amount fed.

Observations indicated that permanent pasture during the winter cut down on hay consumption by half. The consumption of salt and bone meal was also cut in half. Even though pasture was supplied, the winter

gains were below the Missouri Standard. Both groups of heifers made satisfactory gains when put on summer pasture. No ill effects or lowering of vigor was noted due to the feeding trial.

A summary of all of the data on the feeding trial is in Table VIII.

TABLE VIII

SUMMARY OF DATA OF FEEDING TRIAL

| Item | Group I | Group II |
|---|---|---|
| Number of animals in trial | 9 | 9 |
| Average age of animals (months) | 22 | 23 |
| Feeding trial (days) | 148 | 148 |
| Pasture period after trial (days) | 95 | 95 |
| Hay fed (pounds) | 28,595 | 16,382 |
| Hay refused (pounds) | 1,800 | 1,407 |
| Hay consumed (pounds) | 26,795 | 14,975 |
| Percent consumed | 93.7 | 90.0 |
| Composition of hay | | |
| Crude protein | 7.54 | 7.54 |
| Ash | 5.00 | 5.00 |
| Moisture | 6.20 | 6.20 |
| Weight | | |
| Hay feeding period: | | |
| Jersey initial weight | 635.5 | 692.2 |
| Gain | -9.0 | 4.5 |
| Holstein initial weight | 966.4 | 987.6 |
| Gain | -37.8 | 33.4 |
| Group initial weight | 819.3 | 851.3 |
| Gains | -225 | 225 |
| Average daily gain | -0.17 | 0.17 |
| Summer pasture period: | | |
| Jersey gain | 74.0 | 121.0 |
| Holstein gain | 149.0 | 124.0 |
| Group gain | 115.0 | 123.6 |
| Average daily gain | 1.21 | 1.29 |
| Height at withers | | |
| Hay feeding period: | | |
| Jersey initial height | 45.06 | 44.37 |
| Gain (inches) | 0.38 | 1.38 |
| Holstein initial height | 50.25 | 50.70 |
| Gain (inches) | 1.40 | 1.40 |
| Group initial height | 47.94 | 47.89 |
| Gain | 0.94 | 1.30 |
| Average daily gain | 0.00635 | 0.00877 |

TABLE VIII

SUMMARY OF DATA OF FEEDING TRIAL (continued)

| Item | Group I | Group II |
|---|---|---|
| Heart girth (inches) | | |
| Hay feeding period: | | |
| Jersey initial heart girth | 59.18 | 61.18 |
| Gain | -0.74 | 0.07 |
| Holstein initial heart girth | 68.95 | 68.38 |
| Gains | -0.25 | 1.57 |
| Group initial heart girth | 64.41 | 65.44 |
| Gain | -0.27 | 0.92 |
| Average daily gain | -0.00182 | 0.00621 |
| Hay fed per heifer | 3,177 | 1,820 |
| Hay refused per heifer | 200 | 156.3 |
| Hay consumed per heifer | 2,977 | 1,664 |
| Hay fed per heifer per day | 21.4 | 12.3 |
| Hay refused per heifer per day | 1.35 | 1.05 |
| Hay consumed per heifer per day | 20.1 | 11.2 |
| Total salt and bone meal consumption | 122 | 60 |
| Salt and bone meal consumption per heifer | 13.5 | 6.6 |

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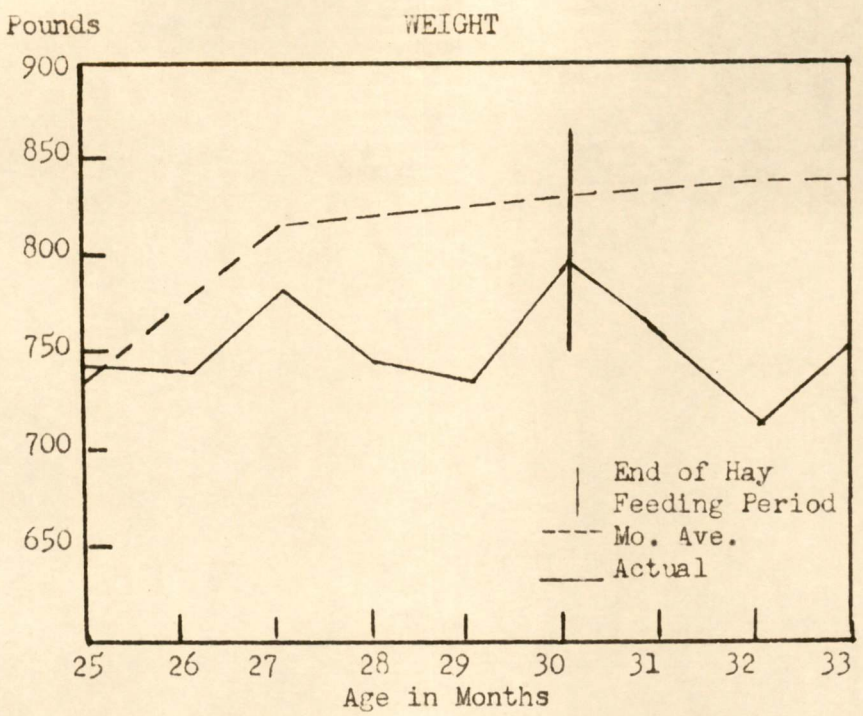
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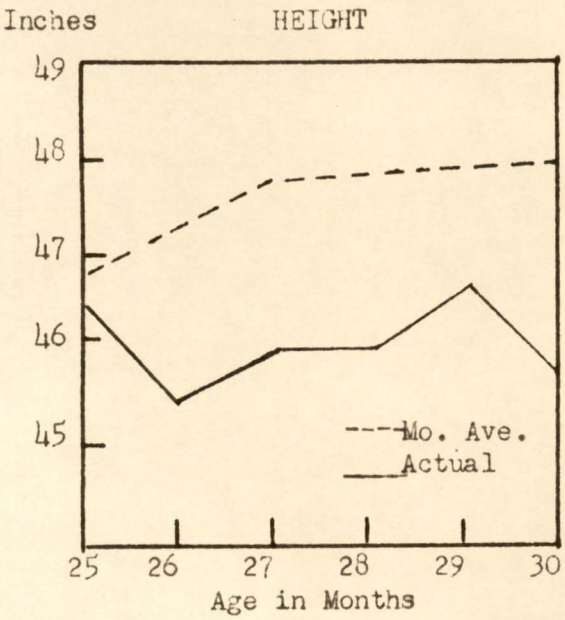
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# APPENDIX



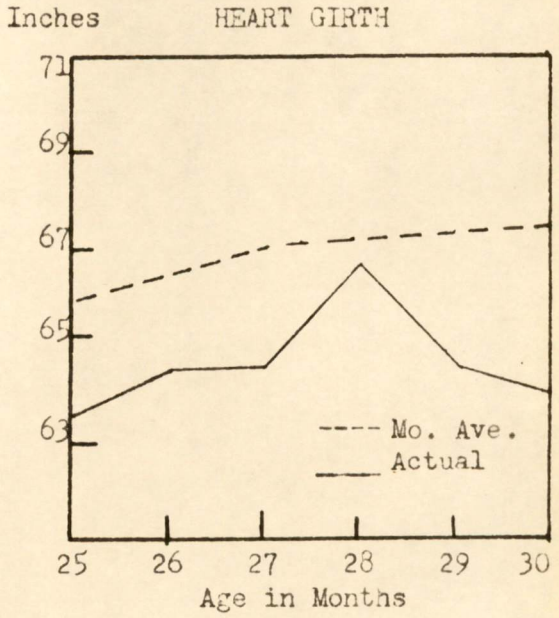




FIGURE 2

COMPARISON OF THE GROWTH MADE BY JERSEY HEIFER T-267 WITH THE AVERAGE GROWTH OF JERSEY HEIFERS AS SHOWN BY THE MISSOURI STANDARD

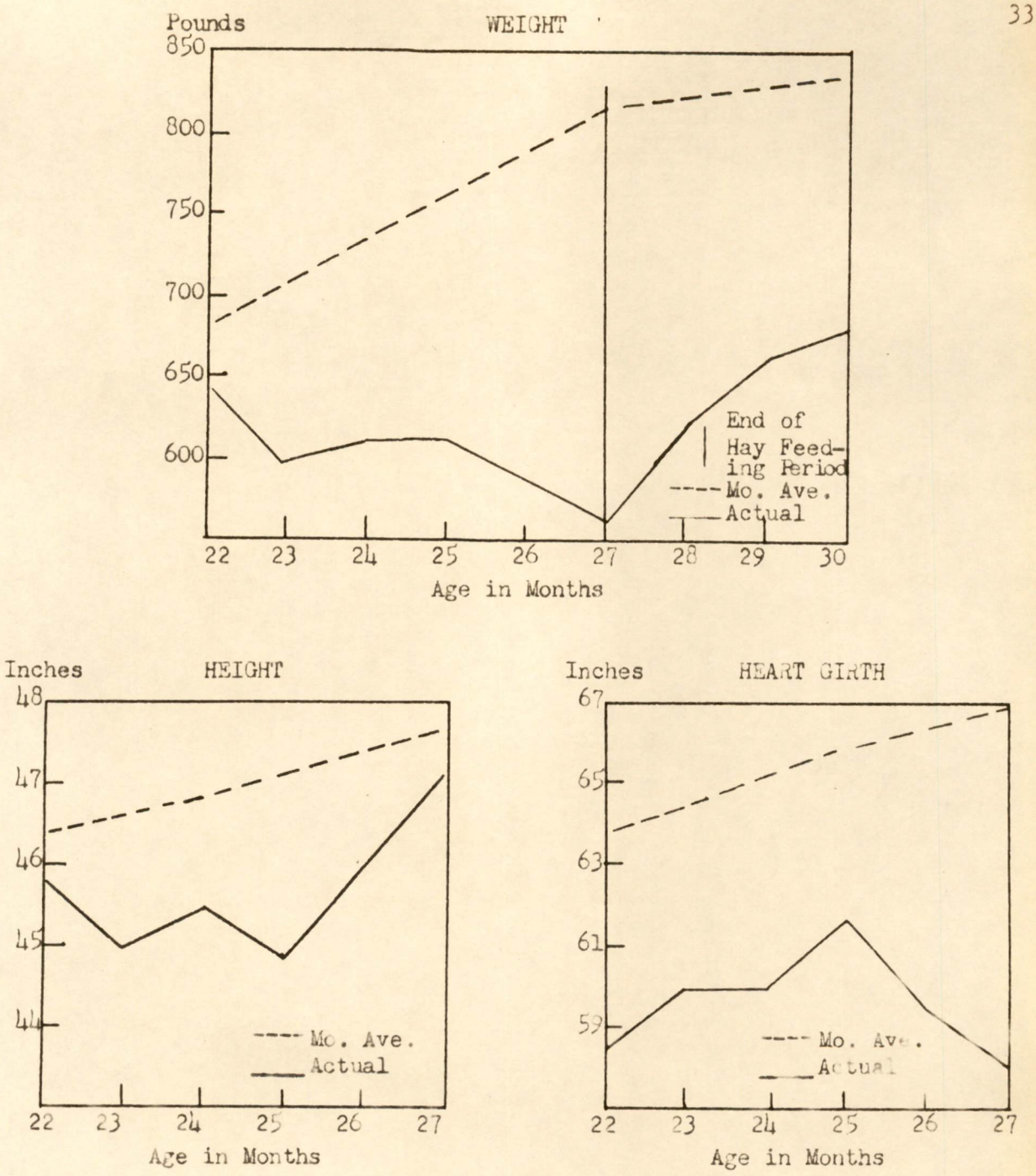
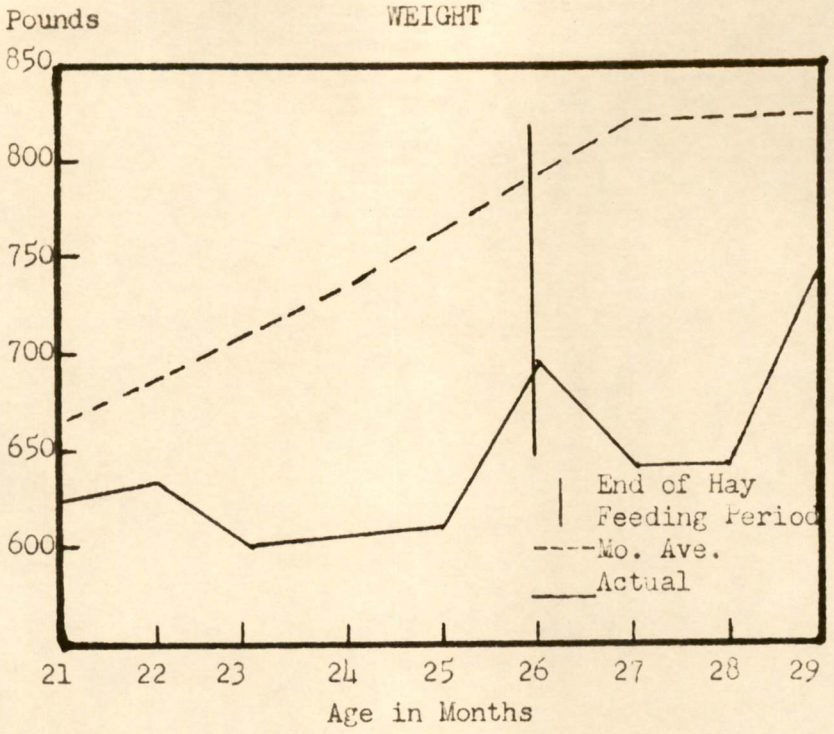
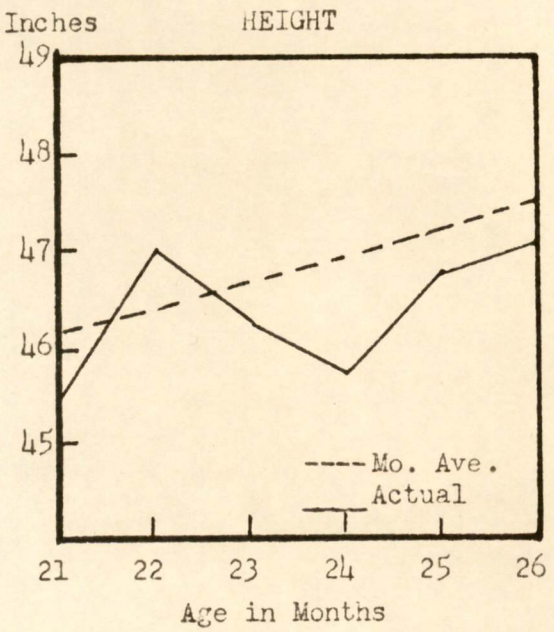



FIGURE 3

COMPARISON OF THE GROWTH MADE BY JERSEY HEIFER T-268 WITH THE AVERAGE GROWTH OF JERSEY HEIFERS AS SHOWN BY THE MISSOURI STANDARD

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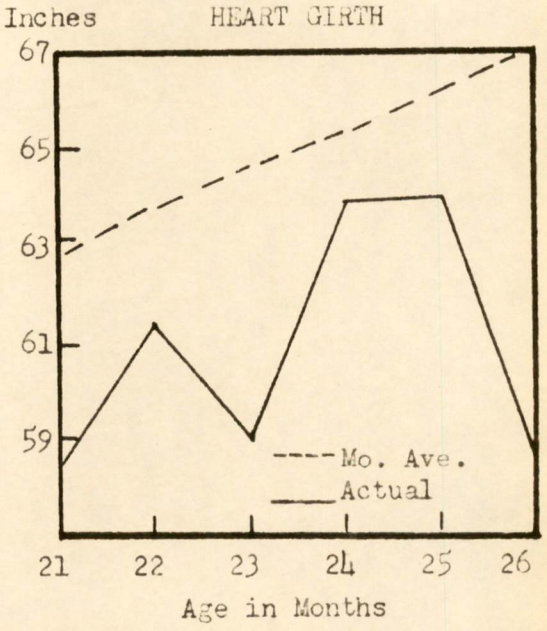




FIGURE 4

COMPARISON OF THE GROWTH MADE BY JERSEY HEIFER T-270 WITH THE AVERAGE GROWTH OF JERSEY HEIFERS AS SHOWN BY THE MISSOURI STANDARD

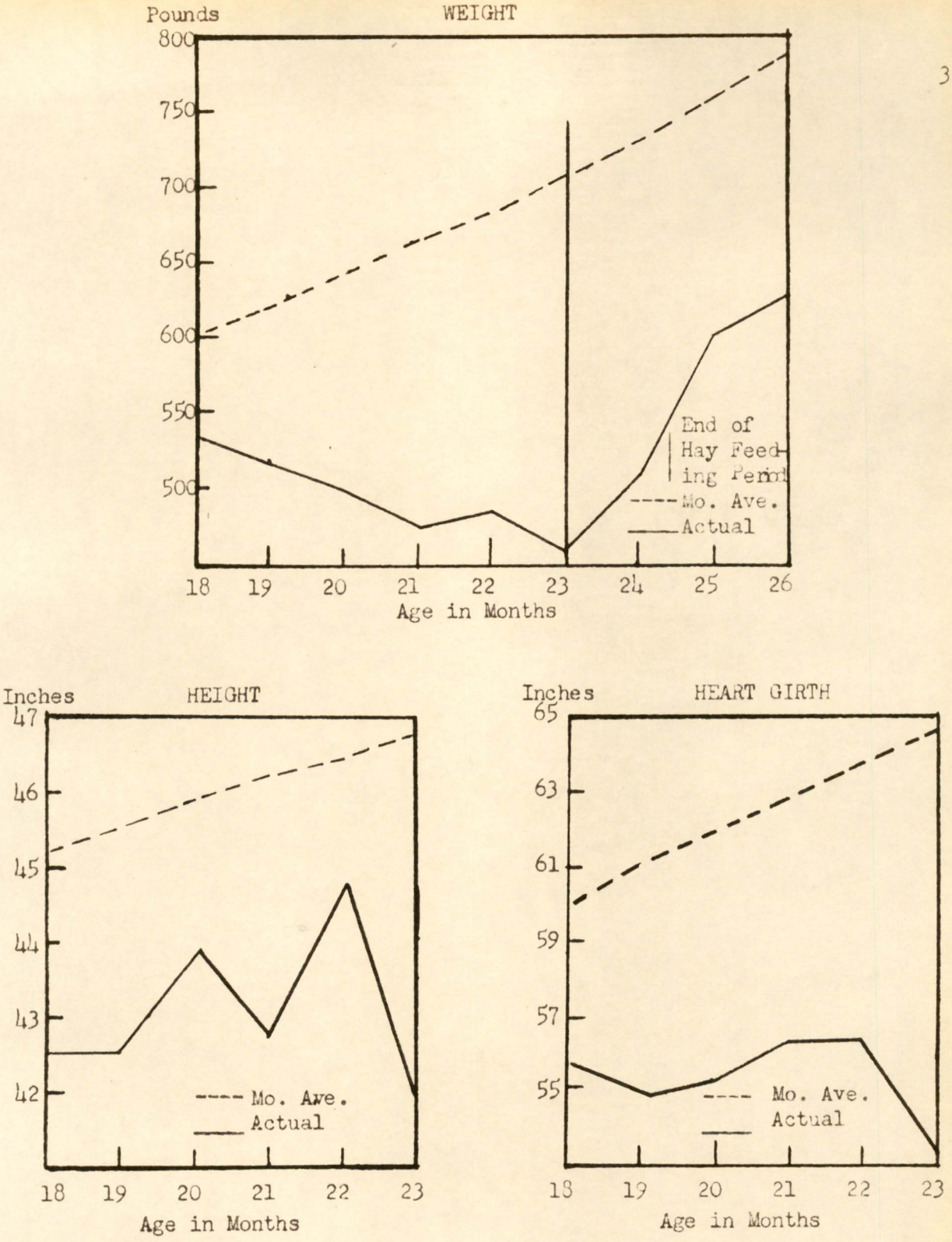



FIGURE 5

COMPARISON OF THE GROWTH MADE BY JERSEY HEIFER T-282 WITH THE AVERAGE GROWTH OF JERSEY HEIFERS AS SHOWN BY THE MISSOURI STANDARD

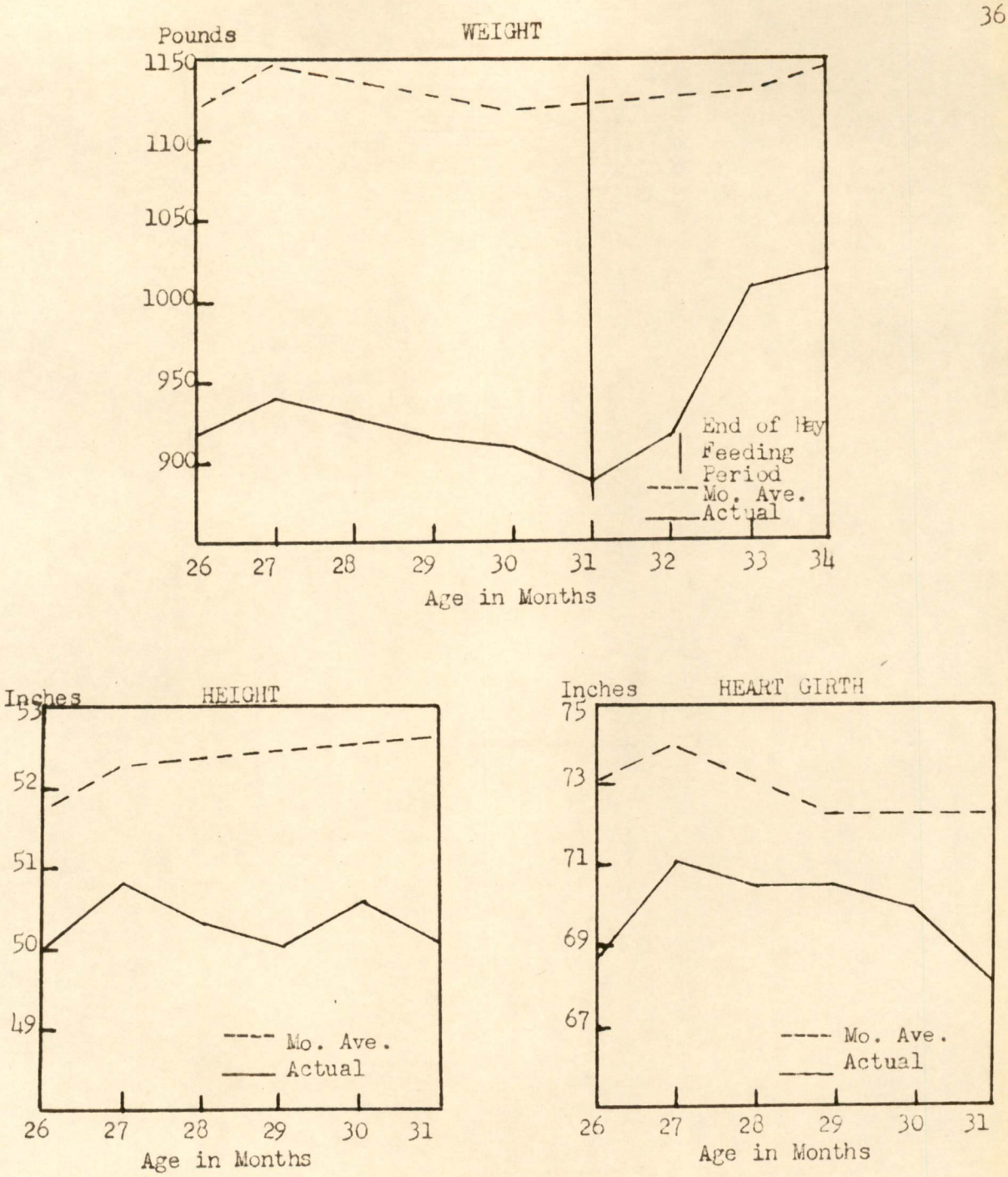



FIGURE 6

COMPARISON OF THE GROWTH MADE BY HOLSTEIN HEIFER 514 WITH THE AVERAGE GROWTH OF HOLSTEIN HEIFERS AS SHOWN BY THE MISSOURI STANDARD

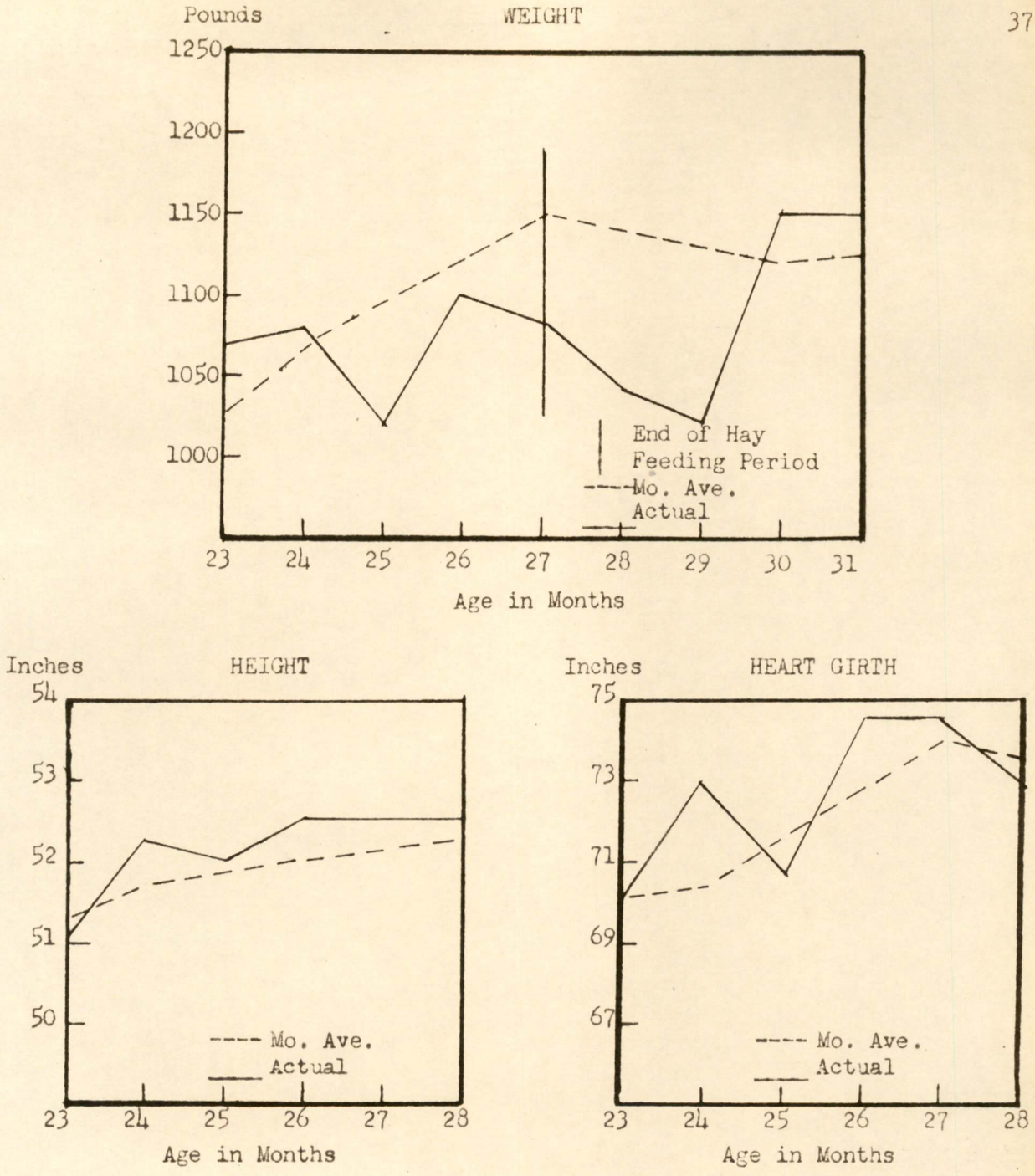



FIGURE 7

COMPARISON OF THE GROWTH MADE BY HOLSTEIN HEIFER 550 WITH THE AVERAGE GROWTH OF HOLSTEIN HEIFERS AS SHOWN BY THE MISSOURI STANDARD

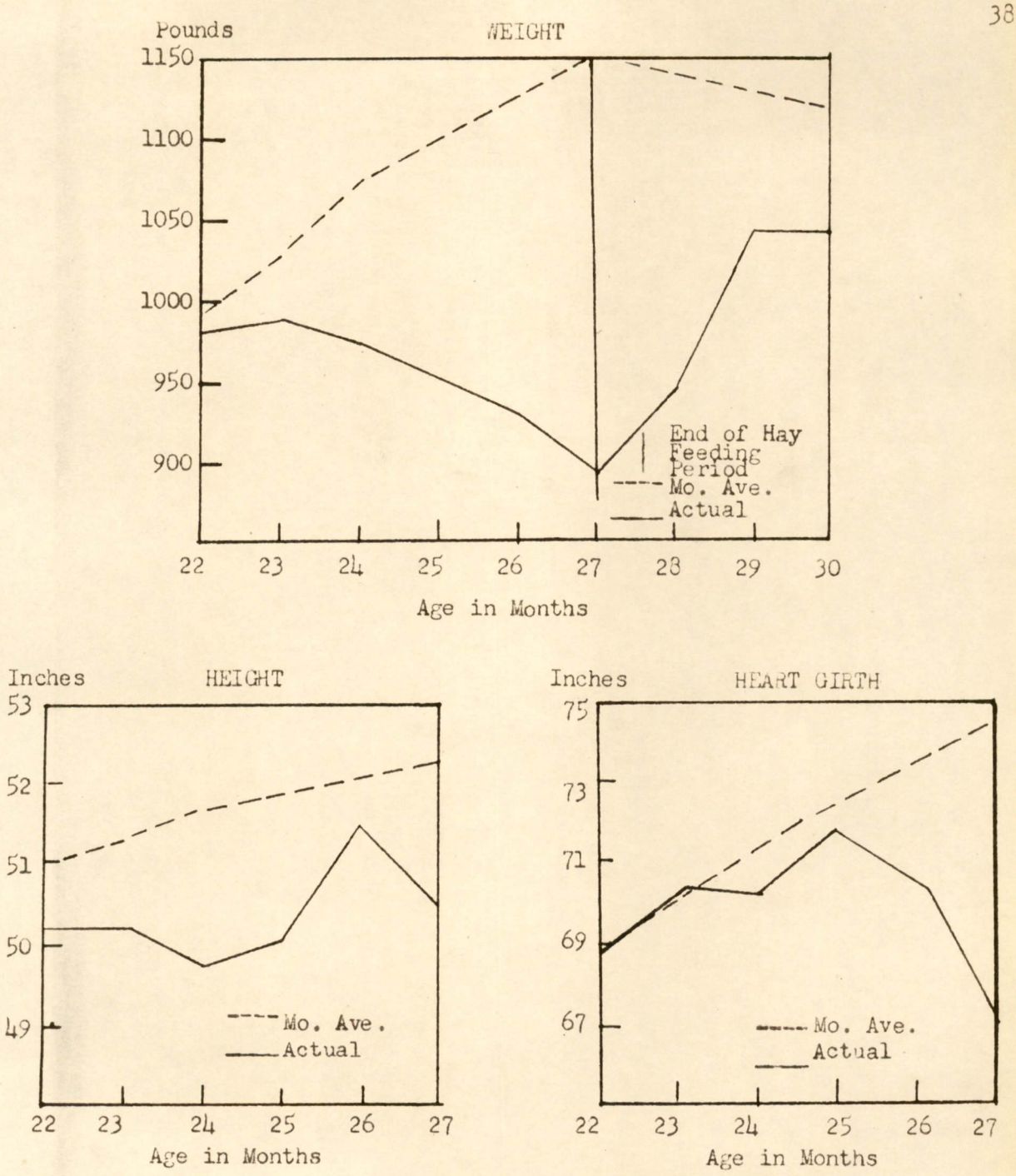
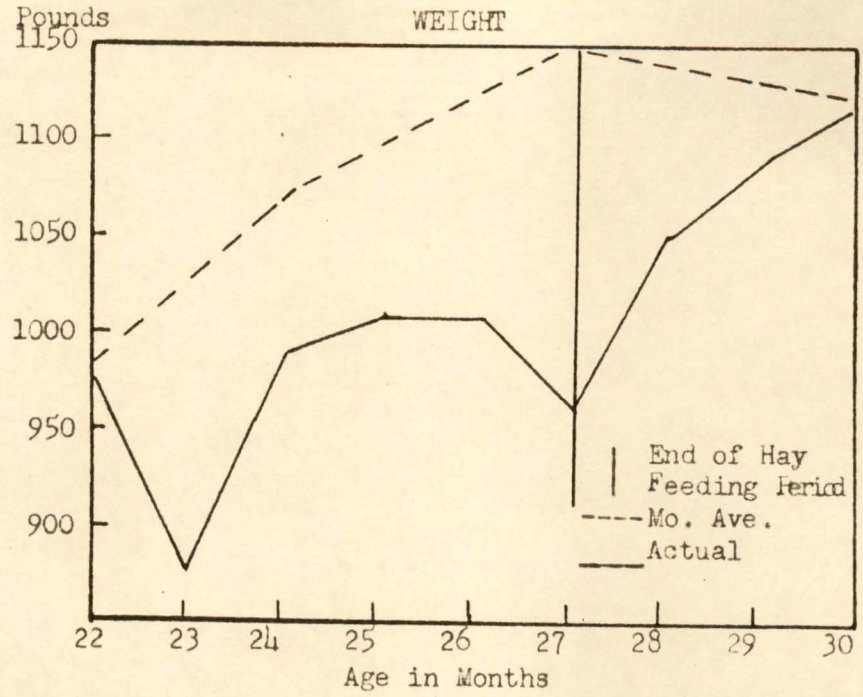
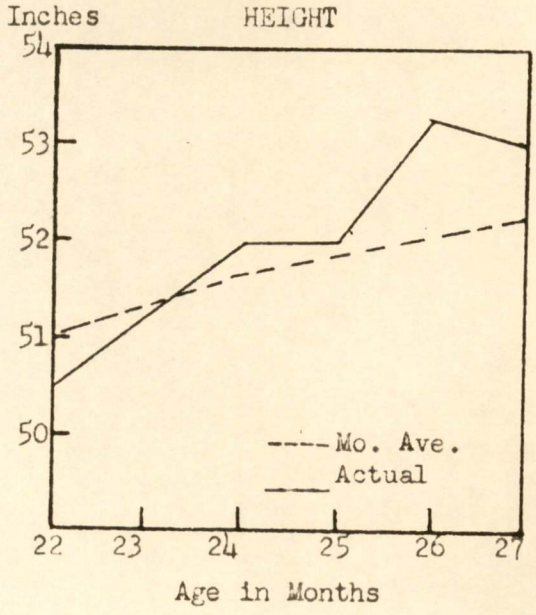



FIGURE 8

COMPARISON OF THE GROWTH MADE BY HOLSTEIN HEIFER 553 WITH THE AVERAGE GROWTH OF HOLSTEIN HEIFERS AS SHOWN BY THE MISSOURI STANDARD



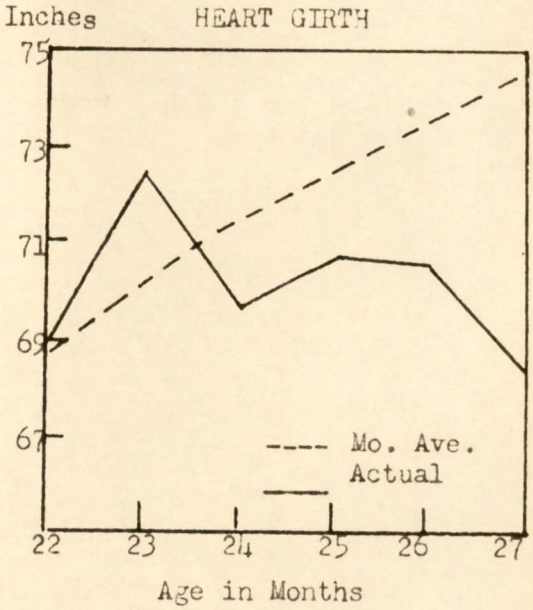




FIGURE 9

COMPARISON OF THE GROWTH MADE BY HOLSTEIN HEIFER 556 WITH THE AVERAGE GROWTH OF HOLSTEIN HEIFERS AS SHOWN BY THE MISSOURI STANDARD

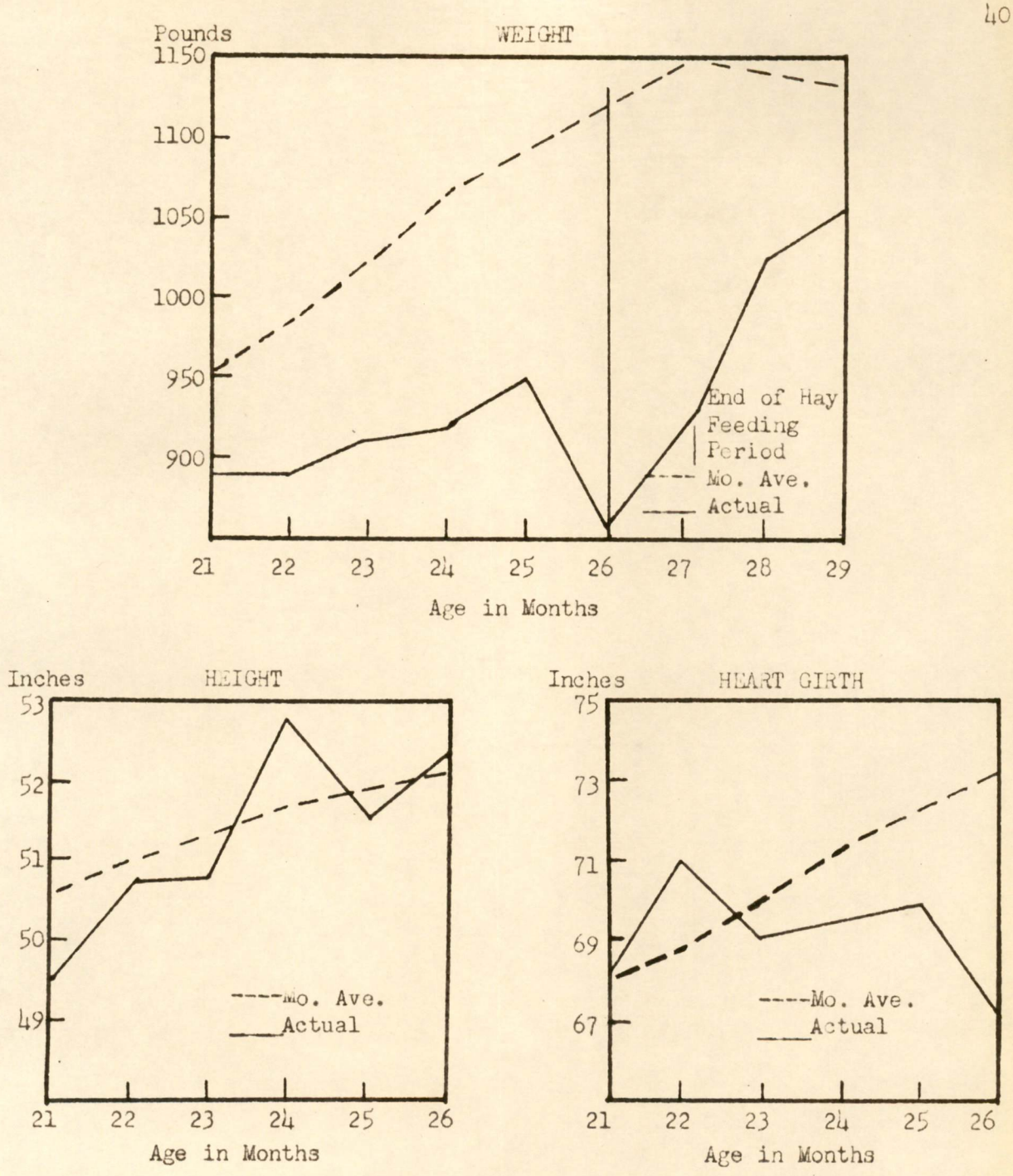



FIGURE 10

COMPARISON OF THE GROWTH MADE BY HOLSTEIN HEIFER 559 WITH THE AVERAGE GROWTH FOR HOLSTEIN HEIFERS AS SHOWN BY THE MISSOURI STANDARD

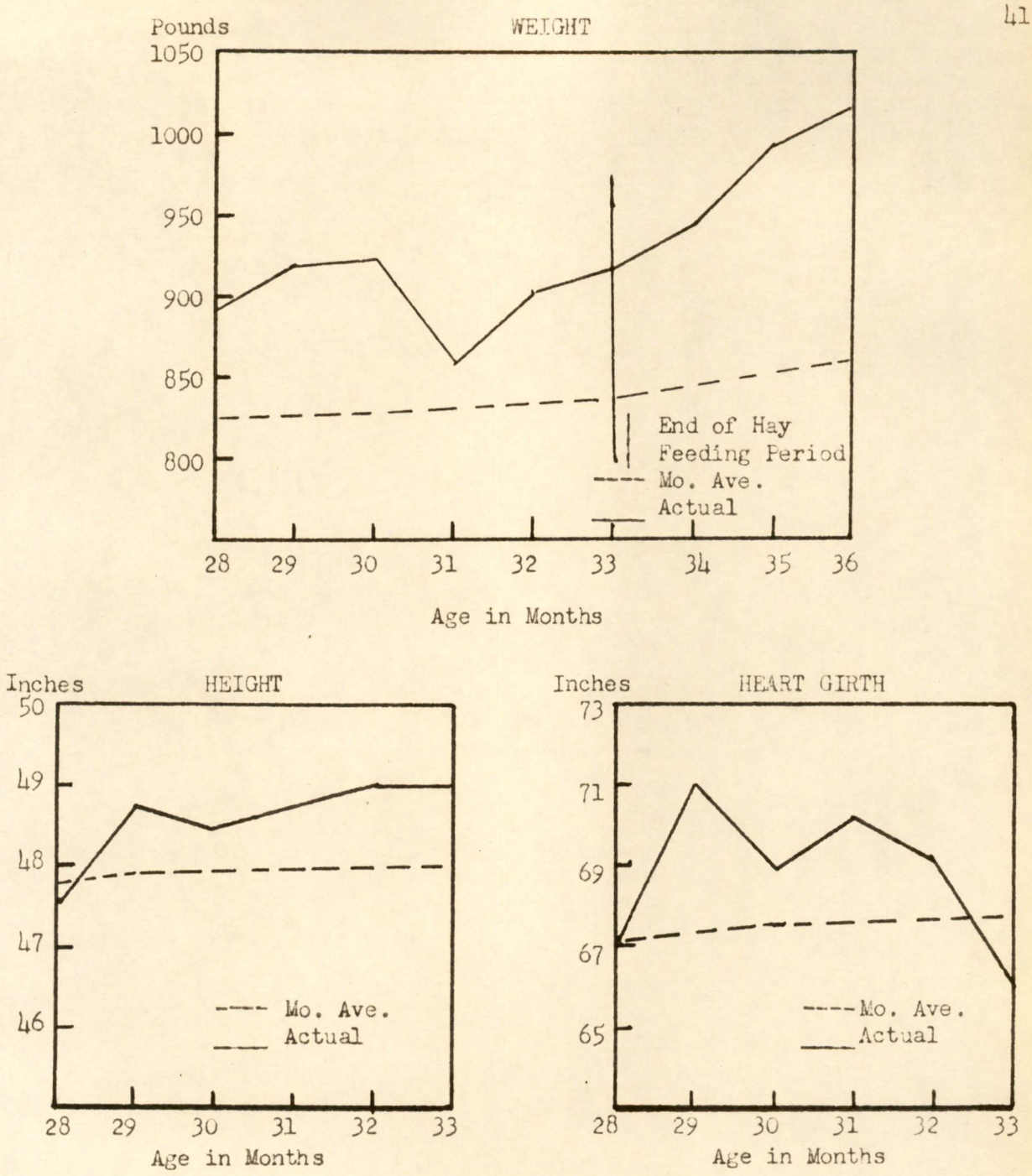



FIGURE 11

COMPARISON OF THE GROWTH MADE BY JERSEY HEIFER T-259 WITH THE AVERAGE GROWTH OF JERSEY HEIFERS AS SHOWN BY THE MISSOURI STANDARD

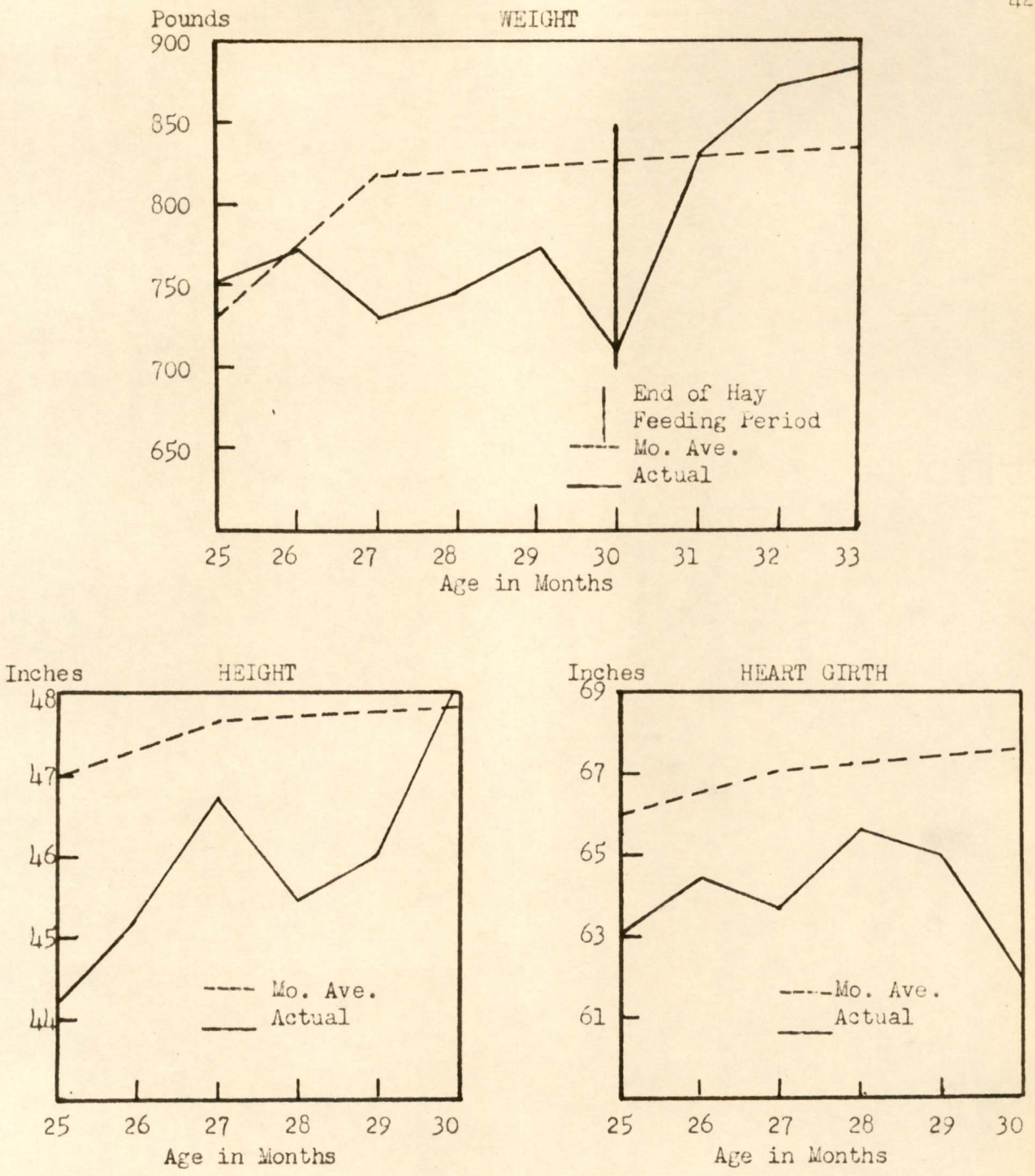



FIGURE 12

COMPARISON OF THE GROWTH MADE BY JERSEY HEIFER T-264 WITH THE AVERAGE GROWTH OF JERSEY HEIFERS AS SHOWN BY THE MISSOURI STANDARD

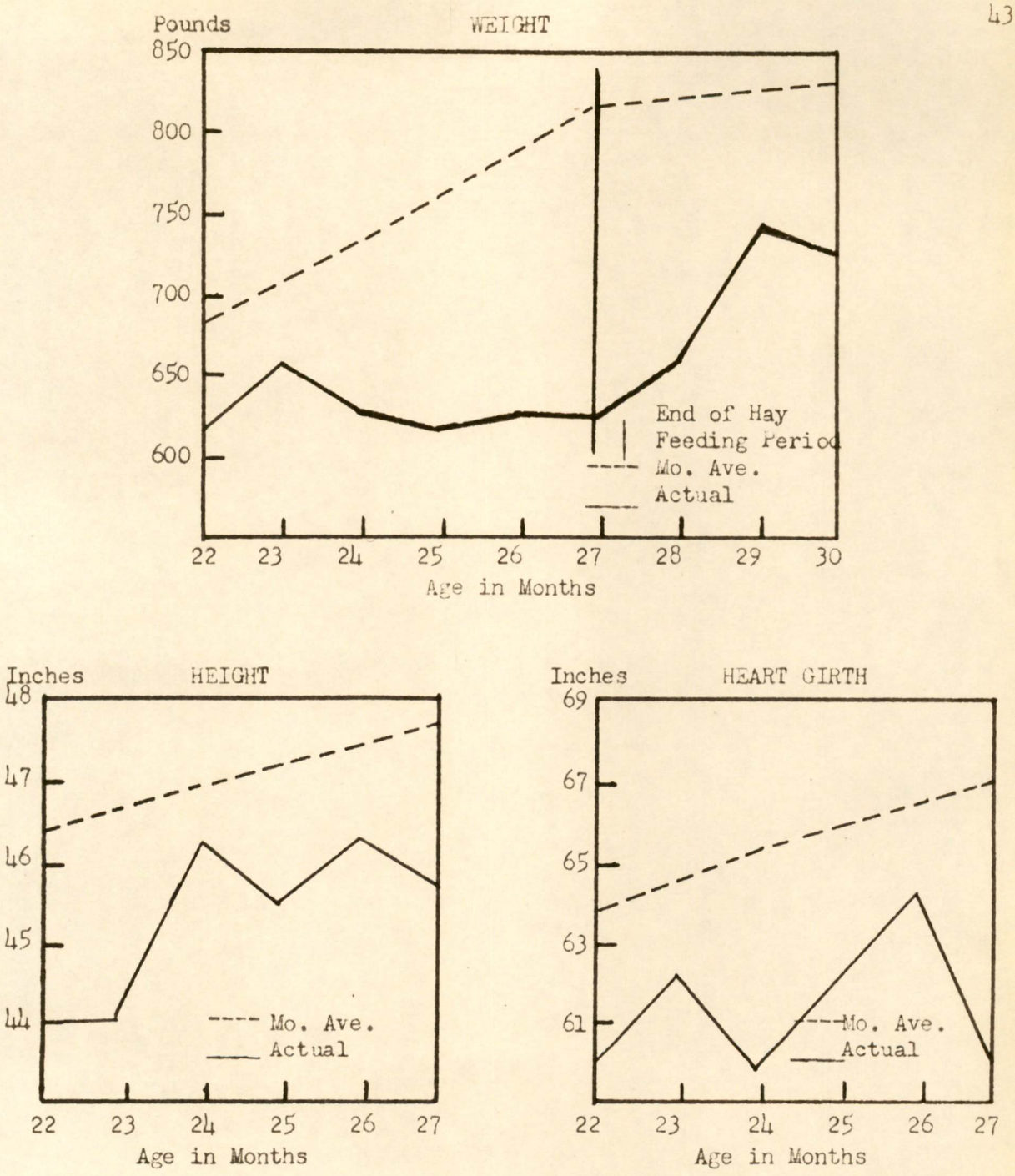



FIGURE 13

COMPARISON OF THE GROWTH MADE BY JERSEY HEIFER T-269 WITH THE AVERAGE GROWTH OF JERSEY HEIFERS AS SHOWN BY THE MISSOURI STANDARD

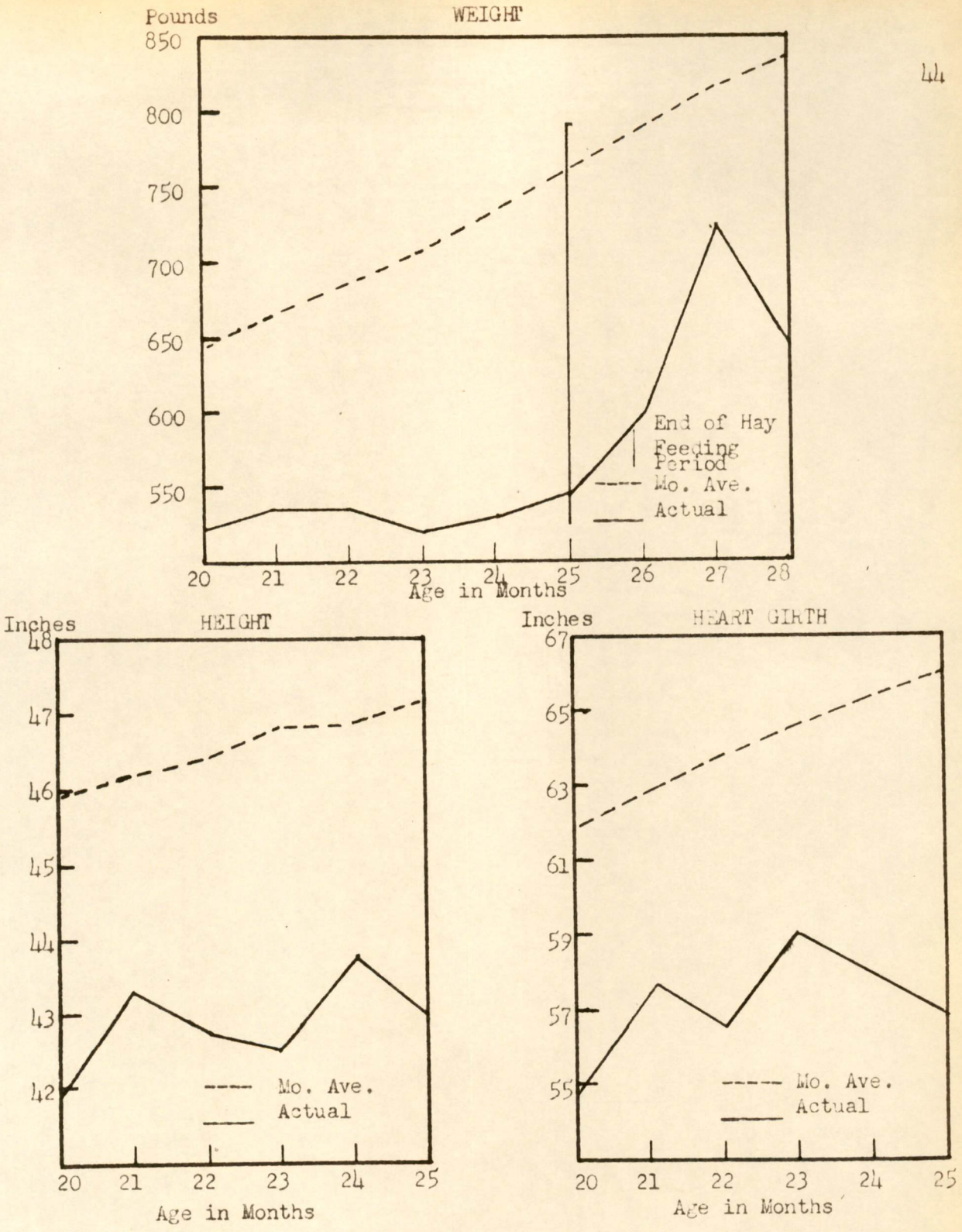



FIGURE 14

COMPARISON OF THE GROWTH MADE BY JERSEY HEIFER T-275 WITH THE AVERAGE GROWTH OF JERSEY HEIFERS AS SHOWN BY THE MISSOURI STANDARD

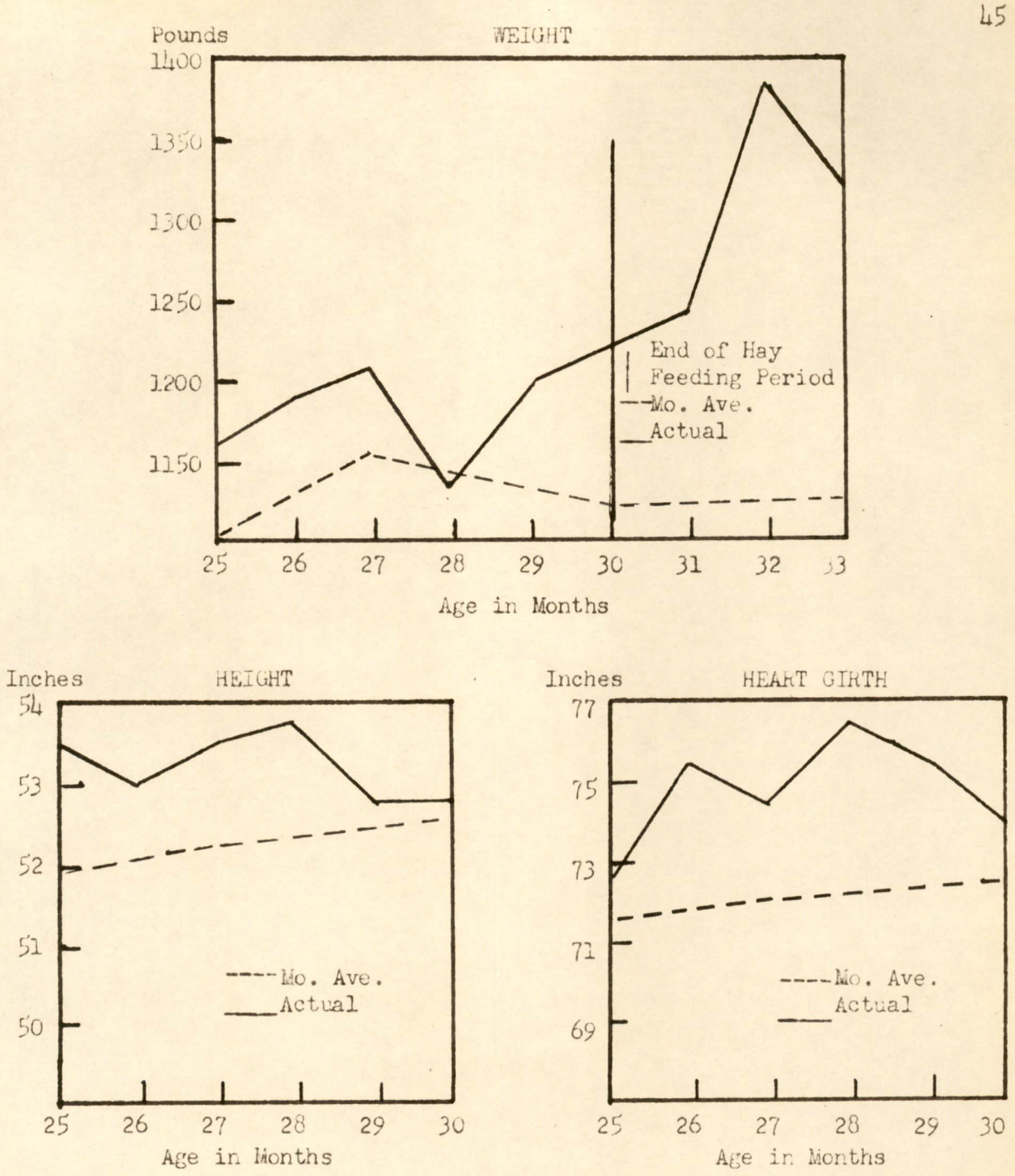



FIGURE 15

COMPARISON OF THE GROWTH MADE BY HOLSTEIN HEIFER 542 WITH THE AVERAGE GROWTH OF HOLSTEIN HEIFERS AS SHOWN BY THE MISSOURI STANDARD

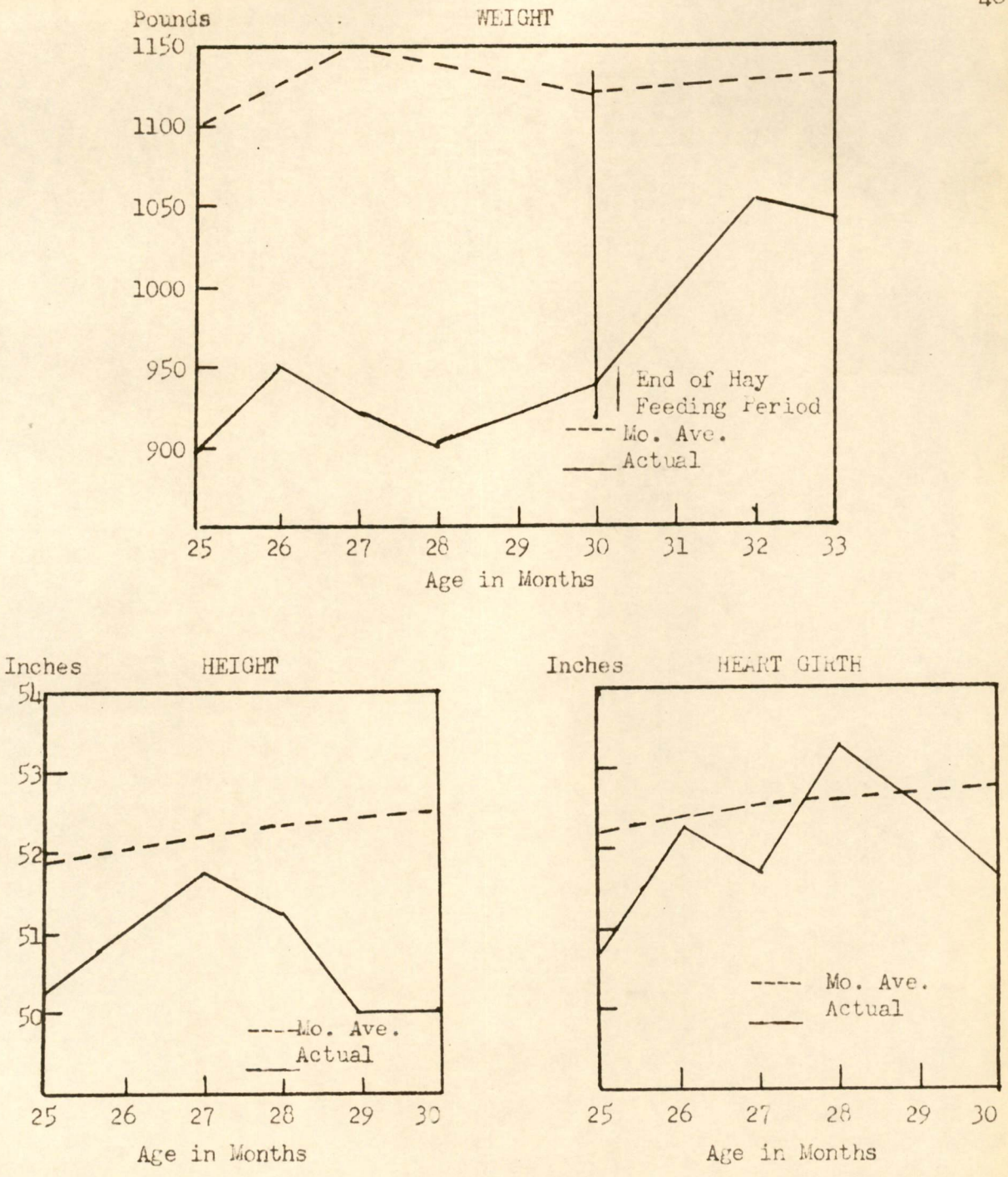



FIGURE 16

COMPARISON OF THE GROWTH MADE BY HOLSTEIN HEIFER 546 WITH THE AVERAGE GROWTH OF HOLSTEIN HEIFERS AS SHOWN BY THE MISSOURI STANDARD

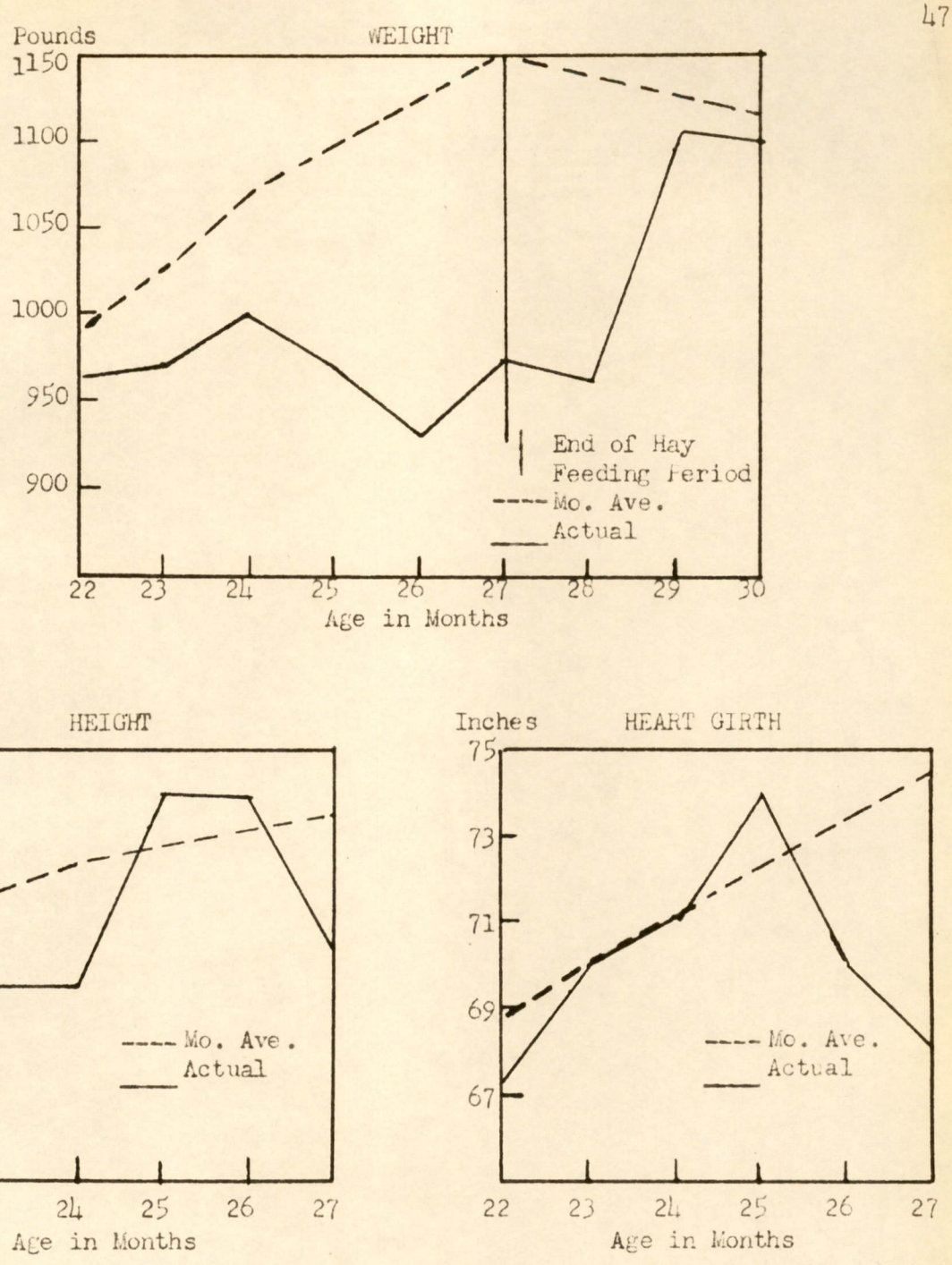
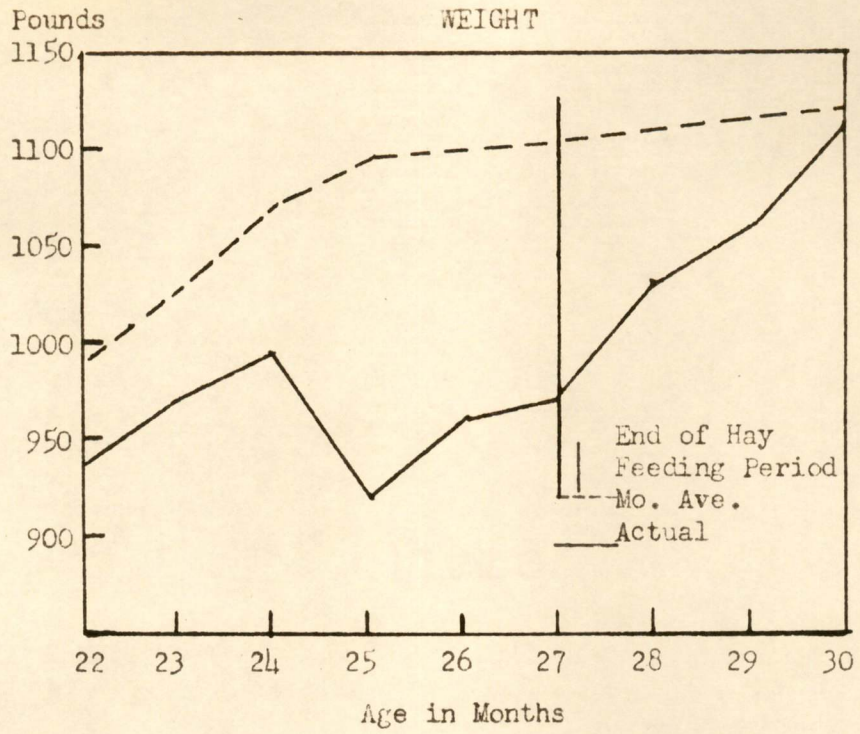
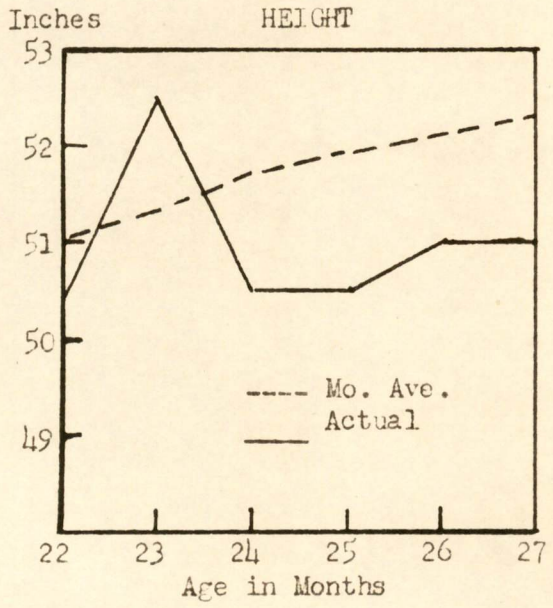



FIGURE 17

COMPARISON OF THE GROWTH MADE BY HOLSTEIN HEIFER 554 WITH THE AVERAGE GROWTH FOR HOLSTEIN HEIFERS AS SHOWN BY THE MISSOURI STANDARD



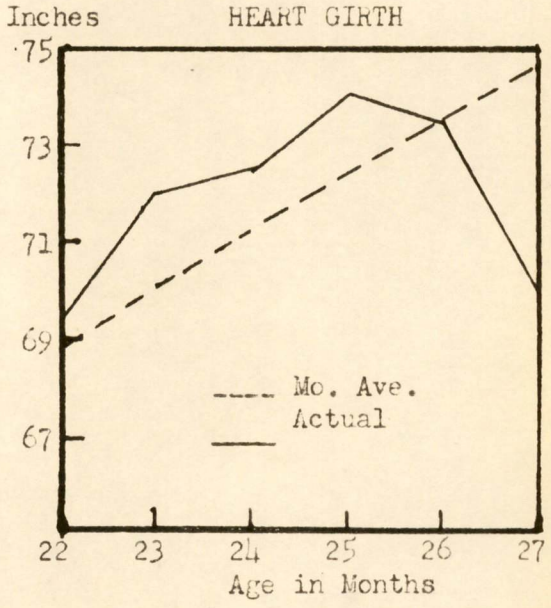
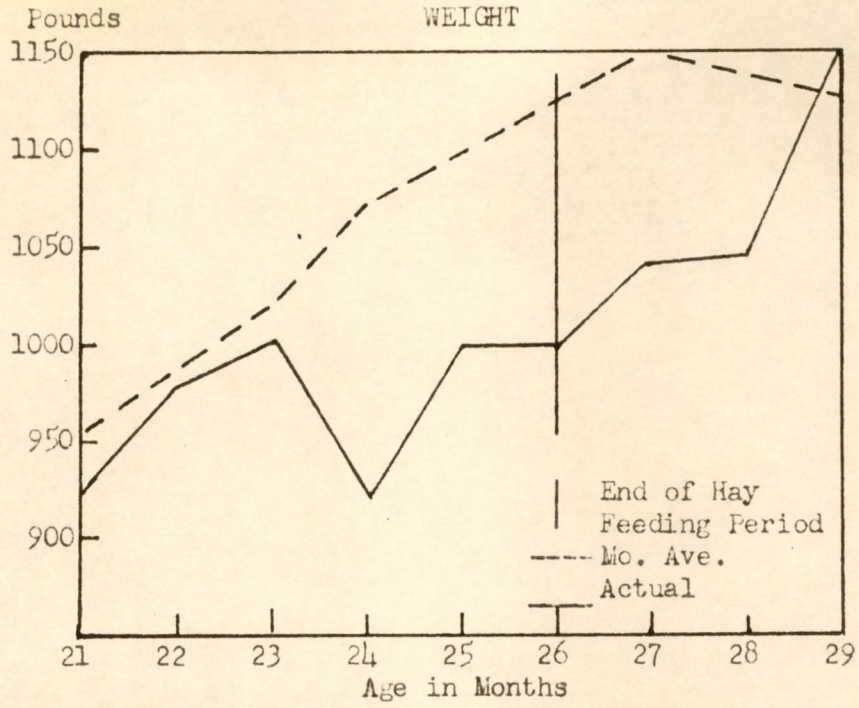
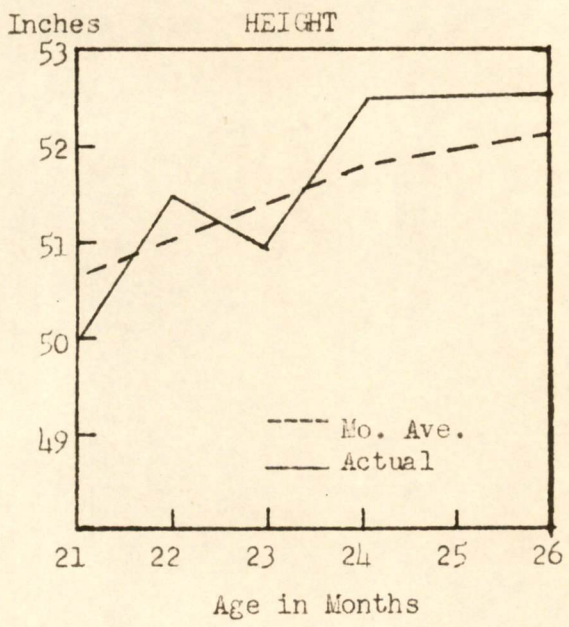




FIGURE 18

COMPARISON OF THE GROWTH MADE BY HOLSTEIN HEIFER 555 WITH THE AVERAGE GROWTH OF HOLSTEIN HEIFERS AS SHOWN BY THE MISSOURI STANDARD



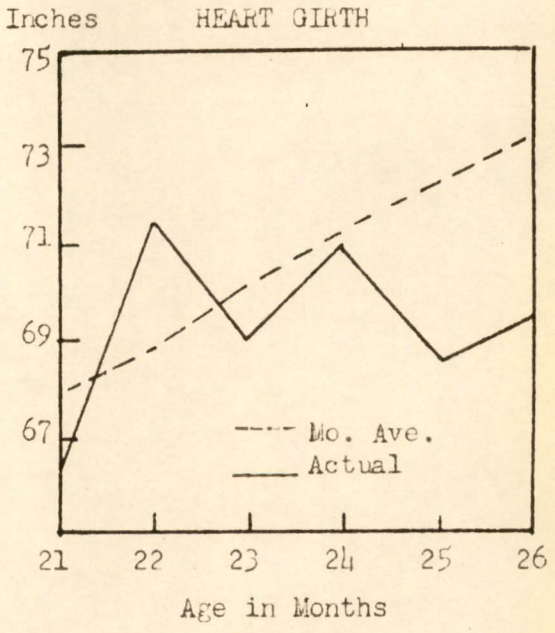
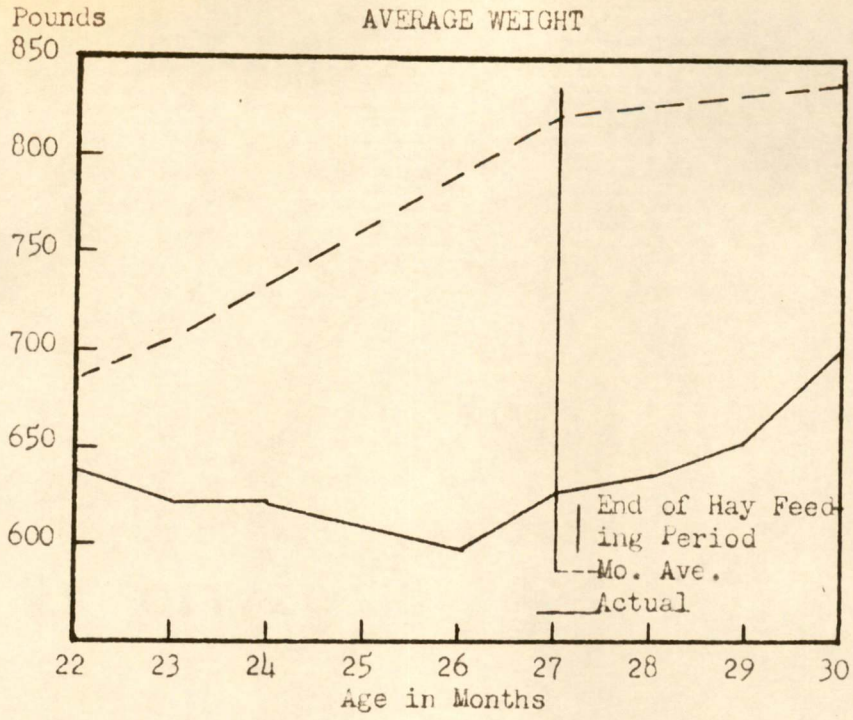
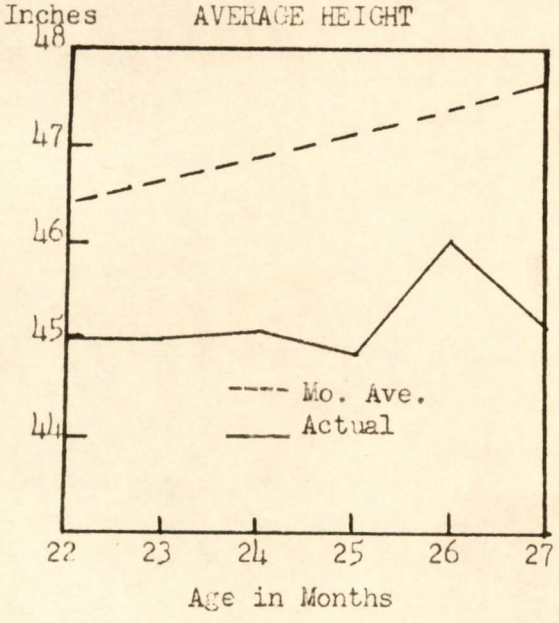




FIGURE 19

COMPARISON OF THE GROWTH MADE BY HOLSTEIN HEIFER 558 WITH THE AVERAGE GROWTH FOR HOLSTEIN HEIFERS AS SHOWN BY THE MISSOURI STANDARD



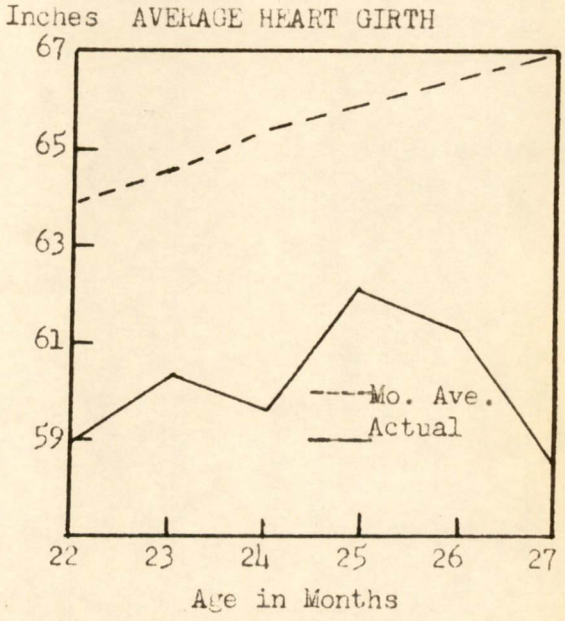
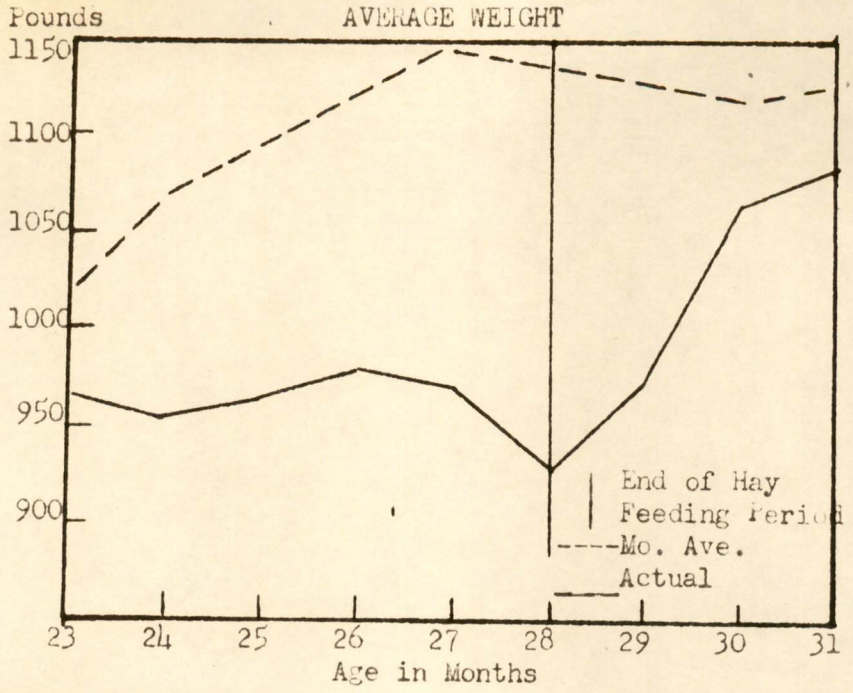
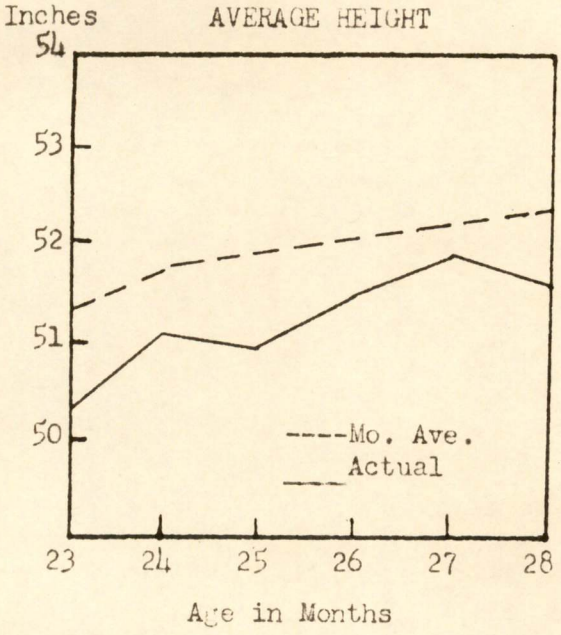




FIGURE 20

COMPARISON OF THE AVERAGE GROWTH MADE BY THE JERSEY HEIFERS IN GROUP I FED HAY ALONE WITH THE AVERAGE GROWTH OF JERSEY HEIFERS AS SHOWN BY THE MISSOURI STANDARD



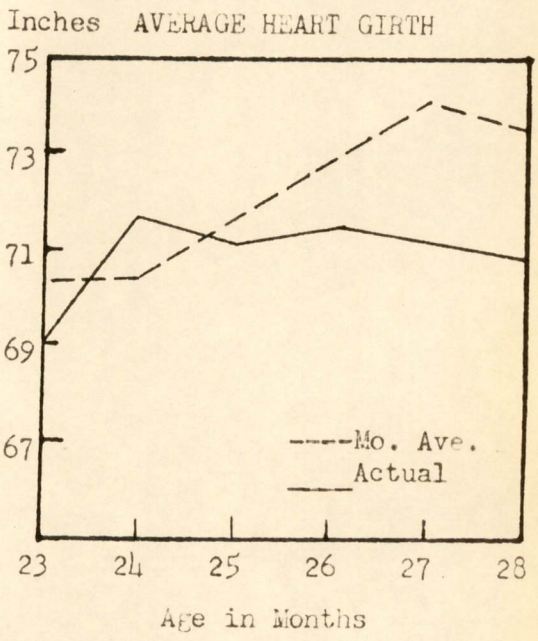
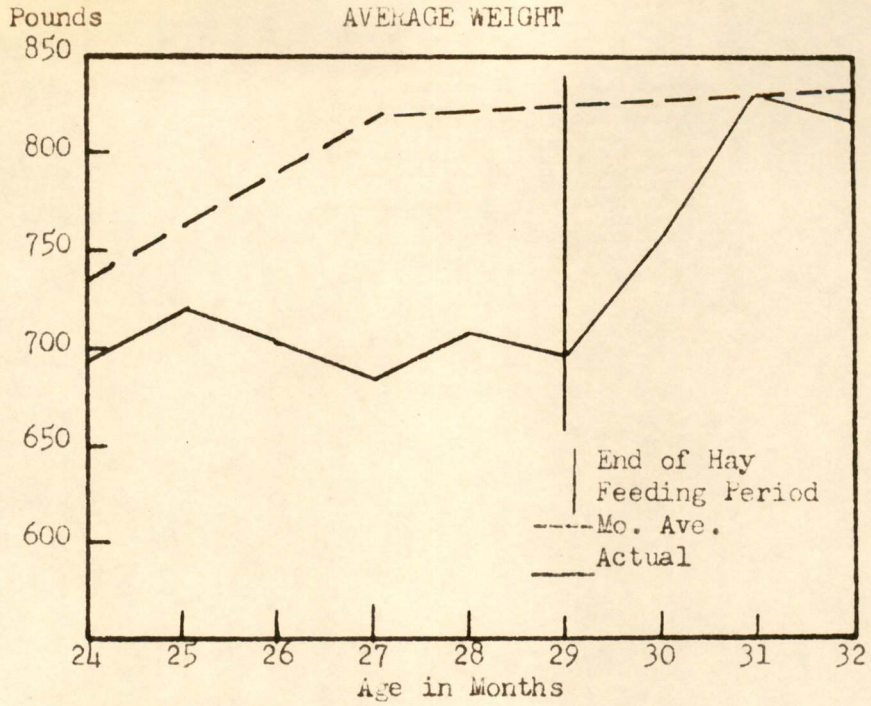
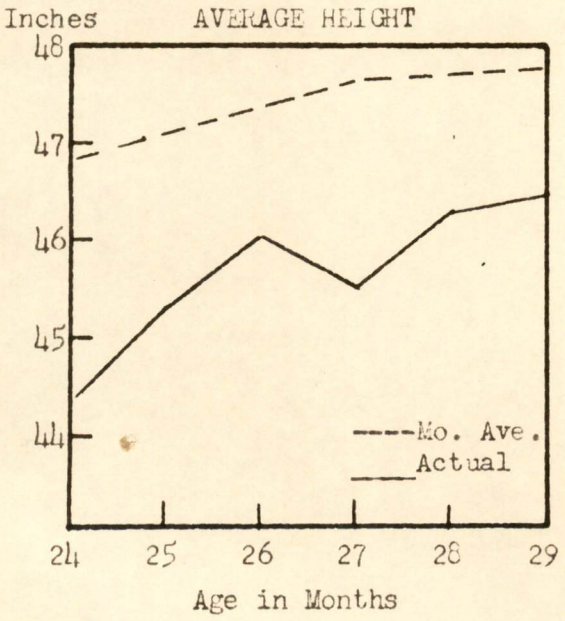




FIGURE 21

COMPARISON OF THE AVERAGE GROWTH MADE BY HOLSTEIN HEIFERS IN GROUP I (HAY ALONE) WITH THE AVERAGE GROWTH OF HOLSTEIN HEIFERS AS SHOWN BY THE MISSOURI STANDARD



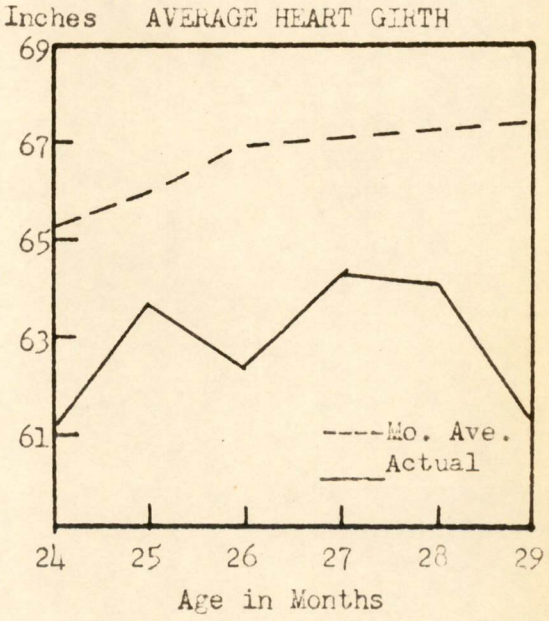
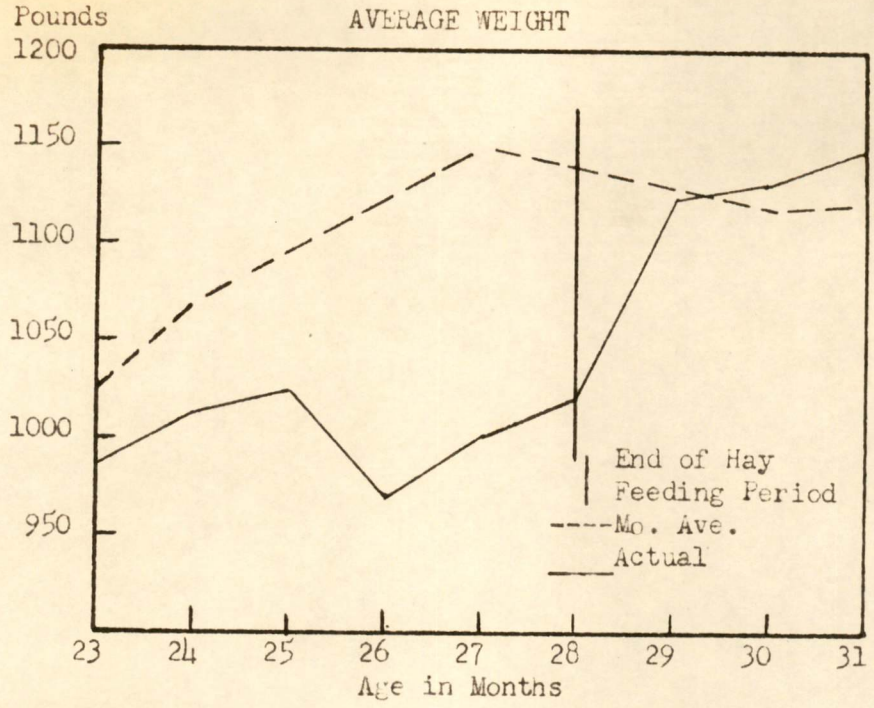
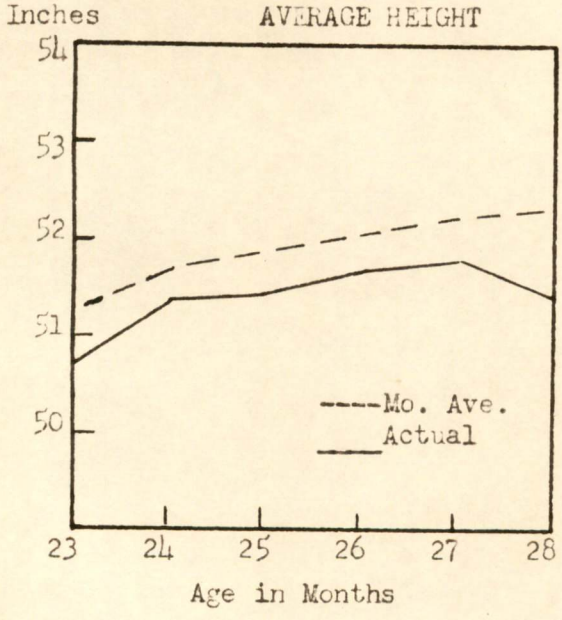




FIGURE 22

COMPARISON OF THE AVERAGE GROWTH MADE BY THE JERSEY HEIFERS IN GROUP II FED HAY AND PASTURE WITH THE AVERAGE GROWTH OF JERSEY HEIFERS AS SHOWN BY THE MISSOURI STANDARD



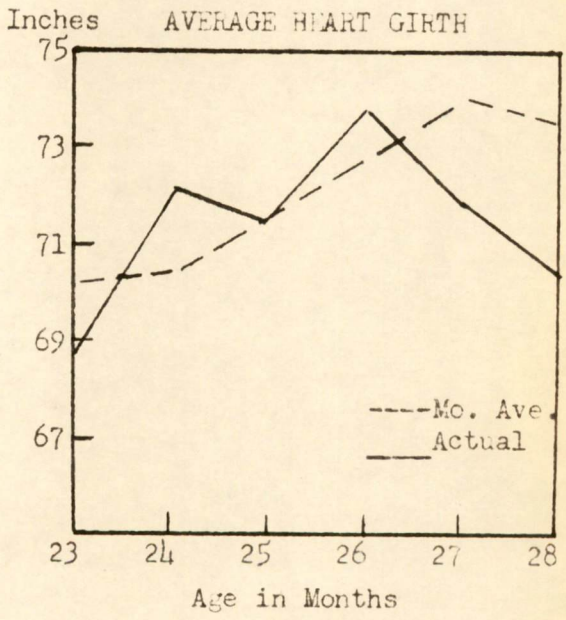




FIGURE 23

COMPARISON OF THE AVERAGE GROWTH MADE BY THE HOLSTEIN HEIFERS IN GROUP II (HAY AND PASTURE) WITH THE AVERAGE GROWTH OF HOLSTEIN HEIFERS AS SHOWN BY THE MISSOURI STANDARD