TEXAS AGRICULTURAL EXPERIMENT STATIONS.

BULLETIN No. 47.

THE EFFECT OF FOOD ON ECONOMIC DAIRY PRODUCTION.

POSTOFFICE:
COLLEGE STATION, BRAZOS CO., TEXAS.

Reports from this Station are sent free to farmers of the State on application to
J. H. CONNELL, DIRECTOR, P. O. College Station, Texas.

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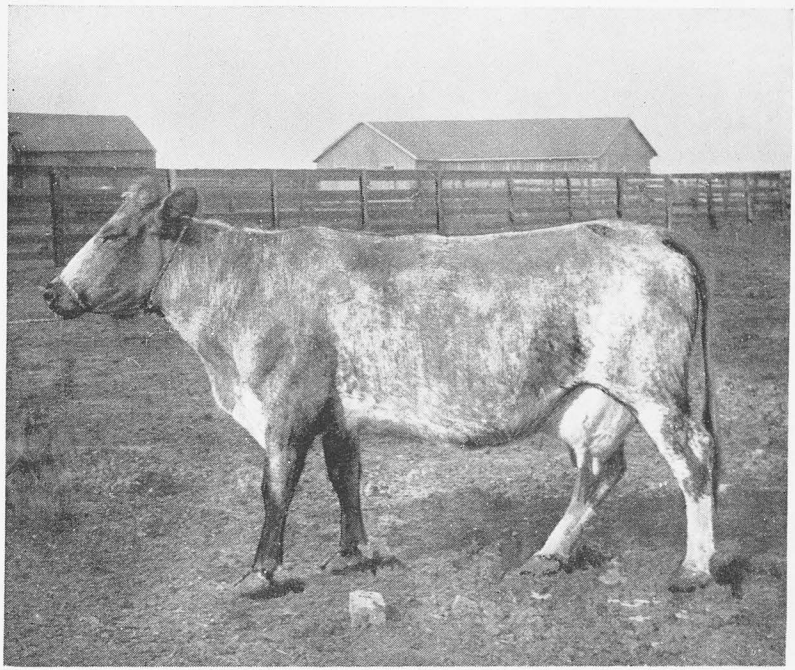

Figure 1.

No. 220.

A typical dairy cow—No. 220—Group IV.
First in yield and profit from milk.
First in yield of butter but third in profit.
For records see Tables X. and XII.
For measurements see Table XXV.

DESCRIPTION.

Large, finely formed cow, with well-developed wedges; deep, wide chest; large digestive capacity, and well-developed udder; not beefy but well fleshed.

ERRATA BULLETIN 47.

p. 1041 l. 36 read desideratum for disideratum.

p. 1050 l. 1 read ratios for rations.

p. 1067 l. 11 read Group III for Group IV.

p. 1075 l. 11 read butter for better.

p. 1078 extreme right hand column of table read

— .003 for + .003

+ .032 for — .032

+ .013 for .013

p. 1088 l. 8 read 13 pounds for 1300 pounds.

p 1088 table at bottom of page columns 12 and 13 read

nutritive milk } for utritive ilk

p. 1090 column 5 of table read protein, lbs for ——

THE EFFECT OF FOOD

ON

ECONOMIC DAIRY PRODUCTION.

BY A. M. SOULE.

SUMMARY OF RESULTS.

1. Grades from crosses of high-class Jersey and Holstein sires on the native cows furnish cheap and excellent foundation stocks for dairy production. (pp. 1041-1044, 1100-1102.)
2. Individuality is of prime importance in the cow. It is an inherent ability resident in every animal and not confined to any particular breed. It influences the entire organization of the cow, affecting the disposition of the food consumed (i. e., whether it shall be used in yielding milk and butter or increase in live weight), and hence the cost of keep and the economy of dairy production. Food has little effect on hereditary tendencies. (pp. 1041-1044, 1051-1052, 1061-1077, 1100-1102, 1105.)
3. A combination of meals proved more effective than the use of a single meal, and with two meals a more satisfactory distribution of the nutrients was secured. (pp. 1073, 1104.)
4. A record must be kept of each cow, so that the unprofitable ones may be eliminated and the specific value (whether for milk or butter) determined. (pp. 1044, 1105.)
5. "Narrow rations" proved the most valuable in milk and butter production, though good results were obtained when the ratios varied from 1:4 to 1:8 for milk and 1:4 to 1:6 to 7 for butter. The best returns were secured when the ratios ranged between 1:5 and 1:6. Owing to the high per cent of protein contained in cotton seed meal, a needless waste of this element occurred whenever that meal was used alone as grain (the ratios were very narrow; see Group III.). When other grains were added, this needless waste of protein was remedied and most excellent yields maintained. (pp. 1069, 1075, 1089, 1090.)
6. The fertilizing elements of the food passing into the excrements are of sufficient value to cover the cost of caring for the cows, milking, and handling the products, if properly preserved and returned to the farm. (pp. 1045-1046, 1095-1097.)
7. The following rations proved most valuable from the standpoint of economic production:

1. The best rations as fed per Group.

		Rating for milk and butter.	Profit for milk.	Profit for butter.
Group I..	6 lbs. C.S.M.; 25 lbs. C.S.H.....	Equal.....	$16 00	$5 41
Group II..	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs.S.	Equal.....	16 39	5 77
Group III..	6 lbs. C.S.M.; 18 lbs. C.S.H.; 35 lbs.S.	Equal.....	21 63	7 29
Group IV.	4 lbs. C.S.M.; 6 lbs. B.; 18 lbs.C.S.H.; 35 lbs. S.	Milk	20 08	
	7 lbs. C.S.M.;16 lbs. C.S.H.; 28 lbs.S.	Butter	.....	6 08
Group V..	4 lbs. C.S.M.; 6 lbs. C.M.; 18 lbs. C.S.H.; 35 lbs. S.	Equal.....	20 64	5 26
Group VI.	4 lbs. C.S.M.; 6 lbs. O.; 18 lbs.C.S.H.; 35 lbs. S.	Milk	20 15	
	6 lbs. C.S.M.; 4 lbs. O.; 16 lbs. C.S.H.; 33 lbs. S.	Butter	.....	7 02

2. The five best rations, irrespective of Groups.

	Profit for milk.	Profit for butter.
1. 6 lbs. C.S.M.; 18 lbs. C.S.H.; 35 lbs. S.....	$21 63	$7 29
2. 6 lbs. C.S.M.; 4 lbs. O.; 16 lbs. C.S.H.; 33 lbs. S.....	20 12	7 02
3. 4 lbs. C.S.M.; 6 lbs. O.; 18 lbs. C.S.H.; 35 lbs. S.....	20 15	6 77
4. 8 lbs. C.S.M.; 18 lbs. C.S.H.; 35 lbs. S	20 64	6 45
5. 7 lbs. C.S.M.; 18 lbs. C.S.H.; 28 lbs. S.....	20 24	6 39

N. B.—C.S.M.—Cotton Seed Meal. C.S.H.—Cotton Seed Hulls. S.—Silage (corn). B.—Bran (wheat). C.M.—Corn Meal. O.—Oats. S.H.—Sorghum Hay.

(pp. 1065, 1072-1073.)

8. Cows have a maximum capacity for milk and butter yields. Some cows can digest and assimilate more food than they can render into milk and butter. The surplus may be used in forming flesh, and not impair the usefulness of the cow for dairy purposes. (p. 1053.)
9. Variations in the yields of milk and butter fat from day to day may cause the loss of 33 cents worth of milk and 15 cents worth of butter per cow per day. Suitable foods, comfortable surroundings, and the removal of annoyances, aid in retarding these undesirable variations. (pp. 1067, 1075.)
10. A rapid increase in live weight, whether due to predisposing causes or the nature of the food, is detrimental to the highest dairy yields. (p. 1053.)
11. The cost of keeping a cow depends on the use she makes of the food (i. e., for milk and butter or for flesh and fat formation). Temperament, digestive and assimilative capacity, the period of lactation, etc., have an important bearing on this question.
12. No apparent ratio existed between the consumption of meals and coarse foods. (pp. 1061-1062.)
13. The nature and character of the food materially influences the cost of milk and butter. For example, Group II. compared favorably with the other Groups in yields during Period I., when all Groups received the same ration. In Periods II., III., and IV.,

when receiving sorghum hay, this Group made a very poor showing, from the standpoint of profit. (pp. 1062-1063, 1070-1073.)

14. Sudden changes in temperature (falling from 49° to 19° F. in 24 hours) materially reduced the yields of milk and butter fat for several days. (p. 1067, Charts A, B, C.)
15. Cotton seed meal failed to increase the fat of milk, as compared with mixtures of cotton seed meal and bran, corn meal and oats, respectively. (pp. 1073, 1104.)
16. A consideration of the profits derived from milk and butter production reveals a decided advantage in favor of milk selling. (pp. 1063, 1074.)
17. Cows are not necessarily equally valuable for milk and butter dairying. In making selections this point must be kept in view, or the losses incurred may prove serious. (pp. 1041-1043, 1083, 1105.)
18. The average cost of 100 pounds of milk and one pound of butter, was as follows, at prices given on page 1048:

	Cost of 100 lbs. of milk.	Cost of 1 lb. of butter.
Group I	54.5 cents	12.1 cents.
Group II	65.2 cents	14.1 cents.
Group III	50.4 cents	10.9 cents.
Group IV	57.5 cents	12.6 cents.
Group V	51.2 cents	12.5 cents.
Group VI	53.5 cents	11.2 cents.

19. The influence of the source and proportion of the digestible nutrients on dairy yield, may be summarized thus:
    1. The periods when the largest quantities of protein and fat were consumed in the meals were not those of highest production or profit.
    2. When the proportions of protein and fats furnished in the meals was least, and the carbohydrates greatest, the yields and profits were the highest.
    3. As a rule, profits increased when the proportion of dry matter and organic matter furnished in the meals were lowest.
    4. When one-third of the total digestible nutrients consumed per day was furnished by the meals, the best financial results were observed. (pp. 1086-1087, 1088-1089.)
20. Results secured in this experiment indicate that rations decidedly at variance with the so-called standard rations, gave excellent returns—financial yields. (pp. 1084-1087, 1092-1093, 1098-1099.)
21. When Jersey and Holstein grades were compared, the former were superior for butter purposes, and the latter as milk manufacturers.
22. Rations having the same nutritive ratios, but containing different amounts of the several nutrients, and derived from entirely different combinations of food-stuffs, often occur. The cost, suitability for a given purpose, and yields derived from these rations, vary as widely as the sources from which they may be derived. Further, these rations will exert a separate influence on each in-

dividual. Thus many feeders have been disappointed by supposing that a certain nutritive ratio would prove satisfactory under all conditions. (pp. 1098-1099.)

23. Cows will eat more food than they can profitably manufacture into dairy products. They may also suffer from lack of a sufficient supply of certain food ingredients. (pp. 1086, 1098.)

24. What may be termed a dry ration (C.S.M. and C.S.H.; C.S.M., S., H.—see Groups I. and II.) proved inferior to a partly succulent ration (C.S.M. and other meals, and C.S.H. and S.—see Groups III., IV., V., and VI.) for economic milk and butter production. (pp. 1053, 1067, 1098, 1103.)

25. From an inspection of the data presented, it is apparent that changes in the rations influenced the cost of the food, the yields of milk and butter, and the profits derived. These points are of vital importance, and must be constantly kept in view in preparing rations. (pp. 1067, 1072, 1098, 1103; Charts A, B, C.)

26. The amounts of food consumed in the production of 100 pounds of milk and one pound of butter, varied with its nature and character, and the proportions in which the digestible nutrients were blended. The cheapest 100 pounds of milk and one pound of butter was yielded by Group III., with an average daily consumption of

	Dry matter, lbs.	Organic matter, lbs.	Protein, lbs.	Carbohydrates, lbs.	Fats, lbs.
Milk	107.1	55.4	11.5	38.4	5.4
Butter	23.2	12.0	2.5	8.3	1.2

(p. 1093.)

27. An ideal ration must be palatable, adapted to the object in feeding, be in accord with the weight and present yields of the cow, and suited to the peculiarities of individual demands. Note the following illustration:

No. of group.	Weight.	Dry matter. lbs.	Organic matter, lbs.	Protein, lbs.	Carbohydrates, lbs.	Fats, lbs.
I	956.5	80.54	37.83	8.42	25.48	3.93
III	933.5	79.34	40.76	8.50	28.24	4.01
VI	848.3	75.39	38.95	5.99	29.77	3.19

28. In economy of milk production, cows 220, 406, and 405 led, as named, while Groups III., VI., IV., V., I., and II. ranged in the order given. The Groups receiving the greatest variety in their rations and partly succulent food, made the best financial returns. The profit secured by the Groups, as named above, was $82.11, $77.81, $77.29, $76.37, $60.67, and $60.62. (pp. 1061-1064.)

29. In economy of butter production, the cows ranging 1st, 2nd, and 3rd, were 406, 405, and 220. The Groups arranged according to profit, occupied the following positions:

Group III..	Yield 190.03 lbs...	Profit $26 50	Greater variety in the ration, and partly succulent in nature.
Group VI..	Yield 187.68 lbs...	Profit 25 69	
Group IV..	Yield 183.57 lbs...	Profit 22 68	
Group V..	Yield 160.00 lbs...	Profit 20 03	
Group I..	Yield 140.20 lbs...	Profit 18 15	Dry foods, no variety.
Group II..	Yield 152.96 lbs...	Profit 16 96	

(p. 1071.)

30. Conformation is of importance in the dairy cow. Attention is called to the illustrations bearing on this point. (See engravings of 220, 406, 405, Gracie, 347, and 442, and p. 1106.)

31. Eight graphic charts are included in this report, demonstrating the following points:

    1. Variations in the yields of milk and butter with the whole herd, and per Group, as affected by food, temperature, etc. (See Charts A, B, C.)
    2. The influence of proportion and amounts of dry matter and organic matter and protein and carbohydrates, on the yields of milk and butter. (See Charts D and E.)
    3. The influence of nutritive ratios on the yields of milk and butter. (See Chart F.)
    4. The cost per Group of 100 pounds of milk and one pound of butter, and the daily profit per Group per period on milk and butter. (See Charts G and H.)

32. The use of 6 pounds of cotton seed meal (when the only meal fed) gave a larger profit, and proved more effective than the use of 7, 8, or 10 pounds.

    When 4 to 6 pounds of cotton seed meal were combined with 6 or 4 pounds of bran, corn meal, or oats, the best yields of milk and butter were secured. (pp. 1073, 1104.)

N. B.—The cost of the milk and butter, as shown in this report, does not include the care, feeding, and management of the cows, nor the manufacture of the butter. The value of the fertilizing constituents of the food, as previously indicated, would be ample to cover these expenses; so that, we have regarded the one as offset by the other.

INTRODUCTION.

The experiments presented in this Bulletin were undertaken for the purpose of studying some of the principles involved in the feeding of dairy cows. These trials were of necessity preliminary in nature, and future investigations may modify the conclusions reached in this resumé of the work.

It is a notorious fact that this department of our agricultural interests has been either disregarded or grossly mismanaged. This is proven by the statement that, of the 17,000,000 milch cows in the United States, the average annual yield of butter does not exceeed 125 pounds per cow.* The magnitude of our dairy interests demands the most thorough and searching experimental investigation of the *feeding question*, for by that means alone may be discovered and disseminated the truths underlying *successful practice.*

It is necessary in any progressive business enterprise to secure the *best machinery* adapted to the *cheap* and *easy* production of the finished article.

In dairying, a *good cow* constitutes the *best machine*, and forms the first requisite. Then *suitable* and *cheap foods properly commingled* must next be secured, and in the happy combination of these prime necessities, namely, (1) *the cow*, (2) *the food*, may be sought *"economy in the production of milk and butter."*

As yet only a superficial examination has been made of the chief feeding stuffs of the Southwest. Therefore it is desirable to test the rations most commonly fed, and ascertain their value, or rectify the error committed by their use. *When the maximum and minimum quantity of grain that may be fed with safety and profit, for a specific purpose, has been approximately determined, scientific feeding will be greatly simplified.* This work has been commenced in these experiments, and the incorporated results will be of interest to those engaged in dairy husbandry.

In view of the following reasons, the problem of scientific feeding is worthy of careful consideration:

1. The profit secured depends largely on the cost of production.
2. It is feasible to lessen the cost of production, though it may be impossible to control market prices.
3. Ignorance of the character and "nutritive effect" of the food-stuffs used makes "feeding" an uncertain industry.
4. A knowledge of the composition, effect on the nutrition of various animals, and how to best combine food factors, to secure the maximum production at the minimum expenditure, is essential.

As all foods vary in composition, they do not have the same value as productive factors, nor do they exert a uniform effect on the nutrition of the several species of domesticated animals. For example, cotton seed meal is fatal to hogs, but when used in moderation, it is an excellent food

*Bulletin No. 11, U. S. Dept. Agr., Dairy Division.

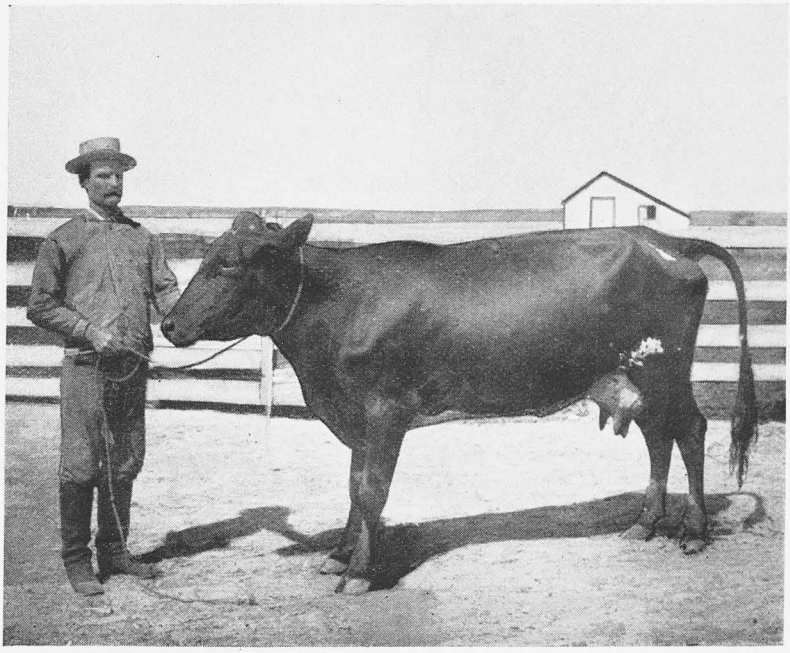

Figure 2.

GRACIE.

A fair type of dairy cow—Gracie—Group III.
Fifth in yield of milk but fourth in profit.
Fifth in yield of butter but sixth in profit.
For records see Tables X. and XII.
For measurements see Table XXV.

DESCRIPTION.

Medium sized cow, lacking in depth through body; bony and angular, with some good wedges; temperament even; digestion good; udder capacious; too leggy.

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for dairy cows. If fed in excess it may have an injurious effect on the digestive and assimilative organs of the cows, causing organic derangement of their several functions, as shown by the relaxed condition of the system. This undesirable condition is indicated by loss of lustre and constant watering of the eye, harsh, dry hair, a thickened hide, a "hide-bound" tendency, and a somewhat feverish condition of the system. Corn meal, eminently useful in *fattening* of all classes of live stock, when fed in limited quantities, forms a valuable adjunct for milk production. Oats, owing to their bulky nature, are especially useful in horse, cattle, and sheep feeding. Bran, considering its light, "fluffy" and filling tendency, is especially adapted for cows, and in a less degree for sheep. While, on account of the limited digestive tract of the hog, as compared with some other species, the bulky nature of bran and oats renders them unsuitable foods for that animal.

The general practice of feeding dairy cows on cotton seed meal and cotton seed hulls, is not a suitable method, as such a ration induces a rapid formation of fat. (See Table VII., Period I.) It is possible that the above combination furnishes the cheapest ration at the command of some feeders, but it is self-evident that it is unsuited to high dairy production, as it fails to provide sufficient variety to stimulate the animal appetite, and it also fails to furnish in proper proportion the digestible constituents required by the cow for milk production.

Experiments seem to indicate that a *protein* or *narrow* ration is better for milk production than a *wide* or *non-nitrogenous* ration. This is reasonable, as milk is rich in "protein," and a tendency to lay on *"fat"* may be detrimental to the highest dairy production, though a *"fleshy"* cow may be an excellent dairy animal. As the milk is manufactured directly and indirectly from the food consumed, and as a continued flow of normal milk may be maintained for an indefinite period by a cow when fed on foods from which the fats have been artificially extracted, it further emphasizes the necessity for a liberal protein supply in the ration, owing—

*1. To its stimulative effect, } while being metabolized in the an-
2. To its constructive function, } imal body.

The so-called German standard ration has long been our feeders' guide, but it does not seem to be in accord with American investigations, as indicated in the following table:

Digestible constituents required per 1000 pounds live weight per day.

	Dry matter. lbs.	Digestible matter.				Nutritive ratio.
		Protein. lbs.	Carbohydrates. lbs.	Fat. lbs.	Total. lbs.	
German standard.....	24	2.50	12.50	.40	15.40	1:5.4
American standard	24.31	2.15	13.27	.74	16.16	1:6.9

*Bulletin 132, N. Y. Agr. Expt. Station.

If the above, or any other "standard," could be adopted, and prove entirely satisfactory, the feeding problem would be easily solved; but right here comes up the question of "animal individuality," and truly, this forms the feeders' stumbling block. Any proposed standard can never be more than a guide to the feeder, because of the many conflicting conditions to be satisfied by a single ration. In support of this statement, these arguments are advanced:

1. The amount and character of a ration will be influenced by the period of lactation. In the first part of the lactation period, when the draught on the system is most severe, the consumption of dry matter, protein, etc., will be greatest, and will decrease as lactation advances. The demands of the system must, therefore, be judged by appetite and production. The food consumed in proportion to the milk and fat yielded is less during the earlier months of lactation.

2. The capacity of the cow must always be considered. Cows of the same age, weight, and breed, differ in their ability to assimilate and profitably utilize various food factors.

3. Adaptability of the ration for the purpose fed. Theoretically, a ration may contain a sufficient proportion of the desired digestible nutrients, and still be illy adapted for cheap milk and butter production. (See pp. 1098-1099.)

4. The size of the cow should be considered. Large cows require more food than small cows; though relatively and absolutely, in actual production, they do not consume so much as smaller cows. (See p. 1053.)

5. The physiological functions demand attention. For example, a certain amount of protein in the food is necessary to carry on animal metabolism.

6. Temperament and the cravings of animal appetite are worthy of study. The effects of the weather on consumption of food should be noted. The palatability, fertilizing constituents, and adaptation of the ration to the section where it is to be fed, all command attention.

Successful feeding depends largely on the exercise of reason and good judgment, and may be briefly summed up in the appended maxims:

1. Select animals of desirable invidiality and adapted to your purpose, whether for milk or butter.
2. Study animal character and find out the needs of the system.
3. Carefully consider the food factors at your command, and combine them suitably for your purpose in production.
4. See that the food is palatable and abundant.
5. Keep the animals in pleasant environments.
6. Supply water and salt *ad libitum*.

OBJECTS OF THE EXPERIMENTS.

These experiments were undertaken for the purpose of solving the following important questions, in so far as that could be accomplished by a single trial:

1. A variety of rations were fed. For example, different proportions of cotton seed hulls, and cotton seed meal, and sorghum hay, with cotton seed meal as a grain adjunct, were fed against several combina-

tions of silage and cotton seed hulls, with cotton seed meal and bran, corn meal and oats, as grain adjuncts. *What ration produced milk and butter most economically?* (See Tables X. and XII.)

2. *When changes were made in the amounts of the digestible nutrients in the daily ration, and in the source from which they were derived, was the "yield," "cost," or "nutrition" of the animal materially influenced?* (See pp. 1053, 1067, 1075, 1098-1099, 1103.)

3. *Does a single meal, or a combination of meals, give the best results, and in what proportion, and at what rate per day, can they be fed with the greatest profit?* (See pp. 1073, 1104.)

4. *Is it true that cotton seed meal increases the fat of milk, as alleged by some writers?* (See pp. 1073, 1104.)

5. *How do grade Jerseys and Holsteins compare in economic dairy production?* (See Table XXII.)

6. *Incidentally, variations in the yields of milk and butter fat, the conformation of dairy cows and animal individuality, were all considered.* (See Tables X. and XII.)

It was the intention to study the effects of feeding cotton seed meal and hulls on the centrifugal separation of milk, the solids of milk, the churnability of the cream, and the flavor, quality, consistency, and keeping properties of the resulting butter. Owing to the great volume of work, this last and very important phase of the experiments had to be abandoned for the time being.

PLAN OF THE EXPERIMENTS.

The experiments were divided into four periods of fourteen days duration, commencing January 9th, and ending March 5th, inclusive, 1897, a period of fifty-six consecutive days.

For the purpose of these experiments eighteen grade cows were selected and divided into six groups with three animals in each group. The animals used were either Jersey or Holstein grades. The first two groups contained two Holstein and one Jersey grade, and the last four two Jersey and one Holstein grade.

This method of treatment enabled the accurate study of the effects on production of the changed rations. It is evident that from results obtained in this way, it would be quickly apparent when further changes *would or would not* be a disideratum. In grouping the animals the endeavor was made to place those of about the same weight, length of time since calving, etc., together.

As the pure-bred Holstein and Jersey breeds both do remarkably well in Texas, the progressive dairyman can secure excellent foundation stock for his herd. The College possesses many superior animals of these breeds, and, in one sense, it is a regrettable fact that they were not available for this test, but, in this connection, the importance of the grade animal should not be overlooked. Where the major portion of the cattle that must form the future basis of our dairy herds are grades, it is interesting to know what results (in actual practice) may be expected when the pure-bred sire is used on our native stocks. A large per cent of the College herd has been built up in the last few years by this process. The animals used in these experiments were bred in this way, and while many of

them are still below the *ideal standard* for a dairy cow, the improvement accomplished is very gratifying, the more so when it is remembered that many of the native cows furnished barely enough milk for the nutrition of their offspring. Neither have these cows been forced for milk production through an entire lactation period. Some interesting data concerning the experimental cows' previous history and performance will be found on referring to Table I. It is there apparent that the work of grades at the College has been satisfactory.

Therefore, to the man of limited capital, the surest and best way to build up a dairy herd, is by the use of a pure-bred sire of the dairy breeds on the best native cows he can secure, and follow this up by a rigorous selection and exclusion of all those animals that are not in accord with his *ideal.*

In reviewing the records displayed in Table I., the great individuality of the cow becomes apparent. For example, 317, a Holstein grade, weighing 903.5 pounds, produced 7007 pounds of milk, worth $175.17 at 2½ cents per pound, or 327 pounds of butter, worth $81.75 at 25 cents per pound, in one lactation period of 273 days; while 405, a Jersey grade, under similar conditions as to food and treatment, and weighing 857.7 pounds, made 7764 pounds of milk, worth $194.10, or 371.4 pounds of butter, worth $92.85, a difference of $18.93 for milk, and $11.10 for butter, in favor of the latter cow.

Again, 115, a Jersey grade, weighing 718.5 pounds, in a lactation period of 196 days, produced 3257 pounds of milk, equal to 16.6 pounds a day for the period, and containing 4.1 per cent of butter fat, and worth $81.42, if sold at 2½ cents per pound. This cow's milk made 155.8 pounds of butter, worth $38.95 at 25 cents per pound.

On the other hand, 347, a Holstein grade, weighing 901 pounds, and milking 195 days, yielded 3344 pounds of milk, equal to 17.1 pounds a day for the lactation period, and containing only 3 per cent of fat. The value of this milk at 2½ cents per pound was $83.60, and it yielded 117 pounds of butter, worth $29.25, at 25 cents per pound. These cows ran parallel in production until the butter was considered, when a difference of $9.47 is apparent in favor of 115.

These results emphasize the fact, that while a cow may be profitable for milk production, she may not be so from the standpoint of the butter maker, and vice versa. Accordingly, cows should be selected adapted to the special line of dairying one wishes to carry on.

In the cases of 545 and 438, the former gave milk worth $108.42, and butter valued at $56.92; the latter, milk worth $141.60, and butter valued at $54.52; while 115 and 323 yielded milk worth $81.42 and $81.85, and butter valued at $38.95 and $52.52, respectively.

It will be found interesting to further study the variations exhibited in Table I. The lactation periods ranged between 195 and 427 days; the average daily milk yield from 10.4 to 26 pounds, the per cent of fat in the milk from 3 to 5.5 per cent, the butter yield from 117 to 371.4 pounds, and the average daily yield of butter from .51 to 1.24 pounds. The differences between the maximum and minimum yield per cow, were in the case of milk 4762 pounds, or a money value of $119.05. When butter is considered, the difference is seen to be 254.4 pounds, representing a money value of $63.60.

TABLE I.—*Data Concerning Records of the Experimental Cows.*

Ear tag number.	Group in experiment.	Breed.	Weight in pounds.	Last calf.	Days in milk.		Pounds of milk produced in—		Per cent of fat in milk.	Pounds of butter produced.		Value of milk and butter produced.	
					When the experiments began.	During one lactation period.	One lactation period.	One day [average]		In one lactation period.	In one day [average]	Milk 2½ cents per pound.	Butter 25 cents per pound.
317....	I.	Holstein grade.....	903.5	8–23–'96	138	273	7007	25.6	4.0	327.0	1.20	$175 17	$81 75
545....		Holstein grade.....	885.5	9–11–'96	119	405	4337	10.7	4.5	227.7	.56	108 42	56 92
191....		Jersey grade	792.5	8–25–'96	137	233	3692	15.8	4.1	176.6	.76	92 30	44 15
B	II.	Holstein grade.....	815.0	9–17–'96	113	206	3002	14.6	4.5	157.6	.76	75 05	39 40
438....		Holstein grade.....	760.0	10–12–'96	88	427	5664	13.2	3.3	218.1	.51	141 60	54 52
653....		Jersey grade.....	635.0	1–1–'97	8	252	3885	15.4	3.8	172.2	.69	97 12	43 01
405....	III.	Jersey grade..... ..	857.7	10–27–'96	73	298	7764	26.0	4.1	371.4	1.24	194 10	92 85
356....		Jersey grade.....	766.0	11–1–'96	68	256	4662	18.2	4.7	255.6	.99	116 54	63 90
Gracie.		Holstein grade.....	825.0	12–27–'96	12	203	3172	15.6	3.7	136.8	.67	79 30	34 20
210....	IV.	Jersey grade.....	761.0	11–4–'96	65	304	3170	10.4	5.1	188.6	.62	79 25	47 15
182....		Jersey grade.....	766.0	11–29–'96	40	240	3197	13.3	4.2	156.6	.65	79 92	39.15
220....		Holstein grade.....	1065.0	12–13–'96	26	230	5679	24.7	3.5	231.9	1.00	141 97	57 97
691....	V.	Jersey grade.....	610.0	1–1–'97	8	250	4727	18.9	4.2	231.6	.92	118 17	57 90
115....		Jersey grade.....	718.5	12–6–'96	33	196	3257	16.6	4.1	155.8	.79	81 42	38 95
347....		Holstein grade.....	901.0	12–20–'96	19	195	3344	17.1	3.0	117.0	.60	83 60	29 25
442....	VI.	Jersey grade.....	560.0	12–20–'96	19	325	3416	10.5	4.7	187.3	.58	85 40	46 82
406....		Jersey grade.....	866.0	1–1–'97	8	285	4090	14.3	4.1	196.6	.68	102 25	48 90
323....		Holstein grade.....	842.5	12–3–'96	36	255	3274	12.8	5.5	210.1	.82	81 85	52 52

The foregoing statement demonstrates why a record of the dairy herd is an essential. The quality and quantity of milk from different cows varies greatly as do the ease and cheapness with which it is manufactured. An account of the assets and liabilities of each cow must, therefore, be kept, in order that the unprofitable ones may be eliminated before they leaven the whole lump.

The ideal cow should milk about eleven months, and yield 5000 pounds of milk, or equivalent to 250 to 300 pounds of butter per annum, when not costing more than $35.00 or $40.00 for keep.

RECORDS.

Records of the daily yields of milk were kept, together with all necessary data pertaining to the health, influence of weather and food on the animals' condition. An aliquot sample of the night's and morning's milk was taken after thorough mixing and preserved in pint bottles with corrosive sublimate. These samples were analyzed by means of the Babcock test for butter fat. The butter fat was converted into butter by increasing it by one-sixth.

The cows were not stabled during the day except while eating. The periods allowed for feeding were from 4 a.m. to 7 a.m. and from 2 p.m. to 5 p.m. This allowance proved ample for the purpose. During the remainder of the day and at night, except in stormy weather, the cows were allowed the freedom of a large paddock. They also had free access to water and salt at all times. All rations were fed per 1000 pounds live weight, and were readjusted after each weighing. The rations were halved and fed morning and evening. The cows were milked at 5 a.m. and 4 p.m. by two experienced milkers. They were weighed on Thursday, Friday, and Saturday of each week just before receiving the evening ration.

METHODS IN FEEDING.

Description of Food Stuffs.—The meal portion of the daily rations consisted of varying quantities of cotton seed meal, bran, corn meal, and ground oats, fed either singly or in combination. These were all in excellent mechanical condition except the oats, which were light and poorly filled. The cotton seed meal was fresh from the mill, and therefore pure and wholesome. It will be observed that the composition of these foods compared very favorably with the analyses of others of a similar nature. We are greatly indebted to Prof. H. H. Harrington, of the Chemical Department, under whose direction the examinations indicated in Table II. were made.

Table II.—*Composition of Food Factors used in Experiment.*

Food analyses.	Cotton seed meal.	Bran.	Corn meal.	Oats.	Cotton seed hulls.	Sorghum hay.	Corn silage.
Moisture at 100 ° C.....	6.54	9.50	10.95	8.51	8.56	9.46	74.64
Dry matter	93.46	91.22	89.30	91.49	91.44	90.54	25.36

TABLE II—continued—*Analysis of Dry Matter.*

Ash	5.87	5.07	1.25	3.68	2.60	6.81	1.86
Crude fiber	6.52	13.62	3.00	16.11	69.75	43.01	9.46
Fat or ether extracts	13.81	5.40	3.60	6.89	2.25	5.26	1.69
Protein	47.50	19.06	9.87	10.56	4.18	4.69	2.09
Nitrogen free extract	19.76	47.07	71.58	54.25	12.66	30.77	10.50

The coarse food stuffs consisted of silage, sorghum, hay, and cotton seed hulls. The silage was uniform in quality, though lower than usual in moisture and grain content, owing doubtless to the effects of the severe drought which prevailed over this portion of the State during the summer of 1896. This did not injure its palatability, as it was greedily eaten by all the cows receiving it. The cotton seed hulls were for the most part fresh and of excellent quality. The sorghum hay was rather coarse, but the analyses show that it compares favorably with the other foods used, and the cows relished it very much, as shown by their continued consumption of 30 pounds per day for forty-two days in succession.

VALUE OF THE FERTILIZING ELEMENTS.

*TABLE III.—*Fertilizing Constituents of Food Stuffs per 100 lbs. and Valuation per Ton.*

Fertilizing Constituents.	Cotton seed meal, lbs.	Bran, lbs.	Corn meal, lbs.	Oats, lbs.	Cotton seed hulls, lbs.	Sorghum hay, lbs.	Corn silage, lbs.
Nitrogen	6.64	2.67	1.58	2.06	0.75	Not obtainable, estimated.	0.28
Phosphoric acid	2.68	2.89	0.63	0.82	0.18		0.11
Potash	1.79	1.61	0.40	0.62	1.08		0.37
Valuation per ton	$19 87	$10 33	$4 70	$6 22	$3 02	$4 00	$1 13

Too often the fertilizing value of the foods consumed on the farms is not taken into consideration, and this evidently works an injustice to the cow.

About 20 per cent of the essential manurial elements of the food consumed, namely, nitrogen, phosphoric acid, and potash, are retained by the cow to aid in supplying the needs of her body and in the elaboration of milk. The remaining 80 per cent passes out with the excreta, and if this is properly cared for, the larger part can be returned to the farm. A ton of whole milk removes from the farm manurial elements to the value of $1.60; a ton of skim milk, $1.69; a ton of buttermilk, $1.45; a ton of cream, $1.21, and a ton of butter only 36 cents worth. Thus, if butter is sold and the skim milk fed on the farm, very little fertility is lost.

The above being true, the actual or net cost of maintenance and production of a cow is not represented by the market cost of the food materials consumed, but by the market cost minus the manurial value obtain-

*The average fertilizing constituents of the different substances, together with their manurial value per ton, were taken from the Report of the Pennsylvania Experiment Station for 1896.

able. This is clearly shown in Table VI. This statement further illustrates how dairying properly conducted conserves the fertility of the farm, and demonstrates the necessity of preserving and returning animal excrements to the soil.* The valuation placed upon the fertilizing constituents in the foregoing table is, nitrogen, 12 cents; phosphoric acid, 4 cents; and potash, 5 cents per pound.

DIGESTIBILITY OF THE FOODS CONSUMED.

TABLE IV.—*Digestible Nutrients Contained in Food Factors Fed.*

Name of substance.	Dry Matter.	Digestible matter.			
		Total.	Protein.	Carbo-hydrates.	Fat.
Cotton seed meal	91.80	66.11	37.01	16.52	12.58
Bran	88.50	56.11	12.01	41.23	2.87
Corn meal	85.00	75.46	7.01	65.20	3 25
Oats	89.00	61.77	9.25	48.34	4.18
Cotton seed hulls	88.90	33.06	0.42	30.95	1.69
†Sorghum hay	90.54	53.15	2.46	47.15	3.54
Silage (corn)	20.90	13.00	0.56	11.79	0.65

This table exhibits the digestibility of the foods fed during the experiment. These coefficients represent the average of many determinations in both the Old and New World, and are therefore approximately correct for our purpose. Possessed of a knowledge of the composition and digestibility of the several substances used in feeding, we are enabled to compound rations adequate for various objects in production and to study more exhaustively the effects of varying the amount and character of the nutritive elements on the economy of animal production. Milk is practically stable in composition, except for the variations in the fat. One hundred pounds would ordinarily contain the following ingredients, namely:

‡Water	87.50 per cent.
Total solids	12.50 per cent.
Fats	3.60 per cent.
Solids, not fat	8.90 per cent.
Casein and albumen	3.40 per cent.
Milk sugar	4.75 per cent.
Ash	0.75 per cent.

* See Table XX., pp. —.

†NOTE.—As no digestion coefficients were available for sorghum hay, they have been estimated in this instance as nearly as possible by comparison with other foods similar in composition. It is regrettable that the digestibility of a food so well known and extensively used as sorghum hay has not been carefully examined and reported before this late day. The digestion coefficients used in the table were taken from the year-book of the United States Department of Agriculture for 1895.

‡Chemistry of Dairying, p. 6.

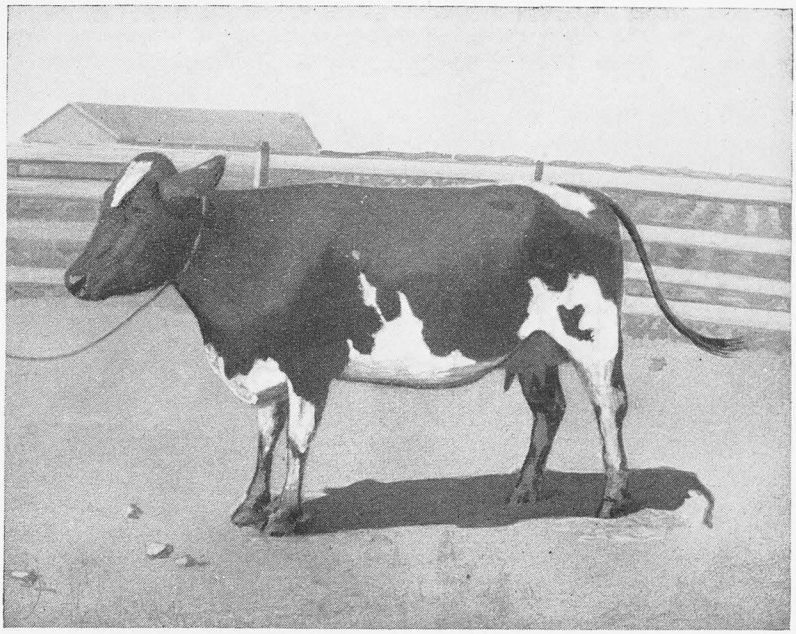

Figure 3.

No. 347.

Too beefy—No. 347—Group V.
Fourth in yield of milk but sixth in profit.
Fourth in yield of butter but thirteenth in profit.
For records see Tables X. and XII.
For measurements see Table XXV.

DESCRIPTION.

A large cow, inclined to lay on flesh readily; a beefy tendency. Too square and blocky; appetite and digestion vigorous; disposition quiet; udder undersized. A fair yielder but too expensive to maintain.

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A cow yielding one hundred pounds per day (and there are a number which have eclipsed that figure in the United States, and notably among these Yentje Netherland, owned and bred by the Texas A. & M. College,) would be required to manufacture the given substances in the amounts indicated. When it is remembered that milk must be made from the food consumed, the necessity for liberal and careful feeding may be more readily appreciated. Think for a moment of the enormous task imposed on a cow when manufacturing 12.50 pounds of the most complex solids in a day and adjusted in such nice proportions as to furnish man the most complete and nourishing food at his command. It takes a strong and vigorous constitution to perform such severe and continued labor. The greater reason then why her efforts should be supplemented with suitable foods. What processes the food goes through during its elaboration into milk in the animal body are as yet largely a mystery, but it is a recognized fact that a cow requires a certain amount of protein in her food or she can not maintain her maximum yields; and the same may be said of the other essential food ingredients. If the animal be overfed or underfed, the first observable effect will be on the milk, which will either increase or decrease according to the complexion of the food offered. Next, the weight will increase or decrease, and if an unsuitable ration be continued long enough, the health of the animal will ultimately be injured. What the exact amount of the essential nutrients, namely, protein, carbohydrates, and fat, should be, is still an unsolved problem. Approximately they are known as previously indicated, and it does not require any very persuasive arguments to convince the intelligent farmer of the importance attaching to this question. As there is one BEST WAY to perform any work, so some rations are better adapted for feeding milch cows than others. Every feeder must strive to secure *the cheapest, most palatable, and productive ration* for his purpose.

Skill in the combination and adjustment of a ration from the foods on hand, and at the same time satisfying animal inviduality, means success. The mastery of this problem underlies successful feeding, and forms the fundamental principles on which all desirable practice must be based.

COST OF THE FOOD PRODUCTS.

*In estimating the cost of production and profit per cow, the following prices were assigned, these being approximately the average market prices during the experimental period. As will be noted, the prices were all reasonable, though they may be somewhat at variance with present market quotations.

The price of a food factor depends primarily on—

1. Supply and demand.
2. Its nutritive value.
3. Its fertilizing substance.

In purchasing adjunct foods these points should be borne in mind.

*As the cost of food factors varies, the data presented in the following tables would not hold good for a new set of conditions. This fact must borne in mind; otherwise, it might prove misleading.

TABLE V.—*Cost of Food Products.*

Name.	Price per ton.	Price per lb.	Fertilizing value, per ton.	Cost of fertilizing constituents, per lb.	Net cost of foods per ton.	Net cost of foods per lb.
		cts.		cts.		cts.
Cotton seed meal	$15 00	.750	*$19 87	.993	*$4 87	*.245
Bran	15 00	.750	10 33	.516	4 67	.234
Corn meal	14 00	.700	4 70	.235	9 30	.465
Oats	15 00	.750	6 22	.311	8 78	.439
Cotton seed hulls	3 50	.175	3 02	.151	48	.024
Sorghum hay	8 00	.400	†4 00	.200	4 00	.200
Silage (corn)	3 00	.150	1 13	.056	1 90	.094

THE RATIONS FED.

From Table VI. it is apparent that nineteen rations were fed to the six groups of cows during the four experimental periods. The periods were divided as follows:

I. Period January 9th to 22d, inclusive ..... 14 days
II. Period January 23d to February 5th, inclusive ..... 14 days
III. Period February 6th to February 19th, inclusive ..... 14 days
IV. Period February 20th to March 5th, inclusive ..... 14 days

This table illustrates the character and composition of the rations consumed per 1000 pounds live weight per cow per day. It further shows their cost, manurial value, and computed digestibility. It will be observed that a narrow ration was fed during the first period. Generally speaking, the rations of the second period were narrow, and gradually widened in the case of every group throughout the third and fourth periods, some of those used in the fourth period being especially wide. A discussion of the effect of these several rations will be found further on.

At no time was the quantity of meal consumed per day in excess of 10 pounds, and the coarse portion of the ration was solely limited by the animals' appetite. A moderate ration of cotton seed meal and hulls and silage constituted the ration during period one. The next step was to substitute a portion of the grain, or coarse substance of the primary ration, for another food material, and note the changes wrought by this differentiation. Further, the endeavor was to determine the maximum quantity of food the animal would consume, and whether it would not eat far in excess of what it could profitably assimilate and manufacture into dairy products. If the point where sufficient food of suitable constitution to fulfill all the demands of the bodily functions can be ascertained, the saving accruing to the feeder possessed of that knowledge would be enormous.

In Period I. all the Groups fared alike. In Period II. Groups I. and II. received cotton seed meal and cotton seed hulls and cotton seed meal and sorghum hay. Group III. was fed an increased amount of cotton seed meal and similar amounts of cotton seed hulls and silage, as given in

*NOTE.—According to this statement the fertilizing constituents of cotton seed meal exceed its market value by $4 87.

†Estimated.

TABLE VI.— *Computed Digestible Nutrients in the Daily Rations with Cost and Manurial Value.*

Period.	Group.	Daily rations fed per 1000 pounds live weight.	Dry matter—lbs.	Total digestible matter—lbs.	Digestible protein—lbs.	Digestible Carbohydrates—lbs.	Digestible fat—lbs.	Calories or fuel value.	Nutritive ratio.	Cost of daily ration—cts.	Manurial value of daily ration—cts.	Net cost of daily ration—cts.
I. Jan. 9th to Jan. 22nd inclusive.	All	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S..	26.502	13.56	2.8175	9.4096	1.3330	28.362	1:4.5	12.25	10.935	1.315
II. January 23d to February 5th inclusive.	1.	10 lbs. C.S.M.; 20 lbs. C.S.H.....	26.960	13.22	3.7850	7.8420	1.5960	28.361	1:3.12	11.00	12.950	†1.95
	2.	10 lbs. C.S.M.; 20 lbs. S.H.*.....	27.288	17.24	4.1930	11.0820	1.9660	36.923	1:3.81	15.50	13.930	1.57
	3.	10 lbs. C.S.M.; 16 lbs. C.S.H.; 33 lbs. S..	30.301	16.19	3.9530	10 4947	1.7429	34.2.7	1:3.75	15.25	14.194	1.056
	4.	6 lbs. C.S.M.; 4 lbs. B.; 16 lbs. C.S.H.; 33 lbs. S.	30.169	15.79	2.9554	11.4831	1.3545	32.567	1:5.03	15.25	12.286	2.964
	5.	6 lbs. C.S.M ; 4 lbs. C.M.; 16 lbs. C.S.H.; 33 lbs. S.	30.029	16.57	2.7554	12.4419	1.3697	30.425	1:5.78	15.05	11.162	3.888
	6.	6 lbs. C.S.M.; 4 lbs. O.; 16 lbs. C.S.H.; 33 lbs. S.	30.189	16.03	2.8550	11.7675	1.4069	33.111	1:5.35	15.25	11.466	3.784
III. February 6th to February 19th inclusive.	1.	8 lbs. C.S.M.; 25 lbs. C.S.H.....	29.569	13.45	3.0658	9.0591	1.3289	28.582	1:4.07	10 37	11.719	†1.349
	2.	8 lbs. C.S.M.; 30 lbs. S.H.*.....	34.506	21.13	3.6988	15.4666	1.9684	48.332	1:5.51	18.00	13.944	4.056
	3.	8 lbs. C.S.M.; 18 lbs. C.S.H.; 35 lbs. S..	29.661	16.27	3.2524	11.6191	1.4181	32.998	1:4.66	14.40	12.622	1.778
	4.	4 lbs. C.S.M.; 6 lbs. B.; 18 lbs. C.S.H.; 35 lbs. S.	31.299	17.09	2.4726	13.4321	1.1871	33.560	1:6.63	15.90	11.746	4.154
	5.	4 lbs. C.S.M.; 6 lbs. C.M.; 18 lbs. C.S.H.; 35 lbs. S.	31.089	18.05	2.1726	14.6703	1.2099	35.774	1:8.14	15.60	10.060	5.540
	6.	4 lbs. C.S.M.; 6 lbs. O.; 18 lbs. C.S.H.; 35 lbs. S.	31.329	17.43	2.3070	13.8580	1.6257	34.377	1:7.38	15.90	10.516	5.384
IV. February 20th to March 5th, inclusive.	1.	6 lbs. C.S.M.; 25 lbs. C.S.H.....	27.733	12.23	2.3280	8.7287	1.1773	25.529	1:5.05	08.87	9.733	†0.863
	2.	6 lbs. C.S.M.; 30 lbs. S.H.*.....	32.670	19.91	2.9610	15.1362	1.8168	45.279	1:6.64	16.50	11.958	4.542
	3.	6 lbs. C.S.M.; 18 lbs. C.S.H.; 35 lbs. S..	27.825	15.05	2.4916	11.2887	1.2665	29.945	1:5.78	12.90	10.636	2.264
	4.	2 lbs. C.S.M.; 8 lbs. B.; 18 lbs. C.S.H.; 35 lbs. S.	29.463	15.77	1.7324	13.1017	0.9355	30.507	1:8.90	15.90	10.792	5.108
	5.	2 lbs. C.S.M.; 8 lbs. C.M.; 18 lbs. C.S.H.; 35 lbs. S.	30.953	18.43	1.5726	15.8439	1.0233	35.681	1:11.7	15.50	8.544	6.956
	6.	2 lbs. C.S.M.; 8 lbs. O.; 18 lbs. C.S.H.; 35 lbs. S.	31.273	17.37	1.7518	14.1512	1.1037	33.820	1:9.86	15.90	9.152	6.748
For comparison.		German standard ration	24.00	15.40	2.50	12.50	.40	29.600	1:5.4			
		Wisconsin standard ration.....	24.50	16.16	2.15	13.27	.74	31.250	1:6.9			
		Connecticut standard ration	25.00	16.00	2.50	13 to 12	.5+8	31.000	1:5.6			

*Estimated.

†Fertilizing constituents of C.S.M. exceed the food cost of daily ration.

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Period I. Groups IV., V. and VI. were fed the same amounts of cotton seed meal and hulls as Group III., but, instead of receiving 10 pounds of cotton seed meal, 4 pounds of bran, corn meal and oats were substituted for a similar amount of cotton seed meal in each instance. In Period III., Groups I. and II. received 8 pounds of cotton seed meal and an increased amount of cotton seed hulls and sorghum hay, in all, 25 and 30 pounds, respectively. In Group III. the cotton seed meal was decreased 2 pounds, and the cotton seed hulls and silage each increased by 2 pounds. In Groups IV., V. and VI., 18 pounds of cotton seed hulls and 35 pounds of silage formed the coarse portion of the ration, while the cotton seed meal was now reduced to 4 pounds, and an addition of six pounds of bran, corn meal, and oats completed the rations.

In Period IV., Groups I., II., and III. received 6 pounds of cotton seed meal, and the same amount of coarse materials as in Period III. Groups IV., V., and VI. received the same amount of cotton seed hulls and silage as in the previous period, but the cotton seed meal was reduced to the minimum, viz.: 2 pounds, and 6 pounds of bran, corn meal, and oats, respectively, added.

Commercially, *at prices here assumed*, the most expensive ration fed was composed of 8 pounds of cotton seed meal and 30 pounds of sorghum hay, costing 18 cents per day.

The cheapest ration was 6 pounds of cotton seed meal and 25 pounds of cotton seed hulls, costing 8.87 cents per day. These were not necessarily the cheapest rations from the standpoint of production, as will be explained hereafter.

When the manurial value is considered, the most desirable ration in this respect was 10 pounds of cotton seed meal, 16 pounds of cotton seed hulls, and 33 pounds of silage; and the least desirable one was, 2 pounds cotton seed meal, 8 pounds of corn meal, 18 pounds of cotton seed hulls, and 35 pounds of silage. The manurial elements of the former aggregated 14.194, and the latter 8.544 cents. Regarding the net cost of the rations, 6 pounds of cotton seed meal and 25 pounds of cotton seed hulls, was the cheapest, the fertilizing elements being worth 0.863 cents more than the food cost, owing to the high per cent of fertilizing constituents contained in the cotton seed meal. The dearest net ration was 2 pounds of cotton seed meal, 8 pounds of corn meal, 18 pounds of cotton seed hulls, and 35 pounds of silage, costing 6.956 cents. *Thus it is apparent that the farmer often sells cotton seed for less than its fertilizing value per ton, not to mention the profit he should make by feeding it at home.*

A word concerning the rations. They were, in many instances, at variance with any preconceived, or computed standards. It was not the intention in the begining to feed a so-called standard ration, and hence the variety here displayed should make the results doubly interesting.

With cotton seed meal and bran, rich in protein, and sorghum hay, corn meal, oats, and cotton seed meal, rich in fats, and oats, corn meal, bran, sorghum hay, and cotton seed hulls, rich in carbo-hydrates, it would be a difficult matter, with the limited number of foods in hand, to blend them satisfactorily into so-called standard rations.

It will be noticed that some of the rations are high in dry matter, protein, carbo-hydrates and fats, as the case may be, when compared with the so-called standard rations attached to the table; though some of the nu-

tritive rations practically coincide with the latter. It is, therefore, evident, that while a ration may have a given nutritive ratio, the essential digestible material composing it may be entirely at variance, both in proportion and quantity, with any so-called standard. The feeder may be easily misled by this condition, should it arise, and the nutritive effect of divergent rations, with similar ratios, will form an interesting problem for discussion at the proper juncture.

The desideratum expressed by the German standard ration was nearest approached by the ration fed Group III., in Period IV. It consisted of 27.825 pounds of dry matter, 15.05 pounds of digestible organic matter, 2.4946 pounds of digestible protein, 11.2887 pounds of digestible carbohydrates, 1.2665 pounds of digestible fat, with a fuel value of 29.945 calories, and a nutritive ratio of 1:5.78. Probably Group V., in Period IV., received the ration diverging most from the German standard.

The ration approaching most nearly to the Wisconsin standard, was fed to Group IV., in Period III.

Group V., in Period II., received the ration most nearly fulfilling the requirements of the Connecticut standard.

VARIATIONS IN LIVEWEIGHT.

Considering the initial and final weights presented in Table VII., it is apparent that liberal gains were made by all the animals except 653, who lost 32.5 pounds. The greatest gain for the entire experiment was made by 323, with 187.5 pounds. Gains ranging from 109 to 185 pounds were made by 545, 356, Gracie, 220 and 347. These were all Holstein grades with the exception of 356, thus showing the tendency of this breed to lay on flesh readily. The smallest increase in weight was made by B., with 20 pounds.

Group III. made the greatest gain during the 56 days, with 352 pounds. Groups IV., V., I., VI., and II. followed in the order named, the latter only increasing 72.5 pounds in the whole experimental period.

The increase displayed by all the groups during Period I., when a ration of 7 pounds cotton seed meal, 16 pounds of cotton seed hulls, and 28 pounds of silage, with a nutritive ratio of 1:4.5 was fed, were much greater than at any other time. The largest gain was shown by 323, with 123.5 pounds, the smallest by 406, with 1.5 pounds increase to her credit. Group III. gained the most, with 226 pounds, and Group VI. the least, with 159 pounds. The increase in weight in Period I. may be partly attributed to the beefy tendency of several cows, but more especially to the fattening propensities of the ration fed. While it has a narrow nutritive ratio, experiments conducted with steers show that rations of somewhat similar composition and proportion give most excellent results in beef production. The above ration is one freely used in the Southwest, and we wish to especially emphasize its objectionable character when fed in the amount shown here. This makes it plain that a narrow nutritive ratio is not always desirable for milk production. The component parts of a ration call for attention. In this instance the very high protein and fat content of the cotton seed meal and the fattening nature of cotton seed hulls, were probably responsible for the results indicated.

In Period II., with the rations differentiated, the increase in live-weight was much smaller. The largest increase was shown by Groups V., I., and VI., with 113.5, 93.5, and 91.5 pounds respectively. The rations fed were 6 pounds cotton seed meal, 4 pounds corn meal, 16 pounds cotton seed hulls, and 33 pounds of silage, with a nutritive ratio of 1:5.78; and 10 pounds of cotton seed meal and 20 pounds of cotton seed hulls, with a nutritive ratio of 1:3.12; and 6 pounds of cotton seed meal, 4 pounds of oats, 16 pounds of cotton seed hulls, and 33 pounds of silage, with a nutritive ratio of 1:5.35.

Group II., fed on a ration of 10 pounds of cotton seed meal and 20 pounds of sorghum hay, lost 30.5 pounds.

In Period III. Group VI. lost 16.5 pounds, Group II. 14 pounds, and Group V. 1 pound in weight, while the highest gain made by Group IV. was only 38.5 pounds. Group V. received 4 pounds of cotton seed meal, 6 pounds corn meal, 18 pounds of cotton seed hulls, and 35 pounds of silage, with a nutritive ratio of 1:8.4. Group IV. was fed 4 pounds of cotton seed meal, 6 pounds of bran, 18 pounds of cotton seed hulls, and 35 pounds of silage, with a nutritive ratio of 1:6.63.

In Period IV. the gains in weight were smallest, Groups IV., V., and III. showing an increase of 7.5, 7.5, and 15 pounds respectively. Group VI. gained the most, namely, 51.5 pounds. In this period the ration giving the largest increase in weight was 2 pounds of cotton seed meal, 8 pounds of oats, 18 pounds of cotton seed hulls, and 35 pounds of silage, with a nutritive ratio of 1:9.68. The least gain resulted when 6 pounds of cotton seed meal and 30 pounds of sorghum hay, with a nutritive ratio of 1:6.64, constituted the ration.

Apparently the weather had little influence on the loss or gain in weight:

		Average daily temperature for 14 days.
In Period I.	the total gain by all Groups was 1131.0 pounds	....55.2° F.
In Period II.	the total gain by all Groups was 440.5 pounds	.....36.3 F.
In Period III.	the total gain by all Groups was 64.0 pounds	....54.40 F.
In Period IV.	the total gain by all Groups was 20.0 pounds	.....60.2 F.

It is interesting to note the effect of the various rations on the different individuals. For example, 210 and 220 of Group IV., and B. and 438 of Group II., when receiving the same rations per 1000 pounds live weight, showed the following marked divergence in gains and losses of weight by periods:

		Period I.	Period II.	Period III.	Period IV.
Group IV.	210	+29.0	+30.0	∓ 0.0	+ 5.0
	220	+90.0	+55.5	+22.0	+17.5
Group II.	B.	+66.0	—19.0	— 2.0	—25.0
	438	+82.5	+ 9.0	+ 8.5	—15.0

For the sake of comparing the influence of gain or loss of weight on the cost and amount of milk and butter made, the following items have been incorporated in this table:

Groups.	Cost of food.				Yield of milk.				Yield of butter.				Gain in weight.			
	Maximum.	Period.	Minimum.	Period.	Maximum. lbs.	Period.	Minimum. lbs.	Period.	Maximum. lbs.	Period.	Minimum. lbs.	Period.	Maximum. lbs.	Period,	Minimum. lbs.	Period.
I.	$4 43	I.	$3 85	IV.	794.	IV.	760.20	II.	37.06	III.	32.38	I.	+173.0	I.	−12.0	IV.
II.	6 00	II.	3 84	I.	836.50	III.	809.15	I.	39.06	II.	37.39	IV.	+167.0	I.	−50.0	IV.
III.	5 65	III.	4 27	I.	1076.85	IV.	980.50	I.	50.41	III.	42.66	I.	+226.0	I.	+15.5	IV.
IV.	6 63	IV.	4 45	I.	1051.88	III.	968.15	I.	48.03	IV.	42.13	I.	+201.0	I.	+ 7.5	IV.
V.	5 66	IV.	3 92	I.	1039.76	III.	887.50	I.	42.47	IV.	35.58	I.	+214.0	I.	− 1.0	III.
VI.	6 27	IV.	4 00	I.	1035.10	IV.	887.20	I.	49.54	IV.	39.33	I.	+150.0	I.	−16.5	III.

TABLE VII.—*Initial and Final Weights, and the Loss or Gain in Weight by Periods.*

Ear tag No.	Group	Initial weight, lbs.	Final Weight, lbs.	Total loss or gain in 56 days, lbs.	Loss or gain per group in 56 days, lbs.	Average weight per group, lbs.	Periods.	Ration fed per day per 1,000 lbs. live weight.	Nutritive ratio.	Cost of food per group.	Production per period		Gain or loss in weight by periods.				Feeding Capacity.	Average daily temperature per week and per period.
											of milk, lbs.	of butter, lbs.	Period I.	Period II.	Period III.	Period IV.		
317.....		903.5	994.5	+ 91.0			I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.....	1:4.5	$4 43	780.20	32.38	+ 74.0	+ 37.0	+10.5	−30.5	Medium...	Jan. 9 to 15, 60.90° F.
545.....	I.	888.5	997.5	+109.0	+285.0	861.5	II.	10 lbs. C.S.M.; 20 lbs. C.S.H.....	1:3.12	4 45	760.20	35.65	+ 46.5	+ 30.0	− 1.0	+33.5	Very good	Jan. 15 to 23, 49.5°. F.
191.....		792.5	877.5	+ 85.0			III.	8 lbs. C.S.M.; 25 lbs. C.S.H..	1:4.07	4 16	767.85	35.11	+ 52.5	+ 26.5	+21.0	−15.0	Excellent..	
							IV.	6 lbs. C.S.M.; 25 lbs. C.S.H.....	1:5.05	3 85	794.00	37.06	+ 173.0	+ 93.5	+30.5	−12.0		Average for Period I., 55.2°. F.
B		815.0	835.0	+ 20.0			I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.....	1:4.5	$3 84	809.15	38.44	+ 66.0	− 19.0	− 2.0	−25.0	Poor	Jan. 23 to 29, 29.40° F.
438.....	II	760.0	845.0	+ 85.0	+ 72.5	736.0	II.	10 lbs. C.S.M.; 20 lbs. S., H.....	1:3.81	6 00	814.00	39.06	+ 82.5	+ 9.0	+ 8.5	−15.0	Variable...	Jan. 29 to Feb. 5, 44.5° F.
653.....		635.0	602.5	− 32.5			III.	8 lbs. C.S.M.; 30 lbs. S., H	1:5.51	5 76	836.50	38.07	+ 18.5	− 20.5	−20.5	−10.0	Variable..	
							IV.	6 lbs. C.S.M.; 30 lbs. S., H.	1:6.64	5 68	816.65	37.39	+167.0	− 30.5	−14.0	−50.0		Average for Period II., 36.30° F.
405.....		857.5	930.0	+ 72.5			I.	7 lbs. C.S.M; 16 lbs. C.S.H.; 28 lbs. S.....	1:4.5	$4 27	980.50	42.66	+ 53.5	+ 24.5	− 5.5	+ 0	Excellent..	Feb. 6 to 12, 49.30° F.
356. ...	III.	766.0	877.5	+111.5	+ 352.0	816.1	II.	10 lbs. C.S.M.; 16 lbs. C.S.H.; 33 lbs. S.....	1:3.75	5 65	986.00	48.14	+ 80.0	+ 17.0	+ 7.0	+ 7.5	Very good	Feb. 13 to 18, 59.30° F.
Gracie .		825.0	993.0	+168.0			III.	8 lbs. C.S.M.; 18 lbs. C.S.H.; 35 lbs. S.....	1:4.66	5 51	1069.55	47.82	+ 92.5	+ 42.5	+25.0	+ 8.0	Variable...	
							IV.	6 lbs. C.S.M.; 18 lbs. C.S.H.; 35 lbs. S.....	1:5.78	5 30	1076.85	50.41	+226.0	+ 84.0	+26.5	+15.5		Average for Period III., 54.40° F.
210.....		761.0	825.0	+ 64.0			I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S....	1:4.5	$4 45	968.15	42.13	+ 29.0	+ 30.0	+ 0	+ 5.0	Very good	Feb. 19 to 26. 58.50° F.
182.....	IV.	766.0	852.5	+ 86.5	+335.5	864.0	II.	6 lbs. C.S.M.; 4 lbs. B.; 16 lbs. C.S.H.; 33 lbs. S.....	1:5.03	5 89	984.20	46.41	+ 82.0	+ 3.0	+16.5	−15.0	Excellent..	Feb. 27 to March 5, 61.90° F.
220.....		1065.0	1250.0	+185.0			III.	4 lbs. C.S.M.; 6 lbs. B.; 18 lbs. C.S.H.; 35 lbs. S.....	1:6.63	6 22	1051.88	48.03	+ 90.0	+ 55.5	+22.0	+17.5	Excellent..	
							IV.	2 lbs. C.S.M.; 8 lbs. B.; 18 lbs. C.S.H.; 35 lbs. S. ...	1:8.90	6 63	1014.65	47.00	+201.0	+ 88.5	+38.5	+ 7.5		Average for Period IV. 60.20° F.
691.....		610.0	667.5	+ 57.5			I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.....	1:4.5	$3 92	887.50	36.58	+ 43.5	+ 40.0	−15.0	+25.0	Medium...	
115... .	V.	718.5	800.0	+ 81.5	+298.0	743.1	II.	6 lbs. C.S.M.; 4 lbs. C.M.; 16 lbs. C.S.H.; 33 lbs. S...	1:5.78	5 02	915.35	39.87	+ 84.0	+ 20.0	−12.5	−10.0	Excellent..	
347.....		901.0	1060.0	+159.0			III.	4 lbs. C.S.M.; 6 lbs. C.M.; 18 lbs. C.S.H.; 35 lbs. S...	1:8.14	5 35	1039.76	42.47	+ 86.5	+ 53.5	+26.5	− 7.5	Excellent..	
							IV.	2 lbs. C.S.M.; 8 lbs. C.M.; 18 lbs. C.S.H.; 35 lbs. S...	1:11.7	5 66	1010.95	41.08	+214.0	+113.5	− 1.0	+ 7.5		
442.....		560.0	615.0	+ 55.0			I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.....	1:4.5	$4 00	877.20	39.33	+ 25.0	+ 23.0	− 5.5	+12.5	Excellent .	
406.....	VI.	866.0	900.0	+ 34.0	+276.5	756.1	II.	6 lbs. C.S.M.; 4 lbs. O.; 16 lbs. C.S.H.; 33 lbs. S.....	1:5.35	5 32	1017.65	49.40	+ 1.5	+ 14.0	+ 7.0	+11.5	Excellent .	
323.....		842.5	1030.0	+187.5			III.	4 lbs. C.S.M.; 6 lbs. O.; 18 lbs. C.S.H.; 35 lbs. S.....	1:7.38	5 61	1030.46	49.54	+123.5	+ 54.5	−18.0	+27.5	Variable...	
							IV.	2 lbs. C.S.M.; 8 lbs. O.; 18 lbs. C.S.H.; 35 lbs. S.....	1:9.86	6 27	1035.10	49.41	+150.0	+ 91.5	−16.5	+51.5		

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The yields of milk and butter were apparently influenced very considerably by the rapid gain in weight by all the groups in Period I. During the III. and IV. Periods, when the increase in weight was least, the maximum yields of milk and butter were attained. Careful study of the cost and nature of the foods producing these results will prove interesting to every feeder.

As there is a maximum ability in every cow for digestion and assimilation, so there is a maximum capacity in milk and butter fat production. A cow fed up to the maximum can not be forced beyond that point, yet it is quite possible that a cow may possess assimilative powers greater than her maximum milk and butter capacity, so that any surplus consumed may be converted into body fat or flesh and still not impair her yields of milk and butter.

The necessity for a strong constitution and good digestive powers in the cow are self-evident. A lack of uniformity in the regular consumption of the daily ration reduces the value of such cows as B. and 438 very much and enhances that of 220 in a similar degree. Even temperment is also essential so that the "machine" may run on smoothly without any useless waste of fuel and nervous energy.

TABLE VIII.—*Amount and Character and Cost of the Food Eaten per Cow and per Group in each Period.*

Ear tag No.	Period.	Cotton seed meal—lbs.	Cost.	Cotton seed hulls—lbs.	Cost.	Sorghum hay—lbs.	Cost.	Corn silage—lbs.	Cost.	Cost of food per cow per period.	Group.	Amount and character and cost of the food consumed per group in each period.
317	I.	88.2	$0 66	205.6	$0 36	.....	.....	345.6	$0 52	$1 54	I.	In Period I., Group I. consumed 255.8 pounds of cotton seed meal, costing $1.91; 600.6 pounds of cotton seed hulls, costing $1.05; and 980.6 pounds of silage, worth $1.47; or a total of 1837 pounds of food, costing $4.43.
	II.	134.8	1 01	316.2	55	.....	.....	.....	.....	1 56		
	III.	112.8	85	358.8	64	.....	.....	.....	.....	1 49		
	IV.	93.0	70	387.0	68	.....	.....	.....	.....	1 38		
Totals.	....	428.8	$3 22	1267.6	$2 23	.....	.....	345.6	$0.52			
545	I.	88.2	66	208.2	36	.....	.....	333.7	50	1 52		In Period II., Group I. received 385.4 pounds of cotton seed meal, worth $2.89; 894.6 pounds cotton seed hulls, worth $1.56; or in all 1280 pounds of food, costing $4.45.
	II.	131.6	99	299.4	52	.....	.....	.....	.....	1 51		
	III.	109.2	82	343.0	60	.....	.....	.....	.....	1 42		
	IV.	87.0	65	364.5	64	.....	.....	.....	.....	1 29		
Totals.	....	416.0	$3 12	1215.1	$2 12	.....	.....	333.7	50			In Period III., Group I. consumed 317.6 pounds of cotton seed meal, costing $2.39; 1004.8 pounds of cotton seed hulls, costing $1.77; or in all 1322.4 pounds of food, worth $4.16.
191	I.	79.4	59	186.8	33	.....	.....	301.3	45	1 37		In Period IV., Group I. consumed 259.5 pounds of cotton seed meal, valued at $1.95, and 1084.5 pounds of cotton seed hulls, worth $1.90, or a total of 1344 pounds of food, worth $3.85.
	II.	119.0	89	279.0	49	.....	.....	.....	.....	1 38		
	III.	95.6	72	303.0	53	.....	.....	.....	.....	1 25		
	IV.	79.5	60	333.0	58	.....	.....	.....	.....	1 18		
Totals.	....	373.5	$2 80	1101.8	$1 93	.....	.....	301.3	45			

Figure 4.

No. 442.

Undersize—No. 442—Group VI.
Tenth in yield of milk but eighth in profit.
Tenth in yield of butter but fourth in profit.
For records see Tables X. and XII.
For measurements see Table XXV.

DESCRIPTION.

Undersized; plenty of nervous energy; good digestion; well-formed wedges and udder, but owing to her small size she is not able to manufacture enough food into milk and butter to make her a highly profitable cow.

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B	I.	80.0	$0 60	179.8	$0 31	.....	.....	299.8	$0 45	$1 36	
	II.	123.3	92	.....	.....	338.5	$1 35	.....	.....	2 27	
	III.	96.6	72	.....	.....	340.4	1 36	.....	.....	2 08	
	IV.	78.0	59	.....	.....	379.4	1 52	.....	.....	2 11	
Totals.	....	377.9	$2 83	179.8	31	1058.3	$4 23	299.8	45		
438	I.	75.6	57	179.7	31	.....	.....	301.3	45	1 33	II.
	II.	118.8	89	.....	.....	313.0	$1 25	.....	.....	2 14	
	III.	95.2	71	.....	.....	344.9	1 38	.....	.....	2 09	
	IV.	78.0	59	.....	.....	365.8	1 46	.....	.....	2 05	
Totals.	....	367.6	$2 76	179.7	31	1023.7	$4 09	301.3	45		
653	I.	66.8	50	152.1	27	.....	.....	250.0	38	1 15	
	II.	90.5	69	.....	.....	226.0	$0 90	.....	.....	1 59	
	III.	71.4	53	.....	.....	264.6	1 06	.....	.....	1 59	
	IV.	55.5	42	.....	.....	276.0	1.10	.....	.....	1 52	
Totals.	....	284.2	$2 14	152.1	27	766.6	$3 06	250.0	38		

In Period I., Group II. was fed 222.4 pounds of cotton seed meal, worth $1.67; 511.6 pounds of cotton seed hulls, worth 89 cents; 851.1 pounds of silage, worth $1.28; or a total of 1585.1 pounds of food, valued at $3.84.

In Period II., Group II. received 332.6 pounds of cotton seed meal, costing $2.50, and 877.5 pounds of sorghum hay, costing $3.50, or a total of 1210.1 pounds of food, valued at $6.00.

In Period III., Group II. consumed 263.2 pounds of cotton seed meal, worth $1.96, and 949.9 pounds of sorghum hay, worth $3.80, or in all 1213.1 pounds of food, costing $5.76.

In Period IV., Group II. consumed 211.5 pounds of cotton seed meal, worth $1.60; 1021.2 pounds of sorghum hay, costing $4.08; or a total of 1232.7 pounds of food, costing $5.68.

TABLE VIII.—*Amount and Character and Cost of the Food Eaten per Cow and Per Group in each Period*—continued.

Ear tag No.	Period.	Cotton seed meal—lbs.	Cost.	Bran—lbs.	Cost.	Cotton seed hulls—lbs.	Cost.	Corn silage—lbs.	Cost.	Cost of food per cow per period.	Group.	Amount and character and cost of the food consumed per group in each period.
405	I.	78.8	$0 59	....	.....	192.8	$0 34	332.8	$0 50	$1 43	III.	In Period I., Group III. consumed 242.6 pounds of cotton seed meal, worth $1.82; 562.8 pounds cotton seed hulls, worth 99 cents; and 972 pounds of silage, worth $1.46; or in all 1777.4 pounds of food, worth $4.27.
	II.	133.9	1 00	.....	.....	229.3	40	396.4	60	2 00		
	III.	106.4	80	.....	.....	239.4	42	453.4	68	1 90		
	IV.	82.5	62	.....	.....	250.5	44	475.1	71	1 77		
Totals.	....	401.6	$3 01	.....	.....	912.0	$1 60	1657.7	$2 49			
356	I.	75.6	57	.....	....	181.8	$0 32	312.1	47	1 36		In Period II., Group III. consumed 381.8 pounds of cotton seed meal, costing $2.86; 623.3 pounds of cotton seed hulls, worth $1.08; and 1143.4 pounds of silage, worth $1.72; or a total of 2148.5 pounds of food, valued at $5.66.
	II.	119.1	89	....	....	184.4	32	346.3	52	1 73		
	III.	96.6	72	.....	.....	218.4	38	394.4	59	1 69		
	IV.	78.0	59	....	...	237.0	41	422.2	63	1 63		
Totals.	....	369.3	$2 77	....	.....	821.6	$1 43	1475.0	$2 21			In Period III., Group III. received 310.8 pounds of cotton seed meal, costing $2.33; 701.4 pounds of cotton seed hulls, worth $1.23; and 1298.3 pounds of silage, valued at $1.94; or in all 2310.5 pounds of food, costing $5.50.
Gracie.	I.	88.2	66	....	.....	188.2	$0 33	327.1	49	1 48		In Period IV., Group III. consumed 249 pounds of cotton seed meal, costing $1.87; 754 pounds of cotton seed hulls, worth $1.32; and 1407.3 pounds of silage, valued at $2.11; or in all 2410.3 pounds of food, costing $5.30.
	II.	128.8	97	....	.....	209.6	36	400.7	60	1 93		
	III.	107.8	81	....	.....	243.6	43	450.5	67	1 91		
	IV.	88.5	66	....	.....	266.5	47	510.0	77	1 90		
Totals.	....	413.3	$3 10	.....	.....	907.9	$1 59	1688.3	$2 53			

210	I.	74.0	$0 55	.....	...	173.8	$0 30	307.0	$0 46	1 31		
	II.	65.8	49	44.8	$0 34	174.1	31	378.8	57	1 71		
	III.	46.2	35	68.6	51	206.8	36	403.7	61	1 83		
	IV.	24.0	18	97.5	72	218.2	38	403.6	61	1 89		
Totals.	....	210.0	$1.57	210.9	$1 57	772.9	$1 35	1493.1	$2 25			
182	I.	77.8	58	.....	.....	174.4	30	305.1	46	1 34		
	II.	71.4	54	47.6	37	192.5	34	343.2	51	1 76		
	III.	47.6	36	71.4	54	215.2	38	355.9	53	1 81	IV.	
	IV.	25.5	19	103.5	78	232.0	41	354.7	53	1 91		
Totals.	....	222.3	$1 67	222.5	$1 69	814.1	$1.43	1358.9	$2 03			
220	I.	101.4	76	.....	.....	239.0	42	409.2	61	1 79		
	II.	95.2	71	64.4	48	283.0	50	491.7	74	2 43		
	III.	67.2	51	100.8	75	303.8	53	529.3	79	2 58		
	IV.	36.0	27	147.0	1 11	333.0	58	579.6	87	2 83		
Totals.	....	299.8	$2 25	312.2	$2 34	1158.8	$2 03	2009.8	$3 01			

In Period I., Group IV. consumed 253.2 pounds of cotton seed meal, worth $1.89; 587.2 pounds of cotton seed hulls, costing $1.02; and 1021.3 pounds of silage, valued at $1.53; or a total of 1861.7 pounds of food, costing $4.44.

In Period II., Group IV. received 232.4 pounds of cotton seed meal, worth $1 74; 156.8 pounds of bran, costing $1.19; 649.6 pounds of cotton seed hulls, valued at $1.15; and 1213.7 pounds of silage, costing $1.82; or a total of 2252.2 pounds of food, worth $5.90.

In Period III., Group IV. consumed 161 pounds of cotton seed meal, costing $1.22; 240.8 pounds of bran, worth $1.80; 725.8 pounds of cotton seed hulls, valued at $1.27; and 1288.9 pounds of silage, worth $1.93; or in all 2416.5 pounds of food, valued at $6.22.

In Period IV., Group IV. received 85.5 pounds of cotton seed meal, worth 64 cents; 348 pounds of bran, valued at $2.61; 783.2 pounds of cotton seed hulls, worth $1.37; and 1337.9 pounds of silage, costing $2.01; or a total of 2554.6 pounds of food, costing $6.63.

TABLE VIII.—*Amount and Character and Cost of the Food Eaten per Cow and per Group in each Period*—continued.

Ear tag No.	Period.	Cotton seed meal—lbs.	Cost.	Corn meal—lbs.	Cost.	Oats—lbs.	Cost.	Cotton seed hulls—lbs.	Cost.	Corn silage—lbs.	Cost.	Cost of food per cow per period.	Group.	Amount, character, and cost of the food consumed per group in each period.
691	I.	63.0	$0 47	.....	.....	.....	.....	128.1	$0 22	267.6	$0 40	$1 09		In Period I., Group V., consumed 222.4 pounds of cotton seed meal, worth $1.66; 505.9 pounds of cotton seed hulls, costing 88 cents; and 922.2 pounds of silage, valued at $1.38, or in all 1,650.5 pounds of feed, costing $3 92.
	II.	54.6	41	36.4	$0 26	....	....	112.8	20	292.7	44	1 31		
	III.	37.8	28	57.4	40	.....	.....	169.8	30	328.0	49	1 47		
	IV.	19.5	15	79.5	56	.....	.....	180.0	31	328.3	49	1 51		
Totals.		174.9	$1 31	173.3	$1 22			590.7	$1 03	1216.6	$1 82			
11	I.	71.2	53	.....	.....	.....	.....	170.6	30	295.4	44	1 27		In Period II. Group V. received 203.1 pounds of cotton seed meal, worth $1.52; 135.8 pounds of corn meal, costing 95 cents; 535.7 pounds of cotton seed hulls, valued at 94 cents; and 1072.8 pounds of silage, worth $1.61, or in all 1937.4 pounds of food, valued at $5.02.
	II.	65.8	49	44.8	31	.....	....	190.9	33	326.5	49	1 62		
	III.	46.2	35	70.0	49	.....	.....	211.4	37	331.8	50	1 71		
	IV.	24.0	18	96.0	67	.....	.....	217.5	38	341.4	51	1 74	V.	
T als.		207.2	1 55	210.8	1 47			790.4	1.38	1295.1	1 94			
347....	I.	88.2	66	....	.....	.....	.....	207.2	36	359.2	54	1 56		In Period III. Group V. consumed 141.4 pounds of cotton seed meal, worth $1.06; 212.8 pounds of corn meal, costing $1.49 cents; 640.2 pounds of cotton seed hulls, valued at $1.12; and 1117.9 pounds of silage, costing $1.68, or in all 2112.3 pounds of food, worth $5.35.
	II.	82.7	62	54.6	38	.....	.....	232.0	41	453.6	68	2 09		
	III.	57.4	43	85.4	60	.....	.....	259.0	45	458.1	69	2 17		
	IV.	31.5	24	127.5	89	....	. ...	288.0	51	512.6	77	2 41		
Tot .		259.8	1 95	267.5	1.87			986.2	1 73	1783.5	2 68			In Period II. Group V. received 75 pounds of cotton seed meal, worth 57 cents; 303 pounds of corn meal, worth $2.12; 685.5 pounds of cotton seed hulls, valued at $1.20; and 1182.3 pounds of silage, costing $1.77, or in all 2245.8 pounds of food, valued at $5.66.

442....	I.	58.6	44	.....	.....	.....	.....	139.5	25	244.8	37	1 06	
	II.	52.9	40	.....	.....	32.2	$ 29	145.2	25	270.1	41	1 35	
	III.	33.6	25	.....	.....	50.4	45	152.6	27	273.2	41	1 38	
	IV.	18.0	13	.....	.....	70.0	63	262.0	46	295.9	44	1 66	
Totals.		163.1	1 22			152.6	1 37	699.3	1 23	1084.0	1 63		
406....	I.	84.4	63	.....	.....	.....	.....	195.5	34	330.2	50	1 47	
	II.	72.8	55	.....	... .	49.0	44	195.6	34	341.2	51	1 84	
	III.	49.0	37	....	. ...	72.8	65	219.2	38	403.8	61	2 01	VI.
	IV.	27.0	20	.....	.....	106.5	96	240.0	42	427.6	64	2 22	
Totals.		233.2	1 75			228.3	2 05	850.3	1.48	1502.8	2 26		
323....	I.	82.2	62	.....	....	.....	.....	195.6	34	337.2	51	1 47	
	II.	81.9	61	.....	.....	54.4	49	219.5	38	433.0	65	2 13	
	III.	67.6	51	.....	.....	81.4	73	218.2	38	401.3	60	2 22	
	IV.	30.0	22	.....	.....	115.5	1 04	267.0	47	441.3	66	2 39	
Totals.		261.7	$1 96			251.3	$2 26	900.3	$1 57	1612.8	$2 42		

In Period I. Group VI. consumed 225.2 pounds of cotton seed meal, worth $1.69; 530.6 pounds cotton seed hulls, worth 93 cents; 912.2 pounds silage, costing $1.38; or in all 1668.0 pounds of food, valued at $4.00.

In Period II. Group VI. received 207.6 pounds of cotton seed meal, worth $1.56; 135.6 pounds of oats, valued at $1.22; 560.3 pounds of cotton seed hulls, costing 97 cents; and 1044.3 pounds of silage, worth $1.57; or a total of 1947.8 pounds of food, costing $5.32.

In Period III. Group VI. consumed 150.2 pounds of cotton seed meal, worth $1.13; 204.6 pounds of oats, valued at $1.83; 590 pounds of cotton seed hulls, worth $1.03; and 1078.3 pounds of silage. worth $1.62, or a total of 2023.1 pounds of food, costing $5.61.

In Period IV. Group VI. received 75 pounds of cotton seed meal, worth 55 cents; 292 pounds of oats, costing $2.63; 769 pounds of cotton seed hulls, worth $1.35; and 1164.8 pounds of silage, worth $1.74, or in all 2300.8 pounds of food, worth $6.27.

THE FOOD CONSTITUENTS CONSUMED.

Table VIII. shows the amount, character, and cost of the food eaten per cow and group in each period. It will be noted that the cost of the food was less for all groups except I. in the First Period than at any other time. As might be expected, great variations in the cost of keeping different cows are apparent. For example, 442 consumed food worth $1.06, while the cost of keeping 220 was $1.79, a difference of 73 cents in favor of 442. These two cows represent the extremes in weight and cost of keep in Period I. 220 weighed a little over twice as much as 442, but it is evident that the cost of feeding 442 was not in proportion to her weight when compared with 220. As a rule, small cows eat more considering their size than large cows. The cheapest fed group in Period I. was II., charged up with $3.84, while Group IV. proved the most expensive, with $4.45 standing against it.

In Period II. the value of the food consumed was much greater than in Period I. The least and most expensive cows to feed were 691 and 220, receiving food valued at $1.31 and $2.43 respectively, the difference in cost of keep between these "extremes" being in this instance $1.12. The food consumed by Group I. cost $4.45; by Group II., $6.00. These were the least and most expensive groups fed in Period II.

In Period III. the minimum cost of keeping a single cow was $1.25, and the maximum $2.58, while Group I. with $4.16 and Group IV. with $6.22 charged against them were respectively the cheapest and dearest groups to feed in this Period.

In Period IV. 317 proved herself the easiest kept cow, consuming food valued at $1.18, and 220 again proved the most expensive, eating materials worth $2.83. Group IV., with a total food cost of $6.63 for the Period was the most expensive, and Group I., with $3.85, the least expensive.

After a careful consideration of this table, it is very certain that the cost of keeping an individual animal or a group of animals largely depends on amount, character, and combination of the substances used as food. For instance, the cost of the food consumed by 220 varied from a minimum of $1.79 to a maximum of $2.83 between the first and fourth experimental periods. Likewise the cost of maintaining the different groups ran from $3.84 on the one hand, to $6.63 on the other. Of course the several individuals can not be fed singly or in groups on one food material at the same cost at all times, much less on a variety of foods (provided the market price of that particular food remain stationary). Larger quantities of food will be eaten during the earlier stages of lactation, and the cost will fluctuate accordingly; but the question of cost must be carefully scrutinized at all times to prevent a useless waste of money and a misdirection of animal energy. If a cow can be fed for fourteen days on a ration costing $1.79 and yield as freely as one costing $2.83, the differences in the profits obtained from the two rations is obvious; but if the ration costing $2.83 be one better suited to the needs and appetite of the cow, and will produce enough more milk and butter to excel the difference in cost between it and the cheaper ration and leave a greater profit than the latter, then it should be fed and the

TABLE IX.—*Summary of Food Ingredients Consumed During Experimental Period.*

Ear tag No.	Group.	Cotton seed meal—lbs.	Bran—lbs.	Corn meal—lbs.	Oats—lbs.	Cotton seed hulls—lbs.	Sorghum hay—lbs.	Corn silage—lbs.	Meal eaten during experiment per cow—lbs.	Cost.	Coarse fodders eaten per cow during experiment—lbs.	Cost.	Total cost of food per cow during experiment.	Rating of cows according to cost.	Total pounds of food consumed by each group in the experimental period, and the cost of the same.
															Group I. Consumed
317		428.8	....	....	.....	1267.6	.....	345.6	428.8	$3 22	1613.2	$2 75	$5 97	6	1218.3 pounds of cotton seed meal; 3584.5 pounds of cotton seed hulls, and 980.6 pounds of silage. Cost $16.89.
545	I.	416.0	....	.....	.....	1215.1	.....	333.7	416.0	3 12	1548.8	2 62	5 74	4	
191		373.5	....	.....	.....	1101.8	.....	301.3	373.5	2 80	1403.1	2 38	5 18	1	
															Group II. Consumed
B		377.9	....	.....	....	179.8	1058.3	299.8	377.9	2 83	1537.9	4 99	7 82	15	1029.7 pounds of cotton seed meal; 511.6 pounds of cotton seed hulls; 2848.6 pounds of sorghum hay, and 851.1 pounds of silage. Cost $21.28.
438	II.	367.6	....	....	....	179.7	1023.7	301.3	367.6	2 76	1504.7	4 85	7 61	14	
653		284.2	....	....	.....	152.1	766.6	250.0	284.2	2 14	1168.7	3 71	5 85	5	
															Group III. Consumed
405		401.6	....	....	....	912.0	.....	1657.7	401.6	3 01	2569.7	4 09	7 10	11	1184.2 pounds of cotton seed meal; 2641.5 pounds of cotton seed hulls, and 4821.0 pounds of silage. Cost $20.73.
356	III.	369.3	....	....	.....	821.6	.....	1475.0	369.3	2 77	2296.6	3 64	6 41	8	
Gracie.		413.3	....	....	.....	907.9	.....	1688.3	413.3	3 10	2596.2	4 12	7 22	12	
															Group IV. Consumed
210		210 0	210.9	....	.....	772.9	.....	1493.1	420.9	3 14	2266.0	3 60	6 74	9	732.1 pounds of cotton seed meal; 745.6 pounds of bran; 2745.8 pounds of cotton seed hulls, and 4861.0 pounds of silage. Cost $23.19.
182	IV.	222.3	222.5	....	.....	814.1	.....	1358.9	444.8	3 36	2173.0	3 46	6 82	10	
220		299.8	312.2	....	.....	1158.8	.....	2009.8	612.0	4 59	3168.6	5 04	9 63	18	
															Group V. Consumed
691		174.9	....	173.3	....	590.7	.....	1216.6	348.2	2 53	1807.3	2 85	5 38	2	641.9 pounds of cotton seed meal; 651.6 pounds of corn meal; 2367.3 pounds of cotton seed hulls, and 4295.2 pounds of silage. Cost $.9.95.
115	V.	207.2	....	210.8	.....	790.4	.....	1295.1	418.0	3 02	2085.5	3 32	6 34	7	
347		259.8	....	267.5	....	986.2	.....	1783.5	527.3	3 82	2769.7	4 41	8 23	17	
															Group VI. Consumed
442		163.1	....	.....	152.6	699.3	.....	1084.0	315.7	2 59	1783.3	2 86	5 45	3	658.0 pounds of cotton seed meal; 632.2 pounds of oats; 2449.9 pounds of cotton seed hulls, and 4199.6 pounds of silage. Cost $21.20.
406	VI.	233.2	.....	.....	228.3	850.3	.....	1502.8	461.5	3 80	2353.1	3 74	7 54	13	
323		261.7	.....	.....	251.3	900.3	.....	1612.8	513.0	4 22	2513.1	3 99	8 21	16	
Totals		5464.2	745.6	651.6	632.2	14300.6	2848.6	20009.3	7493.6	$56 82	37158.5	$66 42	$123 24		

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other discarded. The question of productive capacity and profit secured from the ration fed does not receive the attention its importance merits, and the value of the facts shown in this table can only be appreciated by those who study it thoroughly. In conclusion, the cost of keeping a cow depends on her inherent tendencies—the temperament, etc.—and the disposition she makes of her food. The cow eating the most or making the most milk and butter is not always the cheapest or best cow.

In reviewing Table IX., 220 is seen to have been the most expensive cow to "keep." She consumed 299.8 pounds of cotton seed meal, 312.2 pounds of bran, 1158.8 pounds of cotton seed hulls, and 2009.8 pounds of silage, in all valued at $9.63. The cow next dearest to "keep" was 347, who received 259.8 pounds of cotton seed meal, 267.5 pounds of corn meal, 986.2 pounds of cotton seed hulls, and 1783.5 pounds of silage, in all worth $8.23. The cow costing least to "keep" was 191, of Group I. She ate 373.5 pounds of cotton seed meal, 1101.8 pounds of cotton seed hulls, and 301.3 pounds of corn silage, valued at $5.18. She was followed closely by 691 and 442, with a food cost of $5.38 and $5.45 respectively.

Interesting comparisons may be drawn from the cost of feeding cows in the same Group. The data following will serve for illustration:

		Meal eaten, lbs.	Coarse fodders eaten, lbs.	Cost of food.
Group V.	691	348.2	1807.3	$5 38
	347	527.3	2769.7	8 23
Group VI.	442	315.7	1783.3	5.45
	323	513.0	2513.1	8.21

According to the rating, as to cost of keep, 691 and 442 stood 2 and 3, while 347 and 323 stood 16 and 17.

Irrespective of the much smaller amounts of meal and coarse fodders eaten by the two former cows, as compared with the latter, a balance of $2.85 and $2.76 is found in favor of 691 and 442. Now, the question arises as to whether 347 and 323 so far excelled their rivals in production as to justify the extra cost of feeding them, and it is only by comparisons of this nature that we can determine the relative value of our dairy cows.

A consideration of the relation existing between the consumption of meals and coarse fodders will be of interest at this point.

No. of cow.	Total meal eaten, lbs.	Cost.	Lbs. eaten per day.	Total coarse foods eaten, lbs.	Cost.	Lbs. eaten per day.	Ratio of meal to coarse food eaten.
220...	612.0	$4 59	10.9	3168.0	$5 04	56.6	1:5.2
347...	527.3	3 82	9.4	2769.7	4 41	49.5	1:5.3
356...	369.3	2 77	6.6	2296.6	3 64	41.0	1:6.2
653...	284.2	2 14	5.6	1168.7	3 71	20.8	1:4.2
442...	315.7	2 59	5.6	1783.3	2 86	31.8	1:5.7
438...	367.6	2 76	6.6	1504.7	4 85	26.9	1:4.1

No apparent ratio existed between the meal and coarse food eaten. Each individual seems to have been a law unto herself. As an average of the entire experimental period of 56 days, 220 is seen to have disposed of 10.9 pounds of meal and 56.6 pounds of "roughage," or a ratio of 1 pound of meal to 5.2 pounds of coarse materials. On the other hand, 356, consuming 6.6 pounds of meal and 41 pounds of "roughage," shows a ratio of 1 pound of meal to 6.2 pounds of coarser substances. In the case of 442, the ratio narrows down to 1:4.2, and with 438, to 1:4.1.

A summary of the cost and amounts of the food constituents eaten by each Group, is attached to this table. Group I. was the cheapest fed during the experiment, with a total cost of $16.89. Groups V., III., VI., II., and IV. costing $19.95, $20.73, $21.20, $21.28, and $23.19, following in the order named. The amount and character of the substances constituting the food of each Group can be readily ascertained by reference to the table.

The differences in cost of food consumed between—

Groups I. and V. was	$3 06
Groups I. and III. was	3 84
Groups I. and VI. was	4 31
Groups I. and II. was	4 39
Groups I. and IV. was	6 30

MILK PRODUCTION.

The principal data relating to milk production is included in Table X. The value attached to the milk is 2½ cents per pound. To some the value given may appear too high, but as it is the *actual price* obtained for the milk, we do not think the use improper on this occasion. The cost of delivery was insignificant.

In Period I. the largest yield of milk was made by 220, with 469.65 pounds. The cost was $1.79, and the net profit derived $9.95. B. stood lowest in milk yield, with 213.25 pounds to her credit. It cost $1.36 to produce, and the net profit was $3.97. The easiest kept cow was 442. She made 242.95 pounds of milk, costing $1.06, and leaving a net profit of $5.01. Thus it appears that 220 produced more milk, and made a greater profit than B. and 442 combined.

In Period II., 220 produced the most milk, namely, 498.75 pounds; the cost was $2.43, and the profit secured $10.04. The lowest yield was made by 595, with 212 pounds, costing $1.51, and leaving a margin of $3.79 as profit. The cheapest fed cow was 691. She made 274.55 pounds of milk, costing $1.31, and leaving a profit of $5.55.

In Period III., 220 led again in milk yield. She gave 518.33 pounds, at a cost of $2.58, and the profit secured was $10.38. 595 again brought up the rear, with 201.75 pounds of milk, costing $1.42, and yielding a profit of $3.62. 191 cost least for food, namely, $1.25; she yielded 241.50 pounds of milk, and the profit remaining was $4.79.

In Period IV., 220 maintained her record as an economical milk manufacturer. She made in this period 519.45 pounds of milk, at an outlay of $2.83, and the profit derived was $10.16. B. stood at the foot of the ladder. Her record was 234.30 pounds of milk, costing $2.11, and leav-

Diagramatic Chart A Showing the Total Daily Yields and Variations in Milk Flow with a Herd of 18 Cows During 56 Days

Total yield of milk from 18 Cows per day per Period

Mornings and Nights Milk yielded by 18 Cows per day per Period

Period I | Period II | Period III | Period IV

Jan 9 10 11 12 13 14 15 16 17 18 19 20 21 22 | 23 24 25 26 27 28 29 30 31 Feb 1 2 3 4 5 | 6 7 8 9 10 11 12 13 14 15 16 17 18 19 | 20 21 22 23 24 25 26 27 28 Mch 1 2 3 4 5

Lbs: 435 430 425 420 415 410 405 400 395 390 385 380 375 370 365 360 355 350 345 340 335

Lbs: 250 245 240 235 230 225 220 215 210 205 200 195 190 185 180 175 170 165 160 155 150

Lbs. This represents the variations between the mornings and nights milk and also the variations in total yields from day to day with a herd of 18 cows. Lbs

Lbs: 60 55 50 45 40 35 30 25 20 15 10

Lbs: 55 50 45 40 35 30 25 20 15 10 5

Daily Temp. 54. 63.5 56.5 63.5 65.5 68.5 54.5 65.0 64.5 56.0 42.0 57.5 42.0 42.5 49.5 38.0 19.0 19.0 24.0 28.5 32.0 36.5 38.0 37.0 46.5 54.0 53.0 47.5 52.0 50.5 43.5 49.0 48.0 48.5 53.5 56.0 56.5 52.0 56.5 59.0 67.5 69.0 70.5 71.5 66.0 52.0 48.0 54.5 46.0 52.0 54.5 63.5 65.5 66.0 69.5 62.5

Legend

- Total daily yield of milk from 18 cows.
- *Evenings Milk.
- *Mornings Milk.
- Variations between the yields of mornings and nights milk.
- *Variations in the total milk yields from day to day with 18 cows

*Reads toward the left.

TABLE X.—*Milk Produced, Cost of Food, and Value Derived from Milk per Cow and Group per Period.*

Ear tag number.	Group.	Period.	Ration fed per 1000 pounds live weight per day.	Nutritive ratio.	Milk produced in period I.—lbs.	Cost of food consumed.	Value of milk produced at 2½ cents per lb.	Profit from milk in period I.	Milk produced in period II.—lbs.	Loss or gain in milk in period II.—lbs.	Cost of food consumed.	Value of milk produced at 2½ cents per lb.	Profit from milk in period II.	Milk produced in period III.—lbs.	Loss or gain in milk in period III.—lbs.	Cost of food consumed.	Value of milk produced at 2½ cents per lb.	Profit from milk in period III.	Milk produced in period IV.—lbs.	Loss or gain in milk in period IV.	Cost of food consumed.	Value of milk produced at 2½ cents per lb.	Profit from milk in period IV.	Total milk produced per cow in the four periods—lbs.	Cost of food consumed per cow in the four periods.	Value of milk produced in the four periods at 2½ cents per lb.	Total profit per cow in the four periods.	Rating of cow	Total milk produced per group in the four periods—lbs.	Total cost of food consumed per group in the four periods.	Value of milk produced per group in the four periods.	Profit per group from milk production.	Rating of rations and groups.
317		I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.....	1:4.5	308.75	$1 54	$7 72	$6 18	318.70	+ 9.95	$1 56	$7 97	$6 41	324.60	+ 5.90	$1 49	$8 12	$6 63	329.00	+ 4.40	$1 38	$8 23	$6 85	1281.05	$5 97	$32 03	$26 06	6	780.20	$4 43	$19 50	$15 07	2 18	
545	I.	II.	10 lbs. C.S.M.; 20 lbs. C.S.H.	1:3.12	233.35	1 52	5 83	4 31	212.00	—21.35	1 51	5 30	3 79	201.75	—10.25	1 42	5 04	3 62	214.50	+12.75	1 29	5 36	4 07	861.60	5 74	21 54	15 80	17	760.20	4 45	19 01	14 56	4 21	
191		III.	8 lbs. C.S.M.; 25 lbs. C.S.H.....	1:4 07	238.10	1.37	5.95	4 58	229.50	— 8.60	1 38	5 74	4 36	241.50	+12.00	1 25	6 04	4 79	250.50	+ 9.00	1 18	6 26	5 08	959.60	5 18	23 99	18 81	14	767.85	4 16	19 20	15 04	3 19	
		IV.	6 lbs. C.S.M.; 25 lbs. C.S.H.....	1:5.05	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	794.00	3 85	19 85	16 00	1 16	
																														3102.25	16 89	77 56	60 67	V.	
B		I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.....	1:4.5	213.25	1 36	5 33	3 97	255.95	+42.70	2 27	6 40	4 13	240.70	—15.25	2 08	6 02	3 94	234.30	— 6.40	2 11	5 86	3 75	944.20	7 82	23 61	15 79	18	809.15	3 84	20 23	16 39	1 15	
438	II.	II.	10 lbs C.S.M.; 20 lbs. S.H.....	1:3.81	288.25	1 33	7 21	5 88	304.20	+15.95	2 14	7 60	5 46	328.90	+24.70	2 09	8 22	6 13	328.25	+ 0.65	2 05	8 20	6 15	1249.60	7 61	31 24	23 63	7	814.00	6 00	20 35	14 35	4 22	
653		III.	8 lbs. C.S.M.; 30 lbs. S.H.....	1:5.51	307.65	1 15	7 69	6 54	253.85	—53.80	1 59	6 35	4.76	266.90	+13.05	1 59	6 67	5 08	254.10	—12.80	1 52	6 35	4 83	1082.50	5 85	27 06	21 21	11	836.50	5 76	20 91	15 15	2 17	
		IV.	6 lbs. C.S.M.; 30 lbs. S.H.....	1:6.64	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	816.65	5 68	20 41	14 73	3 20	
																														3276 30	21 28	81 90	60 62	VI	
405		I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.....	1:4.5	387.50	1 43	9 69	8 26	398.75	+11.25	2 00	9 97	7 97	449.95	+59.20	1 90	11 25	9 35	442.35	— 7.60	1 77	11 06	9 29	1678.55	7 10	41 97	34 87	3	980.50	4 27	24 51	20 24	3 4	
356	III.	II.	10 lbs. C.S.M.; 16 lbs. C.S.H.; 33 lbs. S.	1:3.75	238.90	1 36	5 97	4 61	239.25	+ 0.35	1 73	5 98	4 25	248.85	+ 9.60	1 69	6 22	4 53	267.50	+18.65	1 63	6 69	5 06	994.50	6 41	24 87	18 46	15	986.00	5 66	24 66	19 00	4 9	
Gracie.		III.	8 lbs. C.S.M.; 18 lbs. C.S.H.; 35 lbs. S.....	1:4.66	354.10	1 48	8 85	7 37	348.00	— 6.10	1 93	8 70	6 77	370.75	+22.75	1 91	9 27	7 36	367.00	— 3.75	1 90	9 18	7 28	1439.85	7 22	36 00	28 78	5	1069.55	5 51	26 74	21 24	2 2	
		IV.	6 lbs. C.S.M.; 18 lbs. C.S.H.; 35 lbs. S.....	1:5.78	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	..	1076.85	5 30	26 93	21 63	1 1	
																														4112.90	20 73	102 84	82 11	I.	
210		I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.....	1:4 5	229.55	1 31	5 74	4 43	224.40	— 5.15	1 71	5 61	3 90	223.25	— 1.15	1 83	5 58	3 75	233.85	+10.60	1 89	5 85	3 96	911.05	6 74	22 77	16 03	16	968.15	4 44	24 20	19 76	2 7	
182	IV.	II.	6 lbs. C.S.M.; 4 lbs. B.; 16 lbs. C.S.H.; 33 lbs. S...	1:5.03	268.95	1 34	6 72	5 38	261.05	— 7.90	1 76	6 53	4 77	310.30	+49.25	1 81	7 76	5 95	261.35	—48.95	1 91	6 53	4 62	1101.65	6 82	27 54	20 72	12	984.20	5 90	24 61	18 71	4 11	
220		III.	4 lbs. C.S.M.; 6 lbs. B.; 18 lbs. C.S.H.; 35 lbs. S...	1:6.63	469.65	1 79	11 74	9 95	498.75	+28.10	2 43	12 47	10 04	518.33	+19.58	2 58	12 96	10 38	519.45	+ 1.12	2 83	12 99	10 16	2006.18	9 63	50 15	40 52	1	1051.88	6 22	26 30	20 08	1 7	
		IV.	2 lbs. C.S.M.; 8 lbs. B.; 18 lbs. C. S. H.; 35 lbs. S..	1:8.90	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.	1014.65	6 63	25 37	18 74	3 10	
																														4018.88	23 19	100 48	77 29	III.	
691		I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.....	1:4.5	246.35	1 09	6 16	5 07	274.55	+29.20	1 31	6 86	5 55	317.71	+43.16	1 47	7 94	6 47	297.25	—20.46	1 51	7 43	5 92	1135.86	5 38	28 40	23 02	9	887.05	3 92	22 18	18 26	3 12	
115	V.	II.	6 lbs. C.S.M.; 4 lbs. C.M.; 16 lbs. C.S.H.; 33 lbs. S.	1:5.78	276.10	1 27	6 90	5 63	275.25	— 0.85	1 62	6 88	5 26	319.80	+44.55	1 71	7 99	6 28	315.50	— 4.30	1 74	7 89	6 15	1186.05	6 34	29 66	23 32	8	915.35	5 02	22 88	17 86	4 14	
347		III.	4 lbs C.S.M.; 6 lbs. C.M.; 18 lbs. C.S.H.; 35 lbs. S..	1:8.14	364.60	1 56	9 12	7 56	365.55	+ 0.85	2 09	9 14	7 05	402.25	+36.70	2 17	10 06	7 89	398.20	— 4.05	2 41	9 95	7 54	1530.60	8 23	38 26	30 03	4	1039.76	5 35	25 99	20 64	1 3	
		IV.	2 lbs. C.S.M.; 8 lbs. C.M.; 18 lbs. C.S.H.; 35 lbs. S..	1:11.7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	..	1010.95	5 66	25 27	19 61	2 8	
																														3853 11	19 95	96 32	76 37	IV.	
442		I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.....	1:4.5	242.95	1 06	6 07	5 01	280.05	+37.10	1 35	7 00	5 65	293.80	+13.75	1 38	7 34	5 96	293.85	+ 0.05	1 66	7 35	5 69	1110.65	5 45	27 77	22 32	10	877.20	4 00	21 93	17 93	4 13	
406	VI.	II.	6 lbs. C.S.M.; 4 lbs. O.; 16 lbs. C.S.H.; 33 lbs. S...	1:5.35	376.00	1 47	9 40	7 93	441.55	+65.55	1 84	11 04	9 20	463.81	+22.26	2 01	11 60	9 59	458.75	— 5.06	2 22	11 47	9 25	1740.11	7 54	43 50	35 96	2	1017.65	5 32	25 44	20 12	2 6	
323		III.	4 lbs. C.S.M.; 6 lbs. O.; 18 lbs. C.S.H.; 35 lbs. S...	1:7.38	258.25	1 47	6 46	4.99	296.05	+37.80	2 13	7 40	5 27	272.85	—23.90	2 22	6 82	4 60	282.50	+ 9.65	2 39	7 06	4 67	1109.65	8 21	27 74	19 53	13	1030.46	5 61	25 76	20 15	1 5	
		IV.	2 lbs. C.S.M.; 8 lbs. O.; 18 lbs. C.S.H.; 35 lbs. S...	1:9.96	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	..	1035.10	6 27	25 88	19 61	3 8	
																														3960.41	21 20	99 01	77 81	II.	

TABLE X.—*Milk Produced, Cost of Food, and Value Derived from Milk per Cow and Group per Period.*

Ear tag number.	Group.	Period.	Ration fed per 1000 pounds live weight per day.	Nutritive ratio.	Milk produced in period I.—lbs.	Cost of food consumed.	Value of milk produced at 2½ cents per lb.	Profit from milk in period I.	Milk produced in period II.—lbs.	Loss or gain in milk in period II.—lbs.	Cost of food consumed.	Value of milk produced at 2½ cents per lb.	Profit from milk in period II.	Milk produced in period III.—lbs.	Loss or gain in milk in period III.—lbs.	Cost of food consumed.	Value of milk produced at 2½ cents per lb.	Profit from milk in period III.	Milk produced in period IV.—lbs.	Loss or gain in milk in period IV.	Cost of food consumed.	Value of milk produced at 2½ cents per lb.	Profit from milk in period IV.	Total milk produced per cow in the four periods—lbs.	Cost of food consumed per cow in the four periods.	Value of milk produced in the four periods at 2½ cents per lb.	Total profit per cow in the four periods.	Rating of cow	Total milk produced per group in the four periods—lbs.	Total cost of food consumed per group in the four periods.	Value of milk produced per group in the four periods.	Profit per group from milk production.	Rating of rations and groups.
317		I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.	1:4.5	308.75	$1 54	$7 72	$6 18	318.70	+ 9.95	$1 56	$7 97	$6 41	324.60	+ 5.90	$1 49	$8 12	$6 63	329.00	+ 4.40	$1 38	$8 23	$6 85	1281.05	$5 97	$32 03	$26 06	6					
545	I.	II.	10 lbs. C.S.M.; 20 lbs. C.S.H.	1:3.12	233.35	1 52	5 83	4 31	212.00	—21.35	1 51	5 30	3 79	201.75	—10.25	1 42	5 04	3 62	214.50	+12.75	1 29	5 36	4 07	861.60	5 74	21 54	15 80	17					
191		III.	8 lbs. C.S.M.; 25 lbs. C.S.H.	1:4.07	238.10	1.37	5.95	4 58	229.50	— 8.60	1 38	5 74	4 36	241.50	+12.00	1 25	6 04	4 79	250.50	+ 9.00	1 18	6 26	5 08	959.60	5 18	23 99	18 81	14					
		IV.	6 lbs. C.S.M.; 25 lbs. C.S.H.	1:5.05																													
																													3102.25	16 89	77 56	60 67	V.
B		I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.	1:4.5	213.25	1 36	5 33	3 97	255.95	+42.70	2 27	6 40	4 13	240.70	—15.25	2 08	6 02	3 94	234.30	— 6.40	2 11	5 86	3 75	944.20	7 82	23 61	15 79	18					
438	II.	II.	10 lbs C.S.M.; 20 lbs. S.H.	1:3.81	288.25	1 33	7 21	5 88	304.20	+15.95	2 14	7 60	5 46	328.90	+24.70	2 09	8 22	6 13	328.25	+ 0.65	2 05	8 20	6 15	1249.60	7 61	31 24	23 63	7					
653		III.	8 lbs. C.S.M.; 30 lbs. S.H.	1:5.51	307.65	1 15	7 69	6 54	253.85	—53.80	1 59	6 35	4.76	266.90	+13.05	1 59	6 67	5 08	254.10	—12.80	1 52	6 35	4 83	1082.50	5 85	27 06	21 21	11					
		IV.	6 lbs. C.S.M.; 30 lbs. S.H.	1:6.64																													
																													3276 30	21 28	81 90	60 62	VI
405		I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.	1:4.5	387.50	1 43	9 69	8 26	398.75	+11.25	2 00	9 97	7 97	449.95	+59.20	1 90	11 25	9 35	442.35	— 7.60	1 77	11 06	9 29	1678.55	7 10	41 97	34 87	3				3	4
356	III.	II.	10 lbs. C.S.M.; 16 lbs. C.S.H.; 33 lbs. S.	1:3.75	238.90	1 36	5 97	4 61	239.25	+ 0.35	1 73	5 98	4 25	248.85	+ 9.60	1 69	6 22	4 53	267.50	+18.65	1 63	6 69	5 06	994.50	6 41	24 87	18 46	15				4	9
Gracie.		III.	8 lbs. C.S.M.; 18 lbs. C.S.H.; 35 lbs. S.	1:4.66	354.10	1 48	8 85	7 37	348.00	— 6.10	1 93	8 70	6 77	370.75	+22.75	1 91	9 27	7 36	367.00	— 3.75	1 90	9 18	7 28	1439.85	7 22	36 00	28 78	5				2	2
		IV.	6 lbs. C.S.M.; 18 lbs. C.S.H.; 35 lbs. S.	1:5.78																												1	1
																													4112.90	20 73	102 84	82 11	I.
210		I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.	1:4 5	229.55	1 31	5 74	4 43	224.40	— 5.15	1 71	5 61	3 90	223.25	— 1.15	1 83	5 58	3 75	233.85	+10.60	1 89	5 85	3 96	911.05	6 74	22 77	16 03	16				2	7
182	IV.	II.	6 lbs. C.S.M.; 4 lbs. B.; 16 lbs. C.S.H.; 33 lbs. S.	1:5.03	268.95	1 34	6 72	5 38	261.05	— 7.90	1 76	6 53	4 77	310.30	+49.25	1 81	7 76	5 95	261.35	—48.95	1 91	6 53	4 62	1101.65	6 82	27 54	20 72	12				4	11
220		III.	4 lbs. C.S.M.; 6 lbs. B.; 18 lbs. C.S.H.; 35 lbs. S.	1:6.63	469.65	1 79	11 74	9 95	498.75	+28.10	2 43	12 47	10 04	518.33	+19.58	2 58	12 96	10 38	519.45	+ 1.12	2 83	12 99	10 16	2006.18	9 63	50 15	40 52	1				1	7
		IV.	2 lbs. C.S.M.; 8 lbs. B.; 18 lbs. C. S. H.; 35 lbs. S.	1:8.90																													
																													4018.88	23 19	100 48	77 29	III.
691		I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.	1:4.5	246.35	1 09	6 16	5 07	274.55	+29.20	1 31	6 86	5 55	317.71	+43.16	1 47	7 94	6 47	297.25	—20.46	1 51	7 43	5 92	1135.86	5 38	28 40	23 02	9				3	12
115	V.	II.	6 lbs. C.S.M.; 4 lbs. C.M.; 16 lbs. C.S.H.; 33 lbs. S.	1:5.78	276.10	1 27	6 90	5 63	275.25	— 0.85	1 62	6 88	5 26	319.80	+44.55	1 71	7 99	6 28	315.50	— 4.30	1 74	7 89	6 15	1186.05	6 34	29 66	23 32	8				4	14
347		III.	4 lbs C.S.M.; 6 lbs. C.M.; 18 lbs. C.S.H.; 35 lbs. S.	1:8.14	364.60	1 56	9 12	7 56	365.55	+ 0.85	2 09	9 14	7 05	402.25	+36.70	2 17	10 06	7 89	398.20	— 4.05	2 41	9 95	7 54	1530.60	8 23	38 26	30 03	4				1	3
		IV.	2 lbs. C.S.M.; 8 lbs. C.M.; 18 lbs. C.S.H.; 35 lbs. S.	1:11.7																													
																													3853 11	19 95	96 32	76 37	IV.
442		I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.	1:4.5	242.95	1 06	6 07	5 01	280.05	+37.10	1 35	7 00	5 65	293.80	+13.75	1 38	7 34	5 96	293.85	+ 0.05	1 66	7 35	5 69	1110.65	5 45	27 77	22 32	10				4	13
406	VI.	II.	6 lbs. C.S.M.; 4 lbs. O.; 16 lbs. C.S.H.; 33 lbs. S.	1:5.35	376.00	1 47	9 40	7 93	441.55	+65.55	1 84	11 04	9 20	463.81	+22.26	2 01	11 60	9 59	458.75	— 5.06	2 22	11 47	9 25	1740.11	7 54	43 50	35 96	2				2	6
323		III.	4 lbs. C.S.M.; 6 lbs. O.; 18 lbs. C.S.H.; 35 lbs. S.	1:7.38	258.25	1 47	6 46	4.99	296.05	+37.80	2 13	7 40	5 27	272.85	—23.90	2 22	6 82	4 60	282.50	+ 9.65	2 39	7 06	4 67	1109.65	8 21	27 74	19 53	13				1	5
		IV.	2 lbs. C.S.M.; 8 lbs. O.; 18 lbs. C.S.H.; 35 lbs. S.	1:9.96																													
																													3960.41	21 20	99 01	77 81	II.

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ing a profit of $3.75. 191 proved the easiest keeper, with $1.18 charged against her. She gave 250.50 pounds of milk, and left $5.08 as a profit.

Further valuable information might be gleaned from this portion of the table, but that already presented sufficiently proves the influence of individuality in the cow—on capacity to yield a large quantity of milk at a moderate cost. It is true that the cost of feeding 220 was greater in every period than in the case of any other cow, but the yields were also so much larger that the profit derived was in many instances in excess of that obtained from two other cows. Such cows as 220 are essential in the milk industry, and the man in possession of them ought to assuredly succeed.

It is interesting to note the large profits accruing in the milk business. (See table above.) No other branch of dairy husbandry offers such remunerative returns, when properly managed. Of course, some fertility is removed from the farm, but it is comparatively small, and can be easily replaced. The most serious objections are the loss of the skim milk, so valuable in feeding growing live stock, and the labor and drudgery entailed in delivering the milk. The part the important factor, food, plays in the cost of milk production may be studied with profit in the case of 220.

Period.	Milk yield, lbs.	Loss or gain.	Cost.	Profit.
I	469.65	.....	$1 79	$9 95
II	498.75	+28.10	2 43	10 04
III	518.33	+19.58	2 58	10 38
IV	519.45	+ 1.12	2 83	10 16

It is obvious that the ration fed in Period II., though costing so much more, had a decided advantage over that fed in Period I. That fed in Period III. proved slightly superior to that fed in Period II., and the one in Period IV., owing to its increased cost, was not as valuable as that used in Period III. This matter calls for nice distinctions, and the sum of 34 cents, gained by using III., instead of II., when a year is considered, means the difference between failure and success. *The cost and productivity of rations must be constantly studied if success is achieved in dairy enterprises.*

The profit obtained from milk production during the experiment, and the rating of cows, will be found in the table, if any reader desires to further investigate this question. A consideration of the yields of milk by Groups per Period, now follows.

In Period I., Group III. led in milk production, with 980.50 pounds, costing $4.27, and yielding a profit of $20.24. Group IV. was second, with 968.15 pounds of milk, costing $4.44, and giving $19.76 profit. The minimum yield was made by Group I., with 780.20 pounds, costing $4.43, and making a profit of $15.07. The ration was the same for all Groups, namely, 7 pounds of cotton seed meal, 16 pounds of cotton seed hulls, 28 pounds of silage.

In Period II., Group VI. produced the most milk, namely, 1017.65 pounds, costing $5.32, and leaving a profit of $20.12. The ration fed was

6 pounds of cotton seed meal, 4 pounds of oats, 16 pounds of cotton seed hulls, 33 pounds of silage, with a nutritive ratio of 1:5.35.

Group III. was next, with 986 pounds of milk, costing $5.66, and giving as profit $19.00. This group received a ration of 10 pounds of cotton seed meal, 16 pounds of cotton seed hulls, and 33 pounds of silage, with a nutritive ratio of 1:3.75. The lowest yield of milk was by Group I., with 760.20 pounds, costing $4.45, and yielding a profit of $14.56. The ration eaten was 10 pounds of cotton seed meal, 20 pounds of cotton seed hulls, with a nutritive ratio of 1:3.12.

In Period III., Group III. came first in milk yield with 1069.55 pounds. The cost was $5.50 and the profit derived $21.24. Eight pounds of cotton seed meal, 18 pounds of cotton seed hulls, and 35 pounds of silage, with a nutritive ratio of 1:4.66, formed the ration. Group V. came next in profit, but third in milk yield, as follows: 1039.76 pounds of milk, costing $5.35, with a profit $20.64. The ration used was 4 pounds of cotton seed meal, 6 pounds of corn meal, 18 pounds of cotton seed hulls, and 35 pounds of silage. Groups IV., VI., II., and I. followed in the order named.

In Period IV., Group III. again led in milk production, with 1076.85 pounds, at a cost of $5.30, and leaving a profit of $21.63. The only change in the ration was to reduce the cotton seed meal by 2 pounds. This made the nutritive ratio 1:5.78. Group VI. stood second in milk flow, with 1035.10 pounds. The cost of producing it was $6.27 and the profit derived $19.61. The ration consisted of 2 pounds of cotton seed meal, 8 pounds of oats, 18 pounds of cotton seed hulls, and 35 pounds of silage, and the nutritive ratio was 1:9.96. Groups IV., V., II., and I. occupied third, fourth, fifth, and last places respectively.

Considering the four experimental periods, Group III. led in milk production, with a total yield of 4112.90 pounds. The entire cost was $20.73, and the profit secured $82.11. The ration consisted of different proportions of cotton seed meal and hulls and silage combined. The nutritive ratio varied between 1:4.5 and 1:5.78, and was therefore narrow.

Group IV. stood second in milk production and third in profit. The yield of milk was 4018.88 pounds, at a cost of $23.19, and with a profit of $77.29. The coarse foods of the ration were similar to those fed Group III., and the meals used were cotton seed meal and bran. The nutritive ratios varied from 1:4.5 to 1:8.90, or from a narrow to a wide ratio.

Group VI. was third in milk production, but second in profit. 3960.41 pounds of milk was the yield; the cost was $21.30, and the profit derived $77.81. The meal portion of the ration consisted of cotton seed meal and oats, and the coarse materials were similar to those fed Group III. The nutritive ratios ran from 1:4.5 to 1:9.96, or from narrow to wide ratio.

Group V. was fourth in milk production and profit. The milk yielded was 3853.11 pounds, at a cost of $19.95, and with $76.37 as a margin of profit. The same coarse materials were used as in the previous groups, and the meals were a mixture of cotton seed meal and corn meal. The nutritive ratios were from 1:4.5 to 1:11.7, or from narrow to very wide.

Groups VI. and I. divided honors for the last place. Group II. stood sixth in profit and fifth in milk yield, while Group I. occupied the reverse position. Group II. made 3276.30 pounds of milk, costing $21.28,

and leaving a profit of $60.62. The rations fed consisted of cotton seed meal and sorghum hay. The ratios varied from 1:4.5 to 1:6.64, or narrow in nature.

Group I. produced 3102.25 pounds of milk, at a cost of $16.89, and yielding a profit of $60.67. The rations were made up of cotton seed meal and cotton seed hulls, for the most part, and the ratios were from 1:4.5 to 1:5.05, or narrow.

By reference to the table, the rating of the rations with regard to the economic production of milk by groups and according to the productive ability of all the rations fed, will be found. A discussion of these results will not be attempted, but a few of the more important rations will be considered briefly.

1. The Most Effective Rations Fed per Group in any Period.

Group I.	Period IV.	6 lbs. C.S.M.; 25 lbs. C.S.H.
Group II.	Period I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.
Group III.	Period IV.	6 lbs. C.S.M.; 18 lbs. C.S.H.; 35 lbs. S.
Group IV.	Period III.	4 lbs. C.S.M.; 6 lbs. B.; 18 lbs. C.S.H.; 35 lbs. S.
Group V.	Period III.	4 lbs. C.S.M.; 6 lbs. C.M.; 18 lbs. C.S.H.; 35 lbs. S.
Group VI.	Period III.	4 lbs. C.S.M.; 6 lbs. O.; 18 lbs. C.S.H.; 35 lbs. S.

In only one instance (Group II.) did the preliminary ration lead in effectiveness as a milk producer. When either bran, corn meal or oats were combined with cotton seed meal, the combination suggested as most proficient in these experiments is 1½ pounds of the former to 1 pound of the latter, when combined with 16 pounds of cotton seed hulls and 35 pounds of silage.

According to the rating of the entire set of rations fed (when judged by the margin of profit secured) the following proved most desirable:

	Profit secured per group.
1. 6 lbs. C.S.M.; 18 lbs. C.S.H.; 35 lbs. S.	$21 63
2. 8 lbs. C.S.M.; 18 lbs. C.S.H.; 35 lbs. S.	21 23
3. 4 lbs. C.S.M.; 6 lbs. C.M.; 18 lbs. C.S.H.; 35 lbs. S.	20 64
4. 7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.	20 24
5. 4 lbs. C.S.M.; 6 lbs. O.; 18 lbs. C.S.H.; 35 lbs. S.	20 15
6. 6 lbs. C.S.M.; 4 lbs. O.; 16 lbs. C.S.H.; 33 lbs. S.	20 12
7. 4 lbs. C.S.M.; 6 lbs. B.; 18 lbs. C.S.H.; 35 lbs. S.	20 08

The influence of the nutritive ratio on milk production is a problem worthy of examination.

Period.	Group III.	Loss or gain in milk.	Rating.	Group IV.	Loss or gain in milk.	Rating.	Group VI.	Loss or gain in milk.	Rating.	Group V.	Loss or gain in milk.	Rating.
I.	Nutritive ratio 1:4.5	....	3.	1:4.5	....	2.	1:4.5	....	4.	1:4.5	....	3.
II.	Nutritive ratio 1:3.75	+ 5.50	4.	1:5.03	+15.05	4.	1:5.35	+140.45	2.	1:5.78	+ 29.20	4.
III.	Nutritive ratio 1:4.66	+83.55	2.	1:6.63	+67.68	1.	1:7.38	+ 12.11	1.	1:8.14	+124.41	1.
IV.	Nutritive ratio 1:5.78	+ 7.15	1.	1:8.90	−37.23	3.	1:9.96	+ 4.64	3.	1:11.7	− 28.81	2.

TABLE XI.—*Variations in Per Cent. of Fat with Average Per Cents. of Fat in the Milk, by Periods.*

Ear tag number.	Group.	Period.	Rations fed per 1000 pounds live weight per day.	Nutritive ratio.	Highest per cent. of fat per period.				Highest per cent. of fat attained.	Lowest per cent. of fat per period.				Lowest per cent. of fat attained.	Period when maximum per cent. was reached.	Period when minimum per cent. was reached.	Difference between minimum and maximum per cent of fat.	Average per cent. of fat per period.							Rating of cows.
					I.	II.	III.	IV.		I.	II.	III.	IV.					I.	II.	Increase or decrease in per cent. of fat over period I.	III.	Increase or decrease in per cent. of fat over period II.	IV.	Increase or decrease in per cent of fat over period III.	
317		I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.	1:4.5	3.8	4.0	4.1	4.0	4.1	2.4	2.9	3.4	3.6	2.4	III.	I.	1.7	3.26	3.75	+.49	3.66	—.09	3.75	+.09	12
545	I.	II.	10 lbs. C.S.M.; 20 lbs. C.S.H.	1:3.12	4.6	5.1	4.6	4.7	5.1	3.3	3.6	3.8	3.6	3.3	II.	I.	1.8	3.77	4.33	+.56	4.17	—.16	4.18	+.01	8
191		III.	8 lbs. C.S.M.; 25 lbs. C.S.H.	1:4.07	4.2	4.4	4.8	4.6	4.8	2.9	3.5	3.4	3.8	2.9	III.	I.	1.9	3.73	4.11	+.38	4.06	—.05	4.17	+.09	9
		IV.	6 lbs. C.S.M.; 25 lbs. C.S.H.	1:5.05	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	..
B.		I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.	1:4.5	5.4	4.8	5.2	5.4	5.4	4.0	3.7	3.3	4.4	3.3	IV.	III.	2.1	4.78	4.48	—.30	4.38	—.10	4.74	+.36	2
438	II.	II.	10 lbs. C.S.M.; 20 lbs. S.H.	1:3.81	4.2	3.6	3.6	3.4	4.2	2.6	2.8	3.0	2.8	2.6	I.	I.	1.6	3.55	3.40	—.15	3.20	—.20	3.08	—.12	16
653		III.	8 lbs. C.S.M.; 30 lbs. S.H.	1:5.51	5.0	5.2	5.2	4.8	5.2	2.8	3.7	3.0	3.4	2.8	III.	I.	2.4	4.09	4.60	+.51	4.30	—.30	4.26	—.04	4
		IV.	6 lbs. C.S.M.; 30 lbs. S.H.	1:6.64	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	....
405		I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.	1:4.5	4.5	4.5	4.0	4.5	4.5	3.0	3.4	3.4	3.6	3.0	IV.	I.	1.5	3.50	4.04	+.54	3.70	—.34	3.83	+.13	11
356	III.	II.	10 lbs. C.S.M.; 16 lbs. C.S.H.; 33 lbs. S.	1:3.75	5.4	5.5	5.3	5.2	5.5	3.8	4.3	3.8	4.5	3.8	II.	I.	1.7	4.62	5.02	+.40	4.66	—.36	4.95	+.29	1
Gracie		III.	8 lbs. C.S.M.; 18 lbs. C.S.H.; 35 lbs. S.	1:4.66	4.4	4.6	4.1	4.4	4.6	2.4	2.8	2.8	2.9	2.4	II.	I.	2.2	3.38	3.78	+.40	3.44	—.34	3.55	+.11	14
		IV.	6 lbs. C.S.M.; 18 lbs. C.S.H.; 35 lbs. S.	1:5.78	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
210		I.	7 lbs. C.S.M., 16 lbs. C.S.H.; 28 lbs. S.	1:4.5	5.0	5.0	4.9	4.8	5.0	3.8	3.6	3.4	4.0	3.4	II.	III.	1.6	4.40	4.48	+.08	4.31	—.17	4.52	+.21	3
182	IV.	II.	6 lbs. C.S.M.; 4 lbs. B.; 16 lbs. C.S.H.; 33 lbs. S.	1:5.03	4.8	4.8	4.8	4.8	4.8	3.0	3.7	3.6	4.0	3.0	IV.	I.	1.8	3.98	4.30	+.32	4.22	—.08	4.34	+.12	7
220		III.	4 lbs. C.S.M.; 6 lbs. B.; 18 lbs. C.S.H.; 35 lbs. S.	1:6.63	4.0	4.4	5.0	4.4	5.0	2.6	3.0	2.8	2.8	2.6	III.	I.	2.4	3.26	3.71	+.45	3.56	—.15	3.54	—.02	15
		IV.	2 lbs. C.S.M.; 8 lbs. B.; 18 lbs. C.S.H.; 35 lbs. S.	1:8.90	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	....
691		I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.	1:4.5	4.6	4.6	4.9	4.4	4.9	3.2	4.0	3.0	3.3	3.0	III.	III.	1.9	4.08	4.24	+.16	3.93	—.31	3.84	—.09	9
115	V.	II.	6 lbs. C.S.M.; 4 lbs. C.M.; 15 lbs. C.S.H.; 33 lbs. S.	1:5.78	4.2	4.2	3.8	4.0	4.2	2 8	3.3	3.3	2.9	2.8	II.	I.	1.4	3.45	3.90	+.45	3.54	—.36	3.49	—.05	13
347		III.	4 lbs. C.S.M.; 6 lbs. C.M.; 18 lbs. C.S.H.; 35 lbs. S.	1:8.1	3.4	3.4	3.7	3.8	3.8	2.2	3.0	2.8	2.6	2.2	IV.	I.	1.6	2.90	3.23	+.33	3.13	—.10	3.21	+.08	17
		IV.	2 lbs. C.S.M.; 8 lbs. C.M.; 18 lbs. C.S.H.; 35 lbs. S.	1:11.7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	....
442		I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.	1:4.5	4.6	5.0	4.6	4.8	5.0	3.0	4.1	3.7	4.0	3.0	II.	I.	2.0	4.04	4.30	+.26	4.16	—.14	4.37	+.21	6
406	VI.	II.	6 lbs. C.S.M.; 4 lbs. O.; 16 lbs. C.S.H.; 33 lbs. S.	1:5.35	4.5	4.3	4.6	4.1	4.6	2.7	3.6	3.6	3.4	2.7	III.	I.	1.9	3.50	4.05	+.55	4.00	—.05	3.70	—.30	10
323		III.	4 lbs. C.S.M.; 6 lbs. O.; 18 lbs. C.S.H.; 35 lbs. S.	1:7.38	5.0	4.6	5.0	6.3	6.3	3.0	3.8	3.0	3.7	3.0	IV.	I.	3.3	4.03	4.20	+.17	4.29	+.09	4.43	+.14	5
		IV.	2 lbs. C.S.M.; 8 lbs. O.; 18 lbs. C.S.H.; 35 lbs. S.	1:9.86	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	...

Diagramatic Chart B. Showing the Daily Yields and Variations in Milk Flow due to Food, Temperature and Individuality, per Group, per Period.

Groups	Period I Rations	Period II Rations	Period III Rations	Period IV Rations
Milk Yielded per Day per Group Lbs. I	All Groups received	10# C.S.M.; 20# C.S.H.	8# C.S.M.; 25# C.S.H.	6# C.S.M.; 25# C.S.H.
II	the same ration	10# C.S.M.; 20# S.H.	8# C.S.M.; 30# S.H.	6# C.S.M.; 30# S.H.
III	namely,	10# C.S.M.; 16# C.S.H.; 33# S.	8# C.S.M.; 18# C.S.H.; 35# S	6# C.S.M.; 18# C.S.H.; 35# S.
IV	7# C.S.M.; 16# C.S.H.; 28# S.	6# C.S.M.; 4# B.; 16# C.S.H.; 33# S.	4# C.S.M.; 6# B.; 18# C.S.H. 35# S	2# C.S.M.; 8# B.; 18# C.S.H.; 35# S.
V		6# C.S.M.; 4# C.M.; 16# C.S.H.; 33# S.	4# C.S.M.; 6# C.M.; 18# C.S.H.; 35# S	2# C.S.M.; 8# C.M.; 18# C.S.H.; 35# S.
VI		6# C.S.M.; 4# O.; 16# C.S.H. 33# S	4# C.S.M. 6# O.; 18# C.S.H.; 35# S	2# C.S.M.; 8# O.; 18# C.S.H.; 35# S

Jan. 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 Feb. 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 Mch. 1 2 3 4 5

86 85 84 83 82 81 80 79 78 77 76 75 74 73 72 71 70 69 68 67 66 65 64 63 62 61 60 59 58 57 56 55 54 53 52 51 50 49 48 47 46 45

Group III. Group II. Group I. Group IV. Group V. Group VI.

Daily Temp. in F. 54 62.5 56.5 63.5 65.5 68.5 54.5 65.0 60.5 56.0 42.0 37.5 42.0 42.5 49.5 38.0 19.0 19.0 28.5 32.0 36.5 38.0 37.0 46.5 54.0 52.0 47.5 52.0 50.5 43.5 49.0 48.5 48.5 53.5 56.0 55.5 52.0 56.5 58.0 67.0 67.5 69.0 70.5 71.5 66.0 58.0 48.0 54.5 46.0 52.0 64.5 63.5 65.5 64.0 69.5 62.5

Legend

Group I

Group II

Group III

Group IV

Group V

Group VI

There was an increase in milk when the ration was widened for Groups IV., VI., and V., and narrowed for Group III., in Period II. In Period III., the widening of the ration was attended with a decided increase in milk yields for all the groups. With the rations still further widened in Period IV., Groups IV. and V. showed a decided loss in milk yield, and Groups III. and VI. a slight increase. In Groups IV., VI., and V., the best results were secured when the ratios varied from 1:5.0 to 1:8.0, or from moderately narrow to moderately wide ratios. In Group III., there was an increase in milk with a very narrow ration. An increase was also shown in Periods III. and IV., and in all instances the ratios were narrow. The narrowness of the rations fed Group IV. was due to the richness of cotton seed meal in protein, and due allowance must be made for that fact. The rating of the rations refers to the net profit produced.

VARIATIONS IN FAT.

There was a wide range of variations between the highest and lowest per cents of fat in the several periods, as indicated in Table XI. The most remarkable variation shown was by 323. Here a difference of 3.3 per cent of fat between her maximum and minimum yields of the same in Periods IV. and I. is apparent. As this cow was of an irritable disposition, this may in part account for this wide variation. It is plain that the fat in the milk from all the cows was subject to very considerable fluctuation. No well defined reasons have yet been advanced to explain this phenomena. Any annoying circumstances, changes in diet, exposure, sickness, etc., will increase these variations, and the practical lesson this teaches the dairyman is to avoid all these annoying circumstances, giving the cow only pleasant environments. The temperament of the cow seriously affects fat production, hence those of mild and even disposition should be sought. Cows may be divided into two classes in feeding, namely, "even" and "uneven feeders." The latter class are objectionable because of the variations in per cent of fat to which their milk is subject.

Referring again to the table, it is seen that 653 and 220 showed a variation of 2.4 per cent of fat, and stood next to 323 in this respect. The least variation was shown by 115, the remaining cows ranging between 1.6 and 2.0 per cent. The importance of controlling this variation by every means possible can best be shown by an illustration.

Name of cow.	Date.	Milk, lbs.	Per cent. fat.	Butter fat, lbs.	Loss or gain.
Gracie.....	January 17	31.25	3.0	.9375	.....
Gracie.....	January 18	29.75	2.4	.7140	—.2235
Gracie.....	January 19	25.50	3.3	.8415	+.1275
Gracie.....	January 20	27.50	4.3	1.1825	+.3410

A difference of .5685 of a pound of butter fat exists between the total fat yielded on January 18 and 20. This equals over one-half pound of butter, or a loss of nearly 15 cents as between the production of the two days.

The action of the rations on the formation of fat in the milk is presented in this table. It will be observed that the rations fed in Period II. gave an increase in average fat yield over that secured in Period I. in every instance except B. and 438 of Group II. In Period III. there was a decrease in the fat in all cases except one, and in Period IV. an increase is again shown in the majority of cases. It is a noteworthy fact that the largest amounts of fat were not obtained when the milk yield was smallest, and vice versa, as is sometimes held to be the case. The individual rations producing the several results indicated above can be readily ascertained by reference to the table, and owing to the space required it will be impossible to further discuss them at this juncture.

Does temperature influence the yield of butter fat? During the experimental period a very severe norther prevailed, and though the cows were stabled, they were inadequately protected, owing to the high winds prevailing. The influence of this sudden change and rapid fall in temperature may therefore throw some light on the subject.

Group.	Ear tag No.	Date.	Daily Temperature.	Milk, lbs.	Per cent of fat.	Butter fat, lbs.	Loss or gain in butter fat.		Butter, lbs.
I.	317	Jan. 23....	49.5° F	26.50	3.6	.953	.....		2.705
	545	Jan. 23....	49.5° F....	18.75	3.6	.675	.....		
	191	Jan. 23....	49.5° F....	17.25	4.0	.690	.....		
I.	317	Jan. 25....	19° F.....	23.50	3.9	.916	—.038		2.852
	545	Jan. 25....	19° F.....	18.00	4.4	.792	+.117	+.126	
	131	Jan. 25....	19° F.....	16.75	4.4	.737	+.047		
I.	317	Jan. 27....	20° F.....	15.70	3.9	.612	—.304		2.233
	545	Jan. 27....	20° F.....	14.35	4.4	.631	—.161	—.528	
	191	Jan. 27....	20° F.....	15.25	4.4	.671	—.066		
I.	317	Jan. 28....	28.5° F....	18.50	3.9	.921	+.309		2.301
	545	Jan. 28....	28.5° F....	14.75	4.4	.649	+.018	+.261	
	191	Jan. 28....	28.5° F....	13.75	4.4	.605	—.066		
I.	317	Jan. 31....	38° F.....	25.00	4.0	1.000	+.079		2.779
	545	Jan. 31....	38° F.....	13.25	5.1	.675	+.026	+.207	
	191	Jan. 31....	38° F.....	17.25	4.1	.707	+.102		

The per cent. of fat was but slightly influenced, and increased rather than diminished. A very considerable loss of butter, however, is apparent, and this is explained by the shrinkage in milk attributable to the weather conditions. The milk yield was 62.50 pounds on the 23rd; 58.25 pounds on the 25th; 45.30 pounds on the 27th; 47.00 on the 28th; and 55.50 on the 31st. The first effect of the cold was to increase the butter yielded on the 25th somewhat. As it continued through several days, the decrease in milk was marked, until a loss of 17.20 pounds was indicated on the 27th as compared with the 23rd, and this reduction in the milk flow resulted in a loss of .619 of a pound of butter on the same date. The milk and butter yield did not become normal again until the 31st, so that the evil influences of three days of cold weather affected the pro-

Diagramatic Chart C. Showing the Daily Variations in Butter Yields per Group per Periods as Influenced by Food and Temperature etc.

Groups	Period I Rations	Period II Rations	Period III Rations	Period IV Rations
I	All Groups received	10#C.S.M.; 20#C.S.H.	8#C.S.M.; 25#C.S.H.	6#C.S.M.; 25#C.S.H.
II	the same ration	10#C.S.M.; 20#S.H.	8#C.S.M.; 30#S.H.	6#C.S.M.; 30#S.H.
III	namely	10#C.S.M.; 16#C.S.H.; 33#S.	8#C.S.M.; 18#C.S.H.; 35#S.	6#C.S.M.; 18#C.S.H.; 35#S.
IV	7#C.S.M. 16#C.S.H. 28#S	6#C.S.M. 4#B. 16#C.S.H. 33#S.	4#C.S.M. 6#B.; 18#C.S.H.; 35#S.	2#C.S.M.; 8#B. 18#C.S.M. 35#S.
V		6#C.S.M. 4#C.M. 16#C.S.H. 33#S.	4#C.S.M. 6#C.M.; 18#C.S.H. 35#S.	2#C.S.M.; 8#C.M.; 18#C.S.H. 35#S.
VI		6#C.S.M. 4#O. 16#C.S.H.; 33#S.	4#C.S.M. 6#O.; 18#C.S.H.; 35#S.	2#C.S.M.; 8#O.; 18#C.S.H. 35#S.

Butter Yielded per Group per Day per Period Lbs.

Apr. 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 May 1 2 3 4 5 | 6 7 8 9 10 11 12 13 14 15 16 17 18 19 | 20 21 22 23 24 25 26 27 28 May 1 2 3 4 5

Total Yield of Butter for All Groups per Day per Period Lbs.

7 — 20.
6 — 19
5 — 18
4 — 17
3 — 16
2 — 15
1 — 14

Daily Temp. 54 63.5 66.5 62.5 65.5 68.5 54.5 65.0 60.5 56.0 42.0 37.5 44.0 43.5 49.5 38.0 19.0 19.0 20.0 28.5 32.0 36.5 38.0 37.0 45.5 54.0 53.0 47.5 52.0 50.5 43.5 49.0 48.5 48.5 53.5 56.0 56.5 52.0 56.5 59.0 67.5 62.0 70.5 71.5 66.0 53.0 48.0 54.5 46.0 52.0 54.5 63.5 65.5 66.0 68.5 62.5

Legend { The Groups are Distinguished as Follows

Group I — Group II — Group III — Group IV

Group V — Group VI — *All Groups

*Reads toward the left.

duction through a week. The loss of milk and butter was very considerable, and with a large herd would prove serious. This data sufficiently indicates the value of protection for cows in stormy weather.

Generally speaking, a change in the rations caused the per cent of fat to increase in Period II., decrease in Period III., and increase in Period IV. The variations in the fat yield seldom exceeded one-half of one per cent per cow per day, but, when it is remembered that this is the average for 14 days, the gain or loss in fat incurred by the changed rations has an important bearing on the yields and profits derived. This influence is more clearly shown when the Groups and the whole herd are considered. (See Charts A, B and C.)

Chart A shows the total yields of milk to decrease with the whole herd during Periods III. and IV., and that the variations between the total daily yields, and the morning's and night's milk, from day to day, were also least in Periods III. and IV. This does not necessarily mean that the total yields of milk were least in these Periods.

In Chart B, where the Groups are considered, we find the milk increasing through Period I., and starting to increase in Period II. (decrease due to temperature), while the highest average milk yield per Group was shown in Period III., decreasing but slightly during Period IV.

In Chart C, the butter yields by Groups will be found. The butter increased to Period II., and maintained a high average through Periods II., III., and IV., decreasing slightly in Period IV. The sudden fall in temperature in these Periods did not affect the butter yields materially.

From a review of these charts, it is plain that every change in the rations influenced the yields of milk and butter, and the differences displayed in effectiveness show how carefully the relative value of rations must be studied, or else large losses will be the result.

The changed rations exerted a greater influence on the milk yields than on the butter fat in the experiments. Further, a slight decrease in the yields of milk and butter is shown as the rations widen, thus indicating the value of narrow nutritive rations for dairy production. While variations in milk yields, when Groups, and especially the herd, is considered, are very marked, the variations in fat are not so great as we would anticipate, thus showing that the fat may be diluted in a larger or smaller quantity of milk (H_2O), depending on the cow, period of lactation, and the nature of the food provided.

BUTTER PRODUCTION.

By reference to Table XII., the facts and figures pertaining to butter production may be ascertained. The butter was sold at 25 cents per pound, and that factor was used in making the calculations shown in this discussion.

In Period I., 220 made 17.6 pounds of butter. The outlay entailed was $1.79, and the profit secured $2.67. 653 was second in profit. She made 14.61 pounds of butter, at a cost of $1.15, and the profit accruing was $2.50. 442 was the easiest fed cow. She cost $1.06 for food, made 11.45 pounds of butter, and furnished a profit of $1.80. 545 yielded the least butter, namely, 10.27 pounds, at a cost of $1.52, and leaving as profit $1.05.

In Period II., 220 gave 21.58 pounds of butter; the cost was $2.43, and the profit derived $2.96. She was first in yield and second in profit. 406 produced 20.86 pounds of butter; the cost was $1.84, and the profit remaining $3.37. This cow was first in profit and second in yield. 438 was the last in profit, with 88 cents to her credit.

In Period III., 406 led in production and profit. She made 21.64 pounds of butter, at a cost of $2.01, and leaving as profit $3.40. 220 was next in yield, but third in profit. She gave 21.52 pounds of butter, at a cost of $2.58, and a profit of $2.80. 405 was third in yield and second in profit. She produced 19.42 pounds of butter, at a food cost of $1.90, and a net profit of $2.95. 438 again brought up the rear, with $1.00 as profit.

In Period IV., 220 came first in yield, but third in profit. Her account was 21.44 pounds of butter, costing $2.83, and leaving as profit $2.53. 406 was second in yield and profit. She gave 19.80 pounds of butter, at a food cost of $2.22, and with a net profit of $2.73. 405 produced 19.77 pounds of butter, at a cost of $1.77, and leaving as profit $3.17. This cow was third in yield, but first in profit. As usual, 438 brought up the rear. She made 11.80 pounds of butter, at a cost of $2.05, and a net profit of 90 cents.

The standing of the several individuals for the entire experiment was as follows: 220 was first in production, with 82.4 pounds of butter, and showing a profit of $10.96. 406 was first in profit and second in yield. She made 78 pounds of butter, and the profit derived was $11.96. 405 came second in profit, but stood third in production. Her record was 73.8 pounds of butter, and a net profit of $11.34. 438 was lowest in profit. She made 48.1 pounds of butter, and a profit of $4.42. 545 made the least butter, namely, 41.3 pounds, and a net profit of $4.57.

Cows are not necessarily equally valuable for milk and butter making. It is true that 220 led in production for both purposes, but when the cost of keep and the profit derived is taken into account, she stood third as a butter cow. Again, we find 317 and 438 standing 6 and 7 in milk yield, but 9 and 18 when butter is considered. It is true, this rating depends on the net profit derived from each cow, but this is the only just and legitimate means of judging a cow. It may be argued that the cost and character of the foods are responsible in a great measure for the results presented. Food certainly plays an important part. It is this problem we are striving to solve, and granting the above contention as a correct premises, it simply emphasizes the necessity of redoubled efforts to solve the problem.

Period.	220.			405.			406.			438.		
	Butter, lbs.	Cost of food.	Profit.	Butter, lbs.	Cost of food.	Profit.	Butter, lbs.	Cost of food.	Profit	Butter, lbs.	Cost of food.	Profit
I.	17.86	$1 79	$2 67	15.82	$1 43	$2 52	15.75	$1 47	$2 46	12.05	$1.33	$1.66
II.	21.58	2 43	2 96	18.79	2 00	2 70	20.86	1 84	3 37	12.07	2 14	88
III.	21.52	2 58	2 80	19.42	1 90	2 95	21.64	2 01	3 46	12.39	2 09	1 00
IV.	21.44	2 83	2 53	19.77	1 77	3 17	19.80	3 22	2 73	11.80	2 05	90

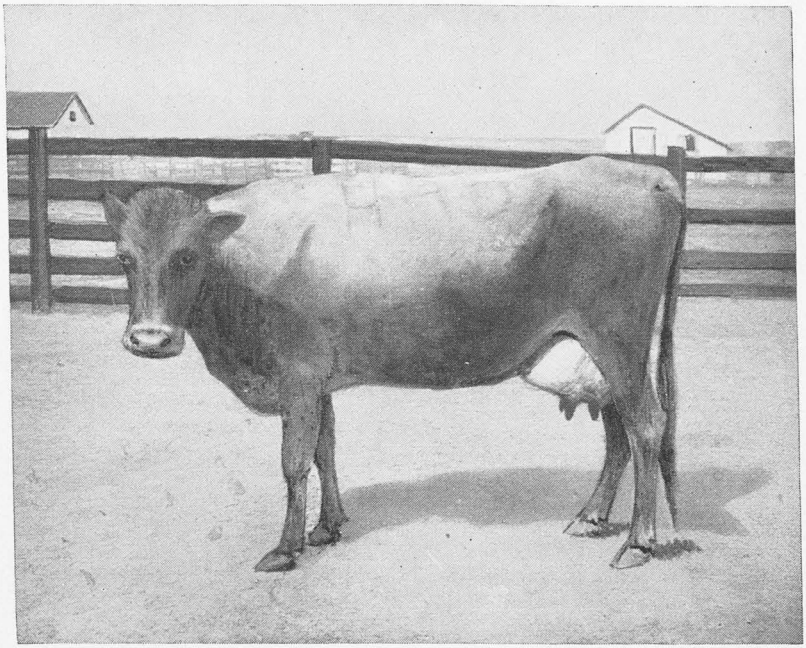

Figure 5.

No. 406.

A superior type of dairy animal—No. 406—Group VI.
Second in yield and profit from milk.
Second in yield of butter but first in profit.
For records see Tables X. and XII.
For measurements see Table XXV.

DESCRIPTION.

Medium in size; clean cut contour and carrying no surplus flesh—though not bony. Vigorous digestion; abundant nervous energy and finely developed udder and milk veins.

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TABLE XII.—*Cost of Butter Production per Cow and per Group per Period.*

Ear tag No.	Group.	Period.	Rations fed per 1,000 pounds live weight per day.	Nutritive ratio.	Period I. Milk, lbs.	Per cent. fat.	Butter, lbs	Cost of food.	Value of butter at 25c per lb.	Profit per cow.	Period II. Milk, lbs.	Per cent. fat.	Butter, lbs.	Cost of food.	Value of butter at 25c per lb.	Profit per cow.	Period III. Milk, lbs.	Per cent. fat.	Butter, lbs.	Cost of food.	Value of butter at 25c per lb.	Profit per cow.	Period IV. Milk, lbs.	Per cent. fat.	Butter, lbs.	Cost of food.	Value of butter at 25c per lb.	Profit per cow.	Totals per cow for the entire experiment. Milk, lbs.	Butter, lbs.	Cost of food.	Value of butter at 25c per lb.	Profit per cow.	Rating of cows.	Totals per group for the entire experiment. Butter, lbs.	Cost of food.	Value of butter.	Profit per Group.	Rating by profit per period.	Rating in profit for herd.
317....	I.	I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.....	1:4.5	308.75	3.26	11.75	$1 54	$2 94	$1 40	318.70	3.75	13.94	$1 56	$3 48	$1 92	324.60	3.66	13.86	$1 49	$3 46	$1 97	329.00	3.75	14.40	$1 38	$3 60	$2 22	1281.05	53.9	$5 97	$13 47	$7 51	9	32.38	$4 43	$8 10	$3 67	4	21
545		II.	10 lbs. C.S.M.; 20 lbs. C.S.H.....	1:3.12	233.35	3.77	10.27	1 52	2 57	1 05	212.00	4.33	10.71	1 51	2 68	1 17	201.75	4.17	9.81	1 42	2 45	1 03	214.50	4.18	10.46	1 29	2 61	1 32	861.60	41.3	5 74	10 32	4 57	17	35.65	4 45	8 91	4 46	3	19
191....		III.	8 lbs. C.S.M.; 25 lbs. C.S.H.....	1:4.0	238.10	3.73	10.36	1 37	2 59	1 22	229.50	4.11	11.00	1 38	2 75	1 37	241.50	4.06	11.44	1 25	2 86	1 61	250.50	4.17	12.20	1 18	3 05	1 87	959.60	45.0	5 18	11 25	6 17	11	35.11	4 16	8 77	4 61	2	18
		IV.	6 lbs. C.S.M.; 25 lbs. C.S.H.....	1:5.05	.....	...	.....	.....	.....	.....	.....	...	.....	.....	.....	.....	.....	...	.....	.....	.....	.....	.....	...	.....	.....	.....	.....	.....	...	.....	.....	.....	....	37.06	3 85	9 26	5 41	1	12
																																			140.20	$16 89	$35 04	$18 15	V.	
B	II.	I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.....	1:4.5	213.25	4.78	11 89	1 36	2 97	1 61	255.95	4.48	13.37	2 27	3 34	1 07	240.70	4.38	12.30	2 08	3 08	1 00	234.30	4.74	12.96	2 11	3 24	1 13	944.20	50.5	7 82	12 62	4 80	16	38.44	3 84	9 61	5 77	1	11
438		II.	10 lbs. C.S.M.; 20 lbs. S.H.....	1:3.81	288.25	3.55	11.94	1 33	2 99	1 66	304.20	3.40	12.07	2 14	3 02	88	328.90	3.20	12.38	2 09	3 09	1 00	328.25	3.08	11.80	2 05	2 95	90	1249.60	48.1	7 61	12 03	4 42	18	39.06	6 00	9 76	3 76	2	20
653....		III.	8 lbs. C.S.M.; 30 lbs. S.H.....	1:5.51	307.65	4.07	14.61	1 15	3 65	2 50	283.85	4.60	13.62	1 59	3 40	1 81	266.90	4.30	13.39	1 59	3 35	1 76	254.10	4.26	12.63	1 52	3 16	1 64	1082.50	54.3	5 85	13 57	7 72	6	38.07	5 76	9 52	3 76	2	20
		IV.	6 lbs. C.S.M.; 30 lbs. S.H.....	1:6.64	.....	...	....	.....	.....	.....	.....	...	.....	.....	.....	.....	.....	...	.....	.....	.....	.....	.....	...	.....	.....	.....	.....	.....	...	.....	.....	.....	....	37.39	5 68	9 35	3 67	3	21
																																			152.96	$21 28	$38 24	$16 96	VI.	
405 ..	III.	I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.....	1:4.5	387.50	3.50	15.82	1 43	3 95	2 52	398.75	4.04	18.79	2 00	4 70	2 70	449.95	3.70	19.42	1 90	4 85	2 95	442.35	3.83	19.77	1 77	4 94	3 17	1678.55	73.8	7 10	18 45	11 34	2	42.66	4 27	10 66	6 39	3	5
356 ..		II.	10 lbs. C.S.M.; 16 lbs. C.S.H.; 33 lbs. S.....	1:3.75	238.90	4.62	12.88	1 36	3 22	1 86	239.25	5.02	14.01	1 73	3 50	1 77	248.85	4.66	13.53	1 69	3 38	1 69	267.50	4.95	15.45	1 63	3 86	2 23	994.50	55.8	6 41	13 95	7 54	8	48.14	5 66	12 03	6 37	4	6
Gracie.		III.	8 lbs. C.S.M.; 18 lbs. C.S.H.; 35 lbs. S.....	1:4.66	354.10	3.38	13.96	1 48	3 49	2 01	348.00	3.78	15.34	1 93	3 83	1 90	370.75	3.44	14.87	1 91	3 72	1 81	367.00	3.55	15.19	1 90	3 79	1 89	1439.85	59.3	7 22	14 83	7 61	7	47.82	5 50	11 95	6 45	2	4
		IV.	6 lbs. C.S.M.; 18 lbs. C.S.H.; 35 lbs. S.....	1:5.78	.....	..	....	.....	.....	.....	.....	...	.....	.....	.....	.....	.....	...	.....	.....	.....	.....	.....	...	.....	.....	.....	.....	.....	...	.....	.....	.....	....	50.41	5 30	12 59	7 29	1	1
																																			190.03	$20 73	$47 23	$26 50	I.	
210	IV.	I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs S.....	1:4.5	229.55	4.40	11.78	1 31	2 94	1 63	224.40	4.48	11.73	1 71	2 93	1 22	223.25	4.31	11.23	1 83	2 81	98	233.85	4.52	12.33	1 89	3 08	1 19	911 05	47.0	6 74	11 75	5 10	15	42.13	4 44	10 52	6 08	1	7
182....		II.	6 lbs. C.S.M.; 4 lbs. B.; 16 lbs. C.S.H.; 33 lbs. S	1:5.03	268.95	3.98	12.49	1 34	3 12	1 78	261.05	4.80	13.10	1 76	3 27	1 51	310.30	4.22	15.28	1 81	3 82	2 01	261.35	4.84	13.23	1 91	3 31	1 40	1101.65	54.1	6 82	13 52	6 70	10	46.41	5 90	11 59	5 69	3	11
220 ..		III.	4 lbs. C.S.M.; 6 lbs. B.; 18 lbs. C.S.H.; 35 lbs. S.....	1:6.63	469.65	3.26	17.86	1 79	4 46	2 67	498.75	3.71	21.58	2 43	5 39	2 96	518.33	3.56	21.52	2 58	5 38	2 80	519.45	3.54	21.44	2 83	5 36	2 53	2006.18	82.4	9 63	20 60	10 96	3	48.03	6 22	12 01	5 79	2	10
		IV.	2 lbs. C.S.M.; 8 lbs. B.; 18 lbs C. S.H.; 35 lbs. S.....	1:8.90	.....	...	....	.....	.....	.....	.....	...	.....	.....	.....	.....	.....	...	.....	.....	.....	.....	.....	...	.....	.....	.....	.....	.....	...	.....	.....	.....	....	47.00	6 63	11 75	5 12	4	15
																																			183.57	$23 19	$45 87	$22 68	III.	
691	V.	I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S	1:4 5	246.35	4.08	11.73	1 09	2 93	1 84	274.55	4.24	13.58	1 31	3 39	2 08	317.71	3.93	14.57	1 47	3 64	2 17	277.25	3.84	13.32	1 51	3 33	1 82	1135.86	53.2	5 38	13 30	7 89	5	36.58	3 92	9 14	5 22	2	14
115....		II.	6 lbs. C.S.M.; 4 lbs. C.M.; 16 lbs. C.S.H.; 33 lbs. S..	1:5.78	276.10	3.45	11.11	1 27	2 78	1 51	275.25	3.90	12.52	1 62	3 13	1 51	319.80	3.54	13.22	1 71	3 31	1 60	315.50	3.49	12.85	1 74	3 21	1 47	1186.65	49.7	6 34	12 43	6 09	12	39.87	5 02	9 96	4 94	3	16
347....		III.	4 lbs. C.S.M.; 6 lbs. C.M.; 18 lbs. C.S.H.; 33 lbs. S..	1:8.1	364.60	3.23	13.74	1 56	3 43	1 87	365.55	3.23	13.77	2 09	3 44	1 35	402.25	3.13	14.69	2 17	3 67	1 50	398.20	3.21	14.91	2 41	3 73	1 32	1530.60	57.1	8 23	14 27	6 04	13	42.47	5 35	10 61	5 26	1	13
		IV.	2 lbs. C.S.M.; 8 lbs. C.M.; 18 lbs. C.S.H.; 33 lbs. S..	1:11.7	.....	...	....	.....	.....	.....	.....	...	.....	.....	.....	.....	.....	...	.....	.....	.....	.....	.....	...	.....	.....	.....	.....	.....	...	.....	.....	.....	....	41.08	5 66	10 27	4 61	4	18
																																			160.00	$19 95	$39 98	$20 03	IV.	
442	VI.	I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.....	1:4.5	242.95	4.04	11.45	1 06	2 86	1 80	280.05	4.30	14.04	1 35	3 51	2 16	293.80	4.16	14.25	1 38	3 56	2 18	293.85	4.37	14.98	1 66	3 74	2 08	1110.65	54.7	5 45	13 68	8 22	4	39.33	4 00	9 82	5 82	4	9
406		II.	6 lbs. C.S.M.; 4 lbs. O.; 16 lbs. C.S.H.; 33 lbs. S ...	1:5.35	376.00	3.59	15.75	1 47	3 93	2 46	441.55	4.05	20.86	1 84	5 21	3 37	463 81	4.00	21.64	2 01	5 41	3 40	458.75	3.70	19.80	2 22	4 95	2 73	1740.11	78.0	7 54	19 50	11 96	1	49.40	5 32	12 34	7 02	1	2
323....		III.	4 lbs. C.S.M.; 6 lbs. O.; 18 lbs. C.S.H.; 35 lbs. S....	1:7.38	258.25	4.03	12.13	1 47	3 03	1 56	296.05	4.20	14.50	2 13	3 62	1 49	272.85	4.29	13.65	2 22	3 41	1 19	282.50	4.43	14.63	2 39	3 66	1 27	1109.65	54.9	8 21	13 72	5 51	14	49.54	5 61	12 38	6 77	2	3
		IV.	2 lbs. C.S.M.; 8 lbs. O.; 18 lbs. C.S.H.; 35 lbs. S....	1:9.86	.....	...	....	.....	.....	.....	.....	...	.....	.....	.....	.....	.....	...	.....	.....	.....	.....	.....	...	.....	.....	.....	.....	.....	...	.....	.....	.....	....	49.41	6 27	12 35	6 08	3	8
																																			187.68	$21 20	$46 89	$25 69	II.	

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Evidently, 438 suffered by a costly and unsuitable ration, but in every other case, when Periods II., III., and IV. are considered, it is difficult to see where any great injustice was done the cows by reason of the rations fed. In fact, it is doubtful if a more suitable or economic disposition could be made of the foods used. If 220, 405, and 406 had been fed at the cheapest food cost shown in the last three periods, the addition to their net profit for that time would have been 55, 36, and 55 cents, respectively. The net profits, as they stand for the last three periods, were for 220, $8.29; for 405, $8.82; for 406, $9.50. By the above proposed change, they would read: $8.84, $9.18, and $10.05. Thus it is demonstrated that it is not the food cost, but the inherent ability to convert food units into butter units, that determined the relative rating of these cows in butter production.

COST OF BUTTER PRODUCTION BY GROUPS.

In Period I., Group III. made 42.66 pounds of butter at an outlay of $4.27 for food and a net profit of $6.39. This group led in yield and profit in this period. Group IV. came next in amount and profit, making 42.13 pounds of butter at a cost of $4.44, and leaving as profit $6.08. Group I. was last in production and profit, with 32.28 pounds of butter, costing $4.43, and leaving as profit $3.67.

In Period II., Group VI. stood first in yield and net returns, with 49.40 pounds of butter, costing $5.32, and leaving as profit $7.02. Group III. was second in both these respects. It made 48.14 pounds of butter at an outlay for food of $5.66, and secured a net return of $6.37. Group I. was lowest in yield with 35.65 pounds of butter, costing $4.45 and giving a profit of $4.46, while Group II. made the least profit, with a production of 39.06 pounds of butter at a cost of $6.00 and a net return of $3.76.

In Period III., Group VI. still maintained the lead in production and profit. Its record was 49.54 pounds of butter, made at a cost of $5.61 for food, and leaving $6.77 as a margin of profit. Group IV. came next in production, but was third in profit. It yielded 48.03 pounds of butter at a cost of $6.22, and left as profit $5.79. Group III.'s position was the reverse of Group IV. It made $47.82 pounds of butter at a cost of $5.50 and gave as profit $6.45. Group II. stood lowest in profit with a production of 38.07 pounds of butter at a cost of $5.76 and a net profit of $3.76.

In Period IV., Group III. occupied first place with regard to yield and profit. It made 50.41 pounds of butter at a cost of $5.30 for food and with a net return of $7.29. Group VI. came second in both respects, producing 49.41 pounds of butter at a cost of $6.27 and a net profit of $6.08. Group IV. stood third in yield and fourth in profit, with 47.00 pounds of butter made at a cost of $6.63 and leaving $5.12 as profit. Group I. made the least butter, namely, 37.06 pounds. The profit derived was $5.41, and in this respect it beat Group II., which made 37.39 pounds of butter, but owing to differences in cost and suitability of the foods consumed only made a net profit of $3.67.

When the entire experiment is considered it will be found that Group III. led in production and profit. Its record was 190.03 pounds of butter, costing $20.73 and leaving a net profit of $26.50. The rations con-

sisted of several proportions of cotton seed meal, cotton seed hulls and silage. The nutritive ratios varied from 1:4.5 to 1:5.78, and might be termed narrow. Group VI. came second in production and profit, with 187.68 pounds of butter costing $21.20 and leaving as profit $26.69. The rations primarily consisted of cotton seed meal and oats and cotton seed hulls and silage. The ratios were from 1:4.5 to 1:9.86, or from narrow to wide. Group IV. occupied the third place. It yielded 183.57 pounds of butter at a cost of $23.19 and with a net profit of $22.69. The rations fed were composed of cotton seed meal and bran and cotton seed hulls and silage. The nutritive ratios ran from 1:4.5 to 1:8.90, or from a narrow to a wide effect. The fourth position fell to Group V., whose record was 160.00 pounds of butter, costing $19.95, and leaving a margin of $20.03 profit. The rations used were mixtures of cotton seed meal and corn meal and cotton seed hulls and silage. The ratios ranged from 1:4.5 to 1:11.7, i. e., from narrow to very wide.

Group II. was fifth in the production and sixth in profit. It made 152.96 pounds of butter at a cost of $21.28 and secured a profit of $16.96. The essential rations were compounded from mixtures of cotton seed meal and sorghum hay. The ratios varied between 1:4.5 and 1:6.64, or from very narrow to moderately narrow ratios.

Group I. occupied a position exactly the reverse of Group II. It yielded 140.20 pounds of butter at an outlay for food of $16.98, and thus made a profit of $18.15. The rations fed were mixtures of cotton seed meal and cotton seed hulls. The ratios were all narrow and ran from 1:4.5 to 1:5.05.

Judged by the profit derived, the following rations proved the most desirable from the standpoint of the butter maker:

I. As Fed by Groups per Period.

Group.	Period.	Rations.	Profit.
I.	IV.	6 lbs. C.S.M.; 25 lbs. C.S.H	$5 41
II.	I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S	5 77
III.	IV.	6 lbs. C.S.M.; 18 lbs. C.S.H.; 35 lbs. S	7 29
IV.	I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S	6 08
V.	III.	4 lbs. C.S.M.; 6 lbs. C.M.; 18 lbs. C.S.H.; 35 lbs. S	5 26
VI.	II.	6 lbs. C.S.M.; 4 lbs. O.; 16 lbs. C.S.H.; 33 lbs. S	7 02

The rations consumed by Groups I., II., III., and V. were identical with those most useful in milk production, while those consumed by Groups IV. and VI. were not. Thus rations are not equally useful in both systems of dairying, so that in determining the foods to be used the object of the business must be kept in view. For instance, if the rations most suitable for milk and butter production were interchanged for Groups IV. and VI., there would have been a loss of 33 and 3 cents on milk and 29 and 25 cents on butter, respectively. Trifling as these amounts may seem, when the loss incurred in a single lactation period is computed, it will be seen to seriously impair what should have provided a handsome revenue.

2. As considered for the Entire Experimental Period.

1. 6 lbs. C.S.M.; 18 lbs. C.S.H.; 35 lbs. S	Profit	$7 29
2. 6 lbs. C.S.M.; 4 lbs. O.; 16 lbs. C.S.H.; 33 lbs. S	Profit	7 02
3. 4 lbs. C.S.M.; 6 lbs. O.; 18 lbs. C.S.H.; 35 lbs. S	Profit	6 77
4. 8 lbs. C.S.M.; 18 lbs. C.S.H.; 35 lbs. S	Profit	6 45
5. 7 lbs. C.S.M.; 18 lbs. C.S.H.; 28 lbs. S	Profit	6 39

Does cotton seed meal affect butter production favorably? In answering this question it will be necessary to examine the results attained when the rations were differentiated for Groups III., IV., V., and VI. When 7, 10, 8, and 6 pounds of cotton seed meal were fed in conjunction with cotton seed hulls and silage to Group III., the best results were derived from the use of 6 pounds of meal. With Group IV., when 7 pounds of cotton seed meal, 6 pounds of cotton seed meal and 4 pounds of bran, 4 pounds of cotton seed meal and 6 pounds of bran, and 2 pounds of cotton seed meal and 8 pounds of bran, were fed with cotton seed hulls and silage, the third mixture proved the best for butter production, but the first one was the most profitable, owing to the difference in food cost. This does not detract from the superiority of the former ration, because if equal amounts of meal had been used in both instances the cost would have been the same.

When Group V. is considered, the same amount and character of foods constituted the ration for Group IV., except that corn meal was substituted for bran. Again, the use of 4 pounds of cotton seed meal with 6 pounds of corn meal proved most effective, and for the reasons expressed under Group IV. the use of 7 pounds of cotton seed meal yielded the greatest profit.

The same proportions and combinations of foods were used with Group VI. as with Groups IV. and V., except the substitution of oats for corn meal or bran. Six pounds of cotton seed meal and 4 pounds of oats gave the greatest profit, and 4 of cotton seed meal and 6 pounds of oats the largest yield of butter.

Irrespective of cost, it is apparent that in every instance the substitution of a portion of the cotton seed meal for bran, corn meal, and oats decidedly increased the actual yield of butter. Further, the use of 6 pounds of cotton seed meal was more effective than the use of 10 pounds. This demonstrates that cotton seed meal has no undue influence as a factor in butter production. With these facts before us we are led to believe that the substitution of suitable mixtures of bran, corn meal, and oats, or oats alone, pound for pound for cotton seed meal, will not impair the effectiveness of a ration, and when the price is equal and the factor of animal individuality eliminated, the difference, if any, will be further reduced. (See p. —.)

Further, we wish to call especial attention to the fact that the feeding of more or less meal does not affect the yield materially (within the limits here stated), while it may very seriously react on the cost of the ration and the profit derived. A careful study of the results, presented in Table XII., will reveal many instances of that nature. When 10 pounds of meal were used with Group III. the profit secured was $6.37; when 6 pounds was used it rose to $7.29, or a difference of .92 cents. When 7 pounds of meal were used with Group VI., as compared with 10

pounds of a mixture, the profits were $5.82 and $7.02, respectively, and the difference apparent $1.20.

A comparison of the profits derived from milk and butter will prove of interest.

Period.	442.		406.		323.	
	Profit on		Profit on		Profit on	
	Milk	Butter	Milk	Butter	Milk	Butter
I	$5 01	$1 80	$7 93	$2 46	$4 99	$1 56
II	5 65	2 16	9 20	3 37	5 27	1 49
III	5 96	2 18	9 59	3 40	4 60	1 19
IV	5 69	2 08	9 25	2 73	4 67	1 27
Fertility sold from farm	—1 78	.....	—2 78	.....	—1 78	.....
Value of skimmed milk at 25 cents per 100 pounds.	.....	+2 50	.....	+3 90	.....	+1 78
Cost of milking at ¼ cent per pound	—2 78	—2 78	—4 35	—4 35	—2 77	—2 77
Cost of delivery at ¾ cent per pound	—8 34	.....	—13 05	.....	—8 31	.....
Fertility added to farm from foods consumed.	+1 82	+1 82	+2 51	+2 51	+2 74	+2 74
Cost of manufacturing butter at 2½ cents per pound.	.....	—1 37	.....	—1 95	.....	—1 38
Net profit on milk and butter	$16 69	$8 39	$25 83	$12 07	$17 62	$6 08
Difference in favor of milk selling	$8 30	.....	$13 76	....	$11 54	.....

In the above summary the fertilizing constituents carried from the farm in a ton of wholemilk were valued at $1.60 per ton, and one-third of the entire cost of the food was regarded as returned to the farm in the excrements. This estimate is certainly not too high where the manure is properly protected. Allowing that one man, at $1.00 a day, shall care for and milk 15 cows per day, the cost of milking would easily come within one quarter of a cent per pound, and the above is below, rather than above, the work a good milker should accomplish. We regard three-quarters of a cent, or slightly over one and one-half cents per quart, as amply sufficient to cover the expenses of delivery, and two and one-half cents should cover the cost of manufacturing a pound of butter where improved machinery is in use and a liberal supply of milk is handled. As experiments indicate that skimmilk has a feeding value of 25 cents per 100 pounds, we regard the above estimates as liberal and just when applied to the case of the above three cows. Manifestly the selling of milk is the more desirable practice in this instance, as the profit from milk is twice that derived from butter-making. The case of 323 illustrates very nicely a point already considered; namely, the varying value of a cow for different purposes.

The influence of the nutritive ratio on butter production is shown by the appended data:

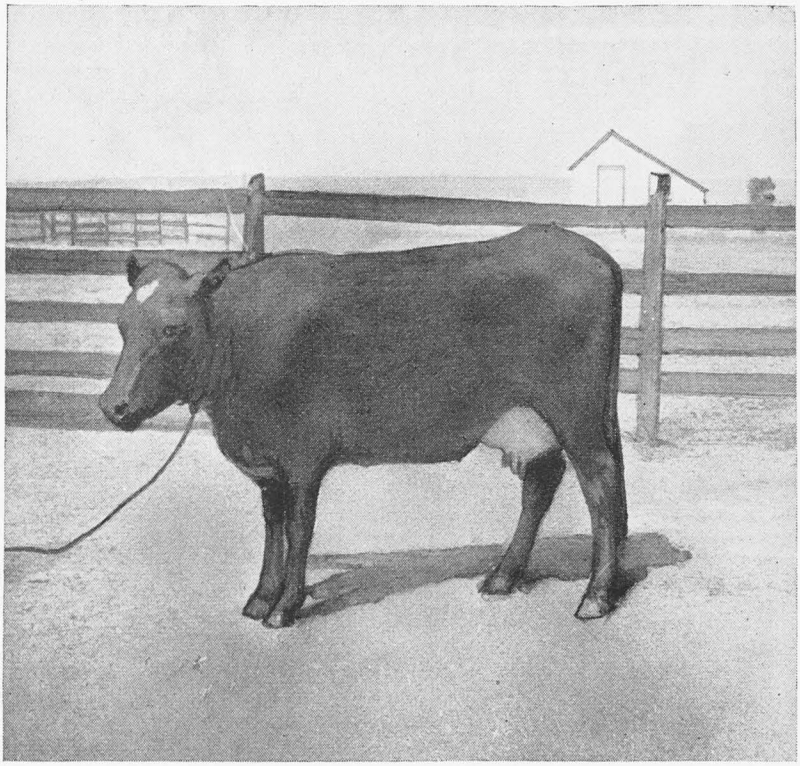

Figure 6.

No. 405.

A desirable cow for dairy production—No. 405—Group III.
Third in yield and profit from milk.
Third in yield for butter but second in profit.
For records see Tables X. and XII.
For measurements see Table XXV.

DESCRIPTION.

A medium sized cow, comfortably fleshed though not beefy, and presenting good wedges. Temperament even, appetite keen; udder showing fine development.

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TABLE XIII.—*Variations in Milk per Cow and per Group per Period.*

Ear tag number.	Group.	Period.	Ration fed per 1000 pounds live weight per day.	Nutritive ratio.	Highest number of pounds of milk produced per day per period.					Lowest number of pounds of milk produced per day per period.					Period when greatest difference was shown between maximum and minimum milk yields.			Average number of pounds of milk produced per day per period.				Average yield, cost, and value of milk per day for the whole experimental period.			Rating.	
					I.	II.	III.	IV.	Average.	I.	II.	III.	IV.	Average.	Maximum.	Minimum.	Difference, lbs.	I.	II.	III.	IV.	Yield, lbs.	Cost.	Value.	Per cow.	Per group.
317....		I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.....	1:4.5	25.50	26.50	24.50	22.75	24.81	18.50	15.70	21.35	20.50	19.01	II.	II.	10.80	22.05	22.75	23.19	23.50	22.87	$0.107	$0.572	6	
545....	I.	II.	10 lbs. C.S.M.; 20 lbs. C.S.H.....	1:3.12	18.75	18.75	15.25	15.00	16.94	13.75	13.00	12.25	13.50	13.12	I. and II.	II.	6.50	16.67	15.14	14.41	15.32	15.38	.102	.384	18	VI.
191....		III.	8 lbs. C.S.M.; 25 lbs. C.S.H.....	1:4.07	19.25	18.50	18.75	18.00	18.62	14.25	13.75	14.50	15.25	14.44	I.	II.	5.80	17.01	16.39	17.25	17.89	17.13	.092	.428	15	
		IV.	6 lbs. C,S.M.; 25 lbs. C.S.H.....	1:5.05	63.50	63.75	58.50	55.75	.....	46.50	42.45	48.10	49.25	.....	II.	II.	21.50	55.73	54.28	54.85	56.71	55.38	.301	1.384	....	
B.....		I.	7 lbs. C.S.M.; 16 lbs. C S.H.; 28 lbs. S.....	1:4.5	17.25	19.25	19.25	17.00	18.18	12.50	14.20	14.50	13.75	13.74	I.	I.	6.75	15.23	18.28	17.19	16.73	16.86	.139	.421	16	
438....	II.	II.	10 lbs. C.S.M.; 20 lbs. S.H.....	1:3.8	23.00	24.35	25.00	23.25	23.90	18.25	19.50	22.75	20.75	20.31	III.	I.	6.75	20.59	21.73	23.49	23.44	22.31	.136	.558	7	V.
653....		III.	8 lbs. C.S.M.; 30 lbs. S.H.....	1:5.51	25.75	21.00	21.00	19.25	21.75	19.50	15.75	16.50	15.25	16.75	I.	IV.	10.50	21.97	18.13	19.06	18.15	19.33	.104	.483	13	
		IV.	6 lbs. C.S.M.; 30 lbs. S.H.....	1:6.64	66.00	64.60	65.25	59.50	.....	50.25	49.45	53.75	49.75	.....	I.	II.	16.55	57.79	58.14	59.74	58.32	58.50	.379	1.462	....	
405....		I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.....	1:4.5	31.25	31.50	34.00	33.00	32.44	22.25	23.75	30.50	28.50	26.25	III.	I.	11.75	27.68	28.48	32.14	31.59	29.97	.127	.750	3	
356....	III.	II.	10 lbs. C.S.M.; 16 lbs. C.S.H.; 33 lbs. S.....	1:3.75	18.50	19.50	19.00	18.50	18.87	15.25	14.50	14.25	16.50	15.12	II.	III.	5.25	17.06	17.09	17.77	19.11	17.76	.114	.444	14	I.
Gracie		III.	8 lbs. C.S.M.; 18 lbs. C.S.H.; 35 lbs. S.....	1:4.66	36.25	32.00	28.00	25.00	30.31	25.50	23.00	24.75	24.00	24.31	I.	II.	13.25	25.29	24.86	26.49	26.21	25.71	.129	.643	5	
		IV.	6 lbs. C.S.M.; 18 lbs. C.S.H.; 35 lbs. S.....	1:5.78	86.00	83.00	81.00	76.50	.....	63.00	61.25	69.50	69.00	.....	I.	II.	24.75	70.03	70.43	76.40	76.91	73.44	.372	1.837	....	
210....		I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.....	1:4.5	18.50	18.25	17.75	17.00	17.87	14.55	12.50	14.00	14.50	13.89	I.	II.	6.00	16.39	16.03	15.93	16.70	16.27	.120	.407	17	
182....	IV.	II.	6 lbs. C.S.M.; 4 lbs. B.; 16 lbs. C.S.H.; 33 lbs. S.	1:5.03	22.25	22.75	21.75	20.50	21.81	15.75	14.85	20.00	13.25	15.96	II.	IV.	9.50	19.21	18.64	22.16	18.67	19.67	.122	.492	12	II.
220....		III	4 lbs. C.S.M.; 6 lbs. B.; 18 lbs. C S.H.; 35 lbs. S.	1:6.63	38.85	40.75	39.00	37.50	39.02	28.25	31.75	34.00	31.00	31.25	II.	I.	16.50	33.54	35.62	37.02	37.10	35.82	.172	.895	1	
		IV.	2 lbs. C.S.M.; 8 lbs. B.; 18 lbs. C.S.H.; 35 lbs. S.	1:8.90	79.60	81.75	78.50	75.00	.....	58.55	59.10	68.00	58.75	.....	II.	I.	23.20	69.14	70.29	75.11	72.47	71.76	.414	1.794	....	
691....		I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.....	1:4.5	24.50	24.25	25.00	22.75	24.12	15.25	16.50	19.41	17.50	17.16	III.	I.	9.75	17.59	19.61	22.69	21.23	20.28	.096	.507	9	
115....	V.	II.	6 lbs. C.S.M.; 4 lbs. C.M.; 16 lbs. C.S.H.; 33 lbs. S.	1:5.78	24.00	24.25	24.25	22.75	23.81	19.25	17.75	21.10	18.75	19.21	II. and III.	II.	6.50	19.72	19.66	22.84	22.53	21.19	.113	.530	8	IV.
347....		III.	4 lbs. C.S.M.; 6 lbs. C.M.; 18 lbs. C.S.H.; 35 lbs. S.	1:8.1	32.45	32.00	29.90	28.00	30.59	25.00	23.00	27.25	24.60	24.96	I.	II.	9.45	26.04	26.11	28.73	28.44	27.33	.147	.683	4	
		IV.	2 lbs. C.S.M.; 8 lbs. C.M.; 18 lbs. C.S.H.; 35 lbs. S.	1:11.7	80.95	80.50	79.15	73.50	.....	59.50	57.25	67.76	60.85	.....	I.	II.	23.70	63.35	65.38	74.26	72.20	68.80	.356	1.720	....	
442....		I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.....	1:4.5	22.00	22.75	22.00	21.00	21.94	19.00	17.05	19.00	17.25	18.07	II.	II.	5.70	17.35	20.00	20.98	20.99	19.83	.097	.496	11	
406....	VI.	II.	6 lbs. C.S.M.; 4 lbs. O.; 16 lbs. C.S.H.; 33 lbs. S.	1:5.35	34.65	36.05	36.50	34.50	35.42	26.75	27.50	30.50	24.25	27.25	III.	IV.	12.25	26.86	31.54	33.13	32.77	31.07	.135	.777	2	III.
323....		III.	4 lbs. C.S.M.; 6 lbs. O.; 18 lbs. C.S.H.; 35 lbs. S.	1:7.38	20.25	20.75	20.75	20.00	20.44	14.75	16.75	17.50	17.75	16.69	II. and III.	I.	6.00	18.44	21.14	19.49	20.18	19.81	.147	.495	10	
		IV.	2 lbs. C.S.M.; 8 lbs. O.; 18 lbs. C.S. H. 35 lbs. S.	1:9.86	76.90	79.55	79.25	75.50	.....	60.50	61.30	67.00	59.25	.....	II.	I.	19.05	62.65	72.68	73.60	73.94	70.71	.379	1.768	....	

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Period.	Group III.	Loss or gain in butter—lbs.	Group IV.	Loss or gain in butter—lbs.	Group V.	Loss or gain in butter—lbs.	Group VI.	Loss or gain in butter—lbs.
I.	Nutritive ratio 1:4.5	.....	1:4.5	.. ..	1:4.5	.....	1:4.5	.....
II.	Nutritive ratio 1:3.75	+5.48	1:5.05	+4.28	1:5.78	+3.69	1:5.35	+1.07
III.	Nutritive ratio 1:4.66	— .32	1:6.63	+1.62	1:8.1	+2.61	1:7.38	+ .14
IV.	Nutritive ratio 1:5.78	+2.59	1:8.90	—1.03	1:11.7	—1.40	1:9.86	— .16

It is plain that every change in the nutritive ratio marked an increase or diminution in the butter yielded. Whether this was due to the change in the nature or character of the food it is impossible to determine with the data at hand. The results are very contradictory in nature, but it is seen that in every instance save one a narrow ration gave a decided increase, while a corresponding decrease is shown when the ration became wide. As has been remarked previously, the ration used in Period I. was very fattening, while that fed in Period II. did not show that tendency, and that probably accounts in part for the larger yields of butter obtained in the latter period. We think that we are justified by this data in recommending a ratio of from 1:5.0, to 1:6, or 7, for better yields. If narrower or wider than this their usefulness is likely to be impaired.

As in the case of fat, so there are sudden and marked variations in the daily yields of milk, the causes in both instances being similar. The condition and nature of the food directly act on the quality and quantity of milk yielded. It is generally conceded that succulent foods increase the volume of milk because of their stimulative action on the circulatory and resorptive organs, and the liver, kidneys, etc., while dry and less palatable food exert a contrary influence. An equal amount of dry matter in either case will exert practically the same potency on the elaboration of milk, hence in the former instance a much greater bulk of food will have to be eaten to secure the requisite amount of dry matter. Thus, while equal volumes of solids in the milk may be produced by equal quantities of digested dry matter, whether from succulent or cured food, the aggregate pounds of milk secured from the former will excel the latter because the solids, and especially the fat, will be diluted in a greater volume of water. An illustration bearing on this point is incorporated here:

Period.	Pounds of milk yielded by					
	Group II.			Group III.		Group VI.
I.	Partly succulent	809.15			980.50	877.20
II.	Dry sorghum, hay, and meal.	814.00	Partly succulent...		986.00	1017.65
III.		836.50			1069.55	1030.46
IV.		816.65			1076.85	1035.10

The advantage of the succulent food and its effect on the yields as already stated, is self-evident.

The greatest difference between maximum and minimum yields of milk in the course of the experiments was shown by 220 with 16.50 pounds variation between Periods II. and I. Gracie came next, with 13.25 pounds, between Periods I. and II. The least variation was shown by 356, with a difference of 5.25 pounds between Periods II. and III. If the milk is valued at 2 cents per pound the loss entailed becomes serious, as with 220 it would amount to 33 cents a day, and with Gracie, 26.5 cents per day. Group III. showed the greatest variation, namely, 24.75 pounds between the First and Second Periods. Group V. followed with a difference of 23.70 pounds between Periods I. and II.; while Group II., with a difference of 16.55 pounds between Periods I. and II., presented the least variation.

In Period I. the greatest difference between maximum and minimum yields of milk was 10.60 pounds by 220, and the least by B., with 4.75 pounds; in Period II., 9 pounds by 220, and 5.75 pounds by 210; in Period III., 6.50 pounds by 406, and 3.00 pounds by 545; and in Period IV., 10.25 pounds by 406, and 1.50 pounds by 545.

With regard to the average pounds of milk yielded per cow and Group per day for the whole experimental period, 220 led with an average production of 35.82 pounds, followed closely by 406 with 31.07, while 545, with 15.38 pounds, was last. Group III. was first in average yield, with 73.44 pounds; Group IV. was second, with 71.76; and Group I. was sixth, with 55.38 pounds per day. Groups III. and IV. led in the value of the milk yielded, while Groups IV., VI., and II., III. were the most expensive to feed, in the order named.

When the average number of pounds of milk produced per day per cow and per Group per Period is compared with the average for the whole experiment, the following results are noted: Groups I. and II. show scarcely any variation, hence all the rations fed exerted a uniform influence. Group III. exhibits little change in Periods I. and II., but in III. and IV., differences of as much as three pounds per day are evident, due probably to the increase of silage in the ration in the last two Periods. Group IV. remained quite uniform during the first two Periods, but in the last two, variations of 5 pounds are witnessed. Group V. shows no change of any moment until the Third and Fourth Periods are reached, when as great differences as are presented by Group VI. are observed.

In the case of Group VI. there was a decided increase in Periods II., III., and IV., amounting to as much as 6 pounds per cow and 8 pounds per Group per day. Thus a difference in the milk-producing ability of the rations fed Groups III., IV., V., and VI., is shown to exist, and we believe it is largely due to the liberal use of silage in the rations given these cows in Periods II., III., and IV., where the greatest increase is observed.

Two very interesting facts are brought out by the data presented in Table XIV., namely, the important bearing of the daily food cost on the profit derived, and the great differences existing between individual animals, with regard to the cost of the food eaten, and the profit secured.

TABLE XIV.—*Average Yield, Cost, and Value of Milk Produced per Cow and per Group per Period.*

Ear tag number.	Group.	Period I.				Period II.				Period III.				Period IV.				Average pounds of milk, with value and cost per day for the whole experiments.			Profit for entire experiment on milk.
		Average lbs. of milk per day.	Value per day.	Cost of food per day.	Profit per day.	Average lbs. of milk per day.	Value per day.	Cost of food per day.	Profit per day.	Average lbs. of milk per day.	Value per day.	Cost of food per day.	Profit per day.	Average lbs. of milk per day.	Value per day.	Cost of food per day.	Profit per day.	Milk lbs.	Value.	Cost.	
317....		22.05	$.551	$.110	$.441	22.75	$.569	$.111	$.458	23.19	$.580	$.106	$.474	23.50	$.587	$.098	$.489	22.87	$.572	$.107	$.465
545 ...	I.	16.67	.416	.108	.308	15.14	.378	.108	.270	14.41	.360	.101	.259	15.32	.383	.092	.291	15.38	.384	.102	.282
191....		17.01	.425	.098	.327	16.39	.410	.099	.311	17.25	.431	.089	.342	17.89	.447	.084	.363	17.13	.428	.092	.336
		55.73	1.392	.316	1.076	54.28	1.357	.318	1.039	54.85	1.371	.296	1.075	56.71	1.417	.274	1.143	55.38	1.384	.301	1.083
B.....		15.23	.381	.098	.283	18.28	.457	.162	.295	17.19	.430	.149	.281	16.73	.418	.150	.268	16.86	.421	.139	.282
438....	II.	20.59	.515	.095	420	21.73	.543	.153	.390	23.49	.587	.150	.437	23.44	.586	.146	.440	22.31	.558	.136	.422
653....		21.97	.549	.082	.467	18.13	.453	.114	.339	19.06	.476	.114	.362	18.15	.454	.109	.345	19.33	.483	.104	.379
		57.79	1.445	.275	1.170	58.14	1.453	.429	1.025	59.74	1.493	.413	1.080	58.32	1.458	.405	1.053	58.50	1.462	.379	1.083
405....		27.68	.692	.102	.590	28.48	.712	.143	.569	32.14	.803	.136	.667	31.59	.790	.126	.664	29.97	.750	.127	.623
356....	III.	17.06	.426	.098	.328	17.09	.427	.124	.303	17.77	.444	.120	.324	19.11	.478	.116	.362	17.76	.444	.114	.330
Gracie		25.29	.632	.106	.526	24.86	.621	.138	.483	26.49	.662	.136	.526	26.21	.655	.136	.519	35.71	.643	.129	.514
		70.03	1.750	.306	1.444	70.43	1.761	.405	1.355	76.40	1.909	.392	1.517	76.91	1.923	.378	1.545	73.44	1.437	.370	1.467
210....		16.39	.410	.094	.316	16.03	.401	.122	.279	15.93	.398	.131	.267	16.70	.417	.135	.282	16.27	.407	.120	.287
182....	IV.	19.21	.480	.096	.384	18.64	.466	.126	.340	22.16	.554	.130	.424	18.67	.467	.136	.331	19.67	.492	.122	.370
220....		33.54	.838	.128	.710	35.62	.890	.173	.717	37.02	.925	.184	.741	37.10	.927	.202	.725	35.82	.895	.172	.723
		69.14	1.728	.318	1.410	70.29	1.757	.421	1.336	75.11	1.877	.445	1.432	72.47	1.811	.473	1.338	71.76	1.794	.414	1.380
691....		17.59	.440	.078	.362	19.61	.490	.093	.397	22.69	.567	.105	.462	21.23	.531	.108	.423	20.28	.507	.096	.411
115. ..	V.	19.72	.493	.090	.403	19.66	.491	.116	.375	22.84	.571	.122	.449	22.53	.563	.124	.439	21.19	.530	.113	.417
347....		26.04	.651	.111	.540	26.11	.653	.149	.504	28.73	.718	.155	.563	28.44	.711	.172	.539	27.33	.683	.147	.536
		63.35	1.584	.279	1.305	65.38	1.634	.358	1.276	74.26	1.856	.382	1.474	72.20	1.805	.404	1.401	68.80	1.720	.356	1.364
442....		17.35	.434	.075	.359	20.00	.500	.096	.404	20.98	.524	.099	.425	20.99	.525	.119	.406	19.83	.496	.097	.399
406....	VI.	26.86	.671	.105	.566	31.54	.788	.131	.657	33.13	.828	.144	.684	32.77	.819	.159	.660	31.07	.777	.135	.642
323....		18.44	.461	.105	.356	21.14	.528	.152	.376	19.49	.487	.159	.328	20.18	.504	.170	.334	19.81	.495	.147	.348
		62.65	1.566	.285	1.281	72.68	1.816	.399	1.437	73.60	1.839	.402	1.437	73.94	1.849	.448	1.400	70.71	1.768	.379	1.389

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In Period I., 220 led in milk yield, with 33.54 pounds per day. The cost of her food was 12.8 cents, leaving as profit 71.0 cents. 405 occupied second place. Her record was 27.68 pounds of milk, costing 10.2 cents, and yielding a daily profit of 59.0 cents. B. came last in milk yield, with 15.23 pounds, made at a food cost of 9.8 cents, and returning a daily profit of 28.3 cents.

In Period II., 220 again led, with the following record, 35.62 pounds of milk, costing for food 17.3 cents, and yielding a daily profit of 7.17 cents. 406 was second, with a production of 31.54 pounds, made at a cost of 13.1 cents for food, and yielding a daily profit of 65.7 cents. 405 fell to third place, with 28.48 pounds of milk, costing 14.3 cents, and giving a net profit of 56.9 cents. 545 brought up the rear, with a daily yield of 15.14 pounds of milk, at a food cost of 10.8 cents, and a profit of 27.0 cents.

In Period III., 220 still retained first place in yield and profit. She gave 37.02 pounds of milk, at a cost of 18.4 cents, and leaving as profit 74.1 cents. 406 was second, with a daily yield of 33.13 pounds of milk, at a cost of 14.4 cents, and with a profit of 68.4 cents per day. 405 was third, with a daily return of 32.14 pounds of milk, made at a food cost of 13.6 cents, and yielding a profit of 66.7 cents. 545 again brought up the rear, with a daily production of 14.41 pounds of milk, costing 10.1 cents, and leaving as profit 25.9 cents.

In Period IV., 220 still retained first place. She gave 37.10 pounds of milk per day, costing 20.2 cents, and giving a profit of 72.5 cents. 405 came third in yield and second in profit. Her record was 31.59 pounds of milk per day, costing 12.6, and leaving as profit 66.4 cents. 406 came second in yield, but third in profit. She made 32.77 pounds of milk per day, at a food cost of 15.9 cents, and a profit of 66.0 cents. B. was last in profit, but next to last in production. She gave 16.73 pounds of milk daily, at a cost of 15.0 cents for food, and leaving a profit of 26.8 cents. 545 was last in milk yield, but third from lowest in profit, as follows: 15.32 pounds of milk per day, costing 9.2 cents, and giving as profit 29.1 cents.

In average production for the entire experiment, the standing was as given below:

No. of cow.	Rating.	Daily milk yield. Lbs.	Daily cost of food.	Daily profit.
220	1	35.82	$0.172	$0.723
406	2	31.07	.135	.642
405	3	29.99	.127	.623
210	Next to lowest.	16.27	.120	.287
545	Last.	15.38	.102	.282

The Influence of Food Cost and Individuality on Profit From Milk Production.

Ear tag No.	Period I.—Daily				Period II.—Daily				Period III.—Daily				Period IV.—Daily			
	Milk yield. Lbs.	Cost of food. Cents.	Profit. Cents.	Loss or gain.	Milk yield. Lbs.	Cost of food. Cents.	Profit. Cents.	Loss or gain.	Milk yield. Lbs.	Cost of food. Cents.	Profit. Cents.	Loss or gain.	Milk yield. Lbs.	Cost of food. Cents.	Profit. Cents.	Loss or gain.
220	33.54	.128	.710	.....	35.62	.173	.717	+.007	37.02	.184	*.741*	+.024	37.10	.202	.725	—.016
402	26.86	.105	.566	.....	31.54	.131	.657	+.091	34.13	.144	*.684*	+.027	32.77	.159	.660	—.024
405	27.68	.102	.590	.....	28.48	.143	.569	—.021	32.14	.136	*.667*	+.098	31.59	.126	.664	+.003
219	16.39	.094	*.316*	.....	16.03	.122	.279	—.037	15.93	.121	.267	—.012	16.70	.135	.282	+.015
545	16.67	.108	*.308*	.....	15.14	.108	.270	—.035	14.41	.101	.259	—.011	15.32	.092	.291	—.032
B	15.23	.089	.283	.....	18.28	.162	*.295*	+.012	17.19	.149	.281	—.014	16.73	.150	.268	.013

The slanting numbers indicate the periods when the greatest profit was derived from each cow. The increase or decrease in profit in the several periods is indicated by plus or minus, and is seen to vary greatly. As already shown, these cows were selected from all those under test, because they either excelled or were deficient milk producers, and the value of the comparison is in nowise injured by this treatment, as the remaining cows, treated in the above manner, would exhibit similar contrasts. It appears that the cost of the food was out of all proportion to the profit returned on some occasions. B's food cost 9.8 cents per day, in Period I., and 16.2 cents in Period II. The gain over Period I. was only 1.2 cents. 405's food cost 10.2 cents per day in Period I., and in Period II. 14.3, or 4.1 cents more per day than in Period I. The increase in milk yield in Period II. was trifling, hence there was a loss of 2.1 cents per day, as a result of feeding the latter rations. Therefore, the cost of the food has a vital bearing on the value of a cow. The similarity of cows from the standpoint of profits is nicely brought out by comparing the maximum yields of 220, 406, and 405, in Period III., when the net profit returned per cow was 74.1, 68.4, and 66.7 cents, respectively. The milk yields were 37.02, 33.13, 32.14 pounds, and the cost of the food 18.4, 14.4, and 13.6 cents per day, respectively. These are seen to be in the right relative proportion. When the food cost was higher, the yields of milk were not sufficiently increased to make it profitable; when the food cost was lowered, the maximum production of milk was not altered. The extremes in yields and profits were 220 and B, in Periods III. and II. 220 made 37.02 pounds of milk, at a food cost of 18.4 cents, and a profit of 74.1 cents, while B made 18.28 pounds of milk, at a food cost of 16.2 cents, and a profit of 29.5 cents. It appears that while the difference in food cost amounted to 2.2 cents, the difference in profits aggregated 44.6 cents. This marks the profitable and undesirable cows.

The positions occupied by the several Groups in the different Periods is shown in the appended summaries:

Period I.

Group.	Rating.	Daily yield of milk, lbs.	Cost of food per day, cts.	Profit per day.
III.	1	70 03	30.6	$1.444
IV.	2	69.14	31.8	1.410
I.	6	55.73	31.6	1.076

Period II.

VI.	1	72.68	39.9	1.437
III.	2	70.43	40.5	1.355
IV.	3	70.29	42.1	1.336
II.	5 { in yield / 6th in profit }	58.14	42.9	1.025
I.	6 { in yield / 5th in profit }	54.28	31.8	1.039

Period III.

III.	1	76.40	39.2	1.517
IV.	2—4th in profit	75.11	44.5	1.432
V.	3—2nd in profit	74.26	38.2	1.474
VI.	4—3rd in profit	73.60	40.2	1.437
I.	6	54.85	29.6	1.075

Period IV.

III.	1	76.91	37.8	1.545
VI.	2—3rd in profit	73.94	44.8	1.400
IV.	3—4th in profit	72.47	47.3	1.338
V.	4—2nd in profit	72.20	40.4	1.401
II.	5—6th in profit	58.32	40.5	1.053

Averages for the Entire Experiment.

III.	1	73.44	37.0	1.467
IV.	2	71.76	41.4	1.380
VI.	3—2nd in profit	70.77	37.9	1.389
V.	4	68.80	35.6	1.364
II.	5—6th in profit	58.50	37.9	1.083
I.	6—5th in profit	55.38	30.1	1.083

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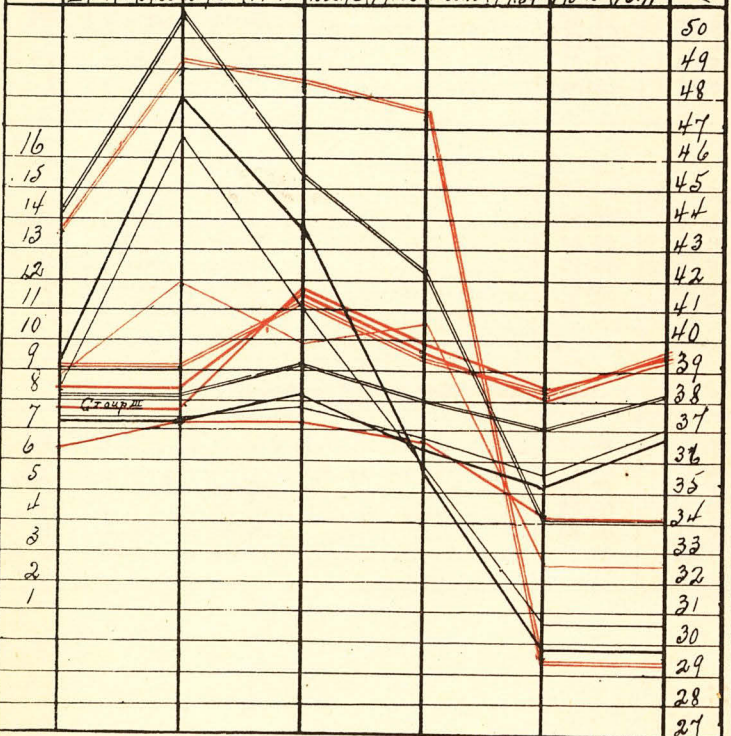
Diagramatic Chart D Showing The Daily Consumption of Protein and Carbohydrates per Group per Period

Groups	Period I Milk Lbs.	Period I Butter Lbs.	Period II Milk Lbs.	Period II Butter Lbs.	Period III Milk Lbs.	Period III Butter Lbs.	Period IV Milk Lbs.	Period IV Butter Lbs.	Averages of all Periods Milk Lbs.	Averages of all Periods Butter Lbs.
I	780.20	32.38	760.20	35.65	767.85	37.06	794.00	35.11	775.56	35.05
II	809.45	38.55	814.00	37.50	836.50	37.41	816.65	27.99	819.07	37.86
III	980.50	42.66	986.00	48.14	1049.55	50.41	1076.85	47.82	1028.22	47.51
IV	968.15	42.13	984.20	46.41	1051.88	47.00	1014.65	48.03	1004.72	45.89
V	887.05	35.18	915.35	39.87	1037.76	41.08	1010.95	42.38	963.28	39.65
VI	877.20	39.33	1017.65	49.40	1030.46	49.38	1035.10	49.54	990.10	46.91

Proteincaten per day per Group per Period Lbs

Carbohydrates eaten per day per Group per Period Lbs *



Legend Group I Group II Group III

Group IV Group V Group VI

* Reads towards the left

The Influence of Food Cost on the Profit From Milk Production by Groups.

Group.	Period I.—Daily			Period II.—Daily				Period III.—Daily				Period IV.—Daily				Average of all periods. Daily		
	Milk yield. Lbs.	Cost of food, cts.	Profit.	Milk yield. Lbs.	Cost of food, cts.	Profit.	Loss or gain, cts.	Milk yield. Lbs.	Cost of food, cts,	Profit.	Loss or gain, cts.	Milk yield. Lbs.	Cost of food, cts.	Profit.	Loss or gain, cts,	Milk yield. Lbs.	Cost of food. cts.	Profit.
I.	55.73	*31.6*	(5) $1.076	*54.28*	31.8	(5) *$1.039*	—03.4	54.85	29.6	(6) $1.075	+03.6	*56.71*	*27.4*	(5) *$1.143*	+07.5	55.38	30.1	(5) $1.083
II.	*57.79*	*27.5*	(6) 1.170	58.14	*42.9*	(6) *1.025*	—14.5	*59.74*	41.3	(5) *1.080*	+05.5	58.32	40.5	(6) 1.053	—02.7	58.50	37.9	(6) 1.083
III.	*70.03*	*30.6*	(1) 1.444	70.43	*40.5*	(2) *1.355*	—08.9	76.40	39.2	(1) *1.517*	+15.7	*76.91*	37.8	(1) *1.545*	—00.7	73.44	37.0	(1) 1.467
IV.	*69.14*	*31.8*	(2) 1.410	70.29	42.1	(3) *1.336*	—06.6	*75.11*	44.5	(4) *1.432*	+08.8	72.47	*47.3*	(4) 1.338	—09.4	71.76	41.4	(3) 1.380
V.	*63.35*	*27.9*	( ) 1.305	65.38	35.8	(4) *1.276*	—02.9	*74.26*	38.2	(2) *1.474*	+19.8	72.20	*40.4*	(2) 1.402	—07.2	68.80	35.6	(4) 1.364
VI.	*62.65*	*28.5*	(4) *1.281*	72.68	39.9	(1) *1.437*	+13.6	73.60	40.2	(3) *1.437*	±00.0	*73.94*	*44.8*	(3) 1.400	—03.8	70.71	37.9	(2) 1.389

The positions occupied by the several Groups in the different Periods are shown by the small bracketed figures. The slanting numbers represent the highest and lowest milk yield, food cost, and profit secured by each Group. It will be observed that the milk yields of Groups I. and II., in all the Periods, when compared with the average results, showed very little variation. These Groups received a non-succulent ration. In Period I. when all Groups received the same ration the profit derived depended on the cost of the food consumed, and the pounds of milk yielded per day, and while this statement is practically true of all the Periods, the difference in the nature of the rations in other instances doubtless had an influence on the yield and profit.

Table XV. presents the average consumption of meal and coarse foods (i. e., the ratio of meal and coarse substances to each other) in the daily ration, arranged in such a manner as to show the effects of these several ratios on the cost and amount of milk and butter produced per cow and per Group per Period.

In Period I., 220 ate 7 pounds of meal and 46.3 pounds of coarse foods, leading in this respect. 545, Gracie, and 347 consumed 6.3 pounds of meal and over 36.4 pounds of coarse foods. The smallest amount of meal and rough foods was eaten by 442, with 4.2 and 27.4 pounds, respectively. 220 excelled in butter yield, with 1.275 pounds per day, followed closely by 405, 406, and 653, with 1.130, 1.121, and 1.043 pounds. 545 was last in production, with .733 pounds of butter per day. With regard to profit 220 led with 19.1 cents per day, 405 was second, with 18 cents, and 406 third, with 17.5 cents. 191 and 545 made the smallest profit, with 8.7 and 7.5 cents per day.

In Period II., 220 consumed 11.4 pounds of meal and 55.3 pounds of rough substances per day. 347 and 323 ate over 9.7 pounds of meal and 46.6 pounds of coarse material, while 442 and 691, representing the minimum consumption, ate 6.1 and 6.5 pounds of meal and 29.7 and 28.9 pounds of roughage, respectively. In this Period seven cows yielded over one pound of butter per day, the maximum being attained by 220, with 1.543 pounds per day; 191 and 545 showed the minimum yields with .786 and .764 pounds per day.

In net profit 406 was first with a credit of 24.2 cents. 220 was next with 21.3 cents, and 405 third with 19.3 cents. The smallest returns were made by 438 and B with 6.3 and 7.6 cents per day.

In Period III., as would be expected from her weight and size, 220 again was first in gross consumption per day, with 12 pounds of meal and 59.5 pounds of coarse foods. 115 disposed of 8.3, 323 of 10.6, and 347 of 10.2 pounds of meal per day, and 347 of 51.2, Gracie 49.6, 405 of 49.5 pounds of roughage per day. In gross butter yield 220 was first with 1.537 pounds. She was followed by 406 and 405 with 1.546 and 1.387 pounds, respectively. The lowest yields were made by 191 and 545 with .817 and .700 pounds. In profit per day 406 was first with a credit of 24.2 cents; 405 was next, with 21.2 cents, and 220 third with 20.0 cents. B and 438 made the smallest gain over cost with 7.1 and 7 cents each.

In Period IV., 220 consumed 13.1 pounds of meal and 65.2 pounds of coarse foods per day. This was the maximum consumption reached by any cow during the experiment. The opposite extreme was represented

TABLE XV.—*Meal and Coarse Foods Consumed per Day; Milk and Butter Produced per Day with Profit on Same per Cow and per Group.*

Ear tag number.	Group.	Period I., 14 days.							Period II., 14 days.							Period III., 14 days.							Period IV.							Averages for entire experimental period.							Rating.	
		Meal, eaten per day, lbs.	Coarse foods eaten per day, lbs.	Milk per day, lbs.	Butter per day, lbs.	Cost of food per day, cents.	Value of butter per day, cents.	Net profit per day, cents.	Meal, eaten per day, lbs.	Coarse foods eaten per day, lbs.	Milk per day, lbs.	Butter per day, lbs.	Cost of food per day, cents.	Value of butter per day, cents.	Net profit per day, cents.	Meal, eaten per day, lbs.	Coarse foods eaten per day, lbs.	Milk per day, lbs.	Butter per day, lbs.	Cost of food per day, cents.	Value of butter per day, cents.	Net profit per day, cents.	Meal, eaten per day, lbs.	Coarse foods eaten per day, lbs.	Milk per day, lbs.	Butter per day, lbs.	Cost of food per day, cents.	Value of butter per day, cents	Net profit per day, cents.	Meal, eaten per day, lbs.	Coarse foods eaten per day, lbs.	Milk per day, lbs.	Butter per day, lbs.	Cost of food per day, cents.	Value of butter per day, cents.	Net profit per day, cents.	Per cow.	Per group.
317....	I.	6.3	39.3	22.05	.836	11.0	20.9	09.9	9.6	22.6	22.75	.995	11.1	24.8	13.7	8.1	25.6	23.19	.990	10.6	24.8	14.2	6.6	27.6	23.50	1.028	0.98	25.7	15.9	7.7	28.8	22.87	.962	10.7	24.0	13.3	9	
545 ...		6.3	38.7	16.67	.733	10.8	18.3	07.5	9.4	21.4	15.14	.764	10.8	19.1	08.3	7.8	24.5	14.41	.700	10.1	17.5	07.4	6.2	26.0	15.32	.748	0.92	18.7	09.5	7.4	27.7	15.38	.731	10.2	18.4	08.2	16	V.
191....		5.7	34.8	17.01	.740	09.8	18.5	08.7	8.5	19.9	16.39	.786	09.9	19.6	09.7	6.8	21.6	17.25	.817	08.9	20.4	11.5	5.7	23.8	17.89	.871	0.84	21.8	13.4	6.7	25.1	17.13	.803	09.2	20.1	10.9	11	
		18.3	112.8	55.73	2.309	31.6	57.7	26.1	27.5	64.9	54.28	2.545	31.8	63.5	31.7	22.7	71.7	54.85	2.507	29.6	62.7	33.1	18.5	77.4	56.71	2.647	2.74	66.2	38.8	21.8	81.6	55.38	2.502	30.1	62.5	32.4		
B	II.	5.7	34.3	15.23	.850	09.8	21.2	11.4	8.8	24.2	18.28	.954	16.2	23.8	07.6	6.9	24.3	17.19	.878	14.9	22.0	07.1	5.6	27.1	16.73	.928	15.0	23.2	08.2	6.7	27.5	16.86	.900	13.9	22.5	08.6	15	
438. ..		5.4	34.3	20.59	.853	09.5	21.3	11.8	8.4	22.3	21.73	.862	15.3	21.6	06.3	6.8	24.6	23.49	.878	15.0	22.0	07.0	5.6	26.1	23.44	.843	14.6	21.1	06.5	6.6	26.9	22.31	.860	13.6	21.5	07.9	17	VI.
653...		4.8	28.7	21.97	1.043	08.2	26.1	17.9	6.5	16.1	18.13	.973	11.4	24.3	12.9	5.1	18.9	19.06	.957	11.4	23.9	11.6	4.0	19.8	18.15	.902	10.9	22.6	11.7	5.1	20.9	19.33	.970	10.4	24.3	13.9	5	
		15.9	97.3	57.79	2.746	27.5	68.6	41.1	23.7	62.6	58.14	2.799	42.9	69.7	26.8	18.8	67.8	59.74	2.713	41.3	67.9	25.7	15.2	73.0	58.32	2.673	40.5	66.9	26.4	18.4	75.3	58.50	2.730	37.9	68.3	30.4		
405....	III.	5.6	37.5	27.68	1.130	10.2	28.2	18.0	9.6	44.7	28.48	1.343	14.3	33.6	19.3	7.6	49.5	32.14	1.387	13.6	34.6	21.2	5.9	51.8	31.59	1.412	12.6	35.3	22.7	7.2	45.9	29.97	1.318	12.7	33.0	20.3	2	
356....		5.4	35.3	17.06	.920	09.8	23.0	13.2	8.5	37.9	17.09	1.000	12.4	25.0	12.6	6.9	43.7	17.77	.966	12.0	24.1	12.5	5.6	47.1	19.11	1.100	11.6	27.5	15.9	6.6	41.0	17.76	.996	11.4	24.9	13.5	8	I.
Gracie		6.3	36.8	25.29	.997	10.6	24.9	14.3	9.2	43.6	24.86	1.093	13.8	27.3	13.5	7.7	49.6	26.49	1.062	13.6	26.6	13.0	6.3	55.5	26.21	1.085	13.6	27.1	13.5	7.4	46.4	25.71	1.059	12.9	26.5	13.6	7	
		17.3	109.6	70.03	3.047	30.6	76.1	45.5	27.3	126.2	70.43	3.436	40.5	85.9	45.4	22.2	142.8	76.40	3.415	39.2	85.3	46.7	17.8	154.4	76.91	3.597	37.8	89.9	52.1	21.2	133.3	73.44	3.373	37.0	84.4	47.4		
210....	IV.	5.3	34.3	16.39	.843	09.4	21.1	11.7	7.9	39.5	16.03	.836	12.2	20.9	08.7	8.2	43.6	15.93	.802	13.1	20.0	06.9	8.7	44.4	16.70	.880	13.5	22.0	08.5	7.7	40.4	16.27	.839	12.0	21.0	09.0	14	
182....		5.6	34.2	19.21	.893	09.6	22.3	12.7	8.5	38.2	18.64	.936	12.6	23.4	10.8	8.5	40.8	22.16	1.091	13.0	27.3	14.3	9.2	41.9	18.69	.945	13.6	23.6	10.0	7.9	38.8	19.67	.966	12.2	24.2	12.0	10	III.
220....		7.2	46.3	33.54	1.275	12.8	32.9	19.1	11.4	55.3	35.62	1.543	17.3	38.6	21.3	12.00	59.5	37.02	1.537	18.4	38.4	20.0	13.1	65.2	37.10	1.531	20.2	38.3	18.1	10.9	56.6	35.82	1.471	17.2	36.8	19.6	3	
		18.1	114.8	69.14	3.011	31.8	75.3	43.5	27.8	133.0	70.29	3.315	42.1	82.9	40.6	28.7	143.9	75.11	3.430	44.5	85.7	41.2	31.0	151.5	72.47	3.356	47.3	83.9	36.6	26.5	135.8	71.76	3.276	41.4	82.0	40.6		
691....	V.	4.5	28.3	17.59	.839	07.8	21.0	13.2	6.5	28.9	19.61	.971	09.3	24.3	15.0	6.8	35.6	22.69	1.040	10.5	26.0	15.5	7.1	36.3	21.23	.950	10.8	23.7	12.9	6.2	32.3	20.28	.950	09.6	23.4	13.8	6	
115 ...		5.1	33.3	19.72	.793	09.0	19.8	10.8	7.9	36.9	19.66	.893	11.6	22.3	10.7	8.3	38.8	22.84	.944	12.2	23.6	11.4	8.6	39.9	22.53	.918	12.4	23.0	10.6	7.5	37.2	21.19	.888	11.3	22.2	10.9	11	IV.
347....		6.3	40.4	26.04	.981	11.1	24.5	13.4	9.8	48.9	26.11	.984	14.9	24.6	09.7	10.2	51.2	28.73	1.050	15.5	26.2	10.7	11.4	57.2	28.44	1.065	17.2	26.6	09.4	9.4	49.5	27.33	1.019	14.7	25.5	10.8	12	
		15.9	102.0	63.35	2.611	27.9	65.3	37.4	24.2	114.7	65.38	2.848	35.8	71.2	35.4	25.3	125.6	74.26	3.034	38.2	75.8	37.6	27.1	133.4	72.20	2.933	40.4	73.3	32.9	23.1	119.0	68.80	2.857	35.6	71.1	35.5		
442....	VI.	4.2	27.4	17.35	.817	07.5	20.4	13.1	6.1	29.7	20.00	1.000	09.6	25.0	15.4	6.0	30.4	20.98	1.018	09.9	25.4	15.5	6.3	39.8	20.99	1.070	11.9	26.8	14.9	5.6	31.8	19.83	.977	09.7	24.4	14.7	4	
406....		6.0	37.5	26.86	1.121	10.5	28.0	17.5	8.7	38.3	31.54	1.490	13.1	37.3	24.2	8.7	44.5	33.13	1.546	14.4	38.6	24.2	9.5	47.7	32.77	1.414	15.9	35.3	19.4	8.2	42.0	31.07	1.393	13.5	34.8	21.3	1	II.
323....		5.9	38.1	18.44	.866	10.5	21.7	11.0	9.7	46.6	21.14	1.036	15.2	25.9	10.7	10.6	44.2	19.49	.971	15.9	24.3	08.4	10.4	50.6	20.18	1.043	17.0	26.1	09.1	9.2	44.9	19.81	.978	14.7	24.5	09.8	13	
		16.1	103.0	62.65	2.804	28.5	70.1	41.6	26.5	114.6	72.68	3.526	37.9	88.2	50.3	25.3	119.1	73.60	3.535	40.2	88.3	48.1	26.2	138.1	73.94	3.527	44.8	88.2	43.4	23.0	118.7	70.71	3.348	37.9	83.7	45.8		

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by 653, who ate 4 pounds of meal and 19.8 pounds of roughage. In butter yield 220, 406, and 405 all made over 1.414 pounds per day, and 191 and 545 made the least butter with .871 and .748 pounds apiece per day. Considering the question of profit, 405 came first with 22.7 cents, 406 next with 19.4 cents, 220 third with 18.1 cents and 438 last with 6.5 cents per day.

In average butter yield and profit for the whole experiment the rating is as follows:

Rating.	Ear tag number.	Butter, lbs.	Rating.	Ear tag number.	Butter, lbs.	Rating.	Ear tag number.	Profit.	Rating.	Ear tag number.	Profit, cents.
1	220	1.471	4	Gracie	1.059	1	220	19.6	4	Gracie	13.6
2	406	1.393	Next to last	191	.803	2	406	21.3	Next to last	191	10.9
3	405	1.318	Last	545	.737	3	405	20.3	Last	545	8.2

The ratios existing between the consumption of meals and coarse foods per day per Groups will now be briefly considered.

In Period I., Group I. consumed the most meal per day with 18.3 pounds, Group IV. was next with 18.1 pounds, Group III. third with 17.3 pounds, and Groups II. and V. last with 15.9 pounds. In the matter of coarse materials Group IV. led with 114.8 pounds per day, followed closely by Groups III. and VI., with .109.6 and 103.0 pounds, respectively. The least food of this nature was eaten by Group V. with 102 pounds. In butter yields Groups III., IV. and VI. averaged 3.047, 3.011 and 2.804 pounds per day, Group I. making the smallest return with 2.309 pounds per day. In net profit Groups III., and IV., and VI. led with 45.5, 45.5 and 41.6 cents per day, while Group I. was last, with 26.1 cents per day.

In Period II., Groups I. and III. and IV. ate over 27 pounds of meal per day, while Groups II. and V. disposed of over 23 pounds. Groups IV. and III. ate 133 and 126.2 pounds of coarse foods, and Group II. 62.6 pounds of the same per day. In butter production Groups VI., III., and IV. led, with 3.526, 3.436, and 3.315 pounds per day. Group I. stood last in this respect, with 2.545 pounds per day. In profits the extremes are represented by Groups VI., III., and IV., with 50.3, 45.4, and 40.6 cents, and Group II. with 26.8 cents per day.

In Period III., Group IV. disposed of 28.7 pounds of meal and 143.9 pounds of coarse foods daily, while Group V. only received 25.3 pounds of meal and 125.6 pounds of roughage. The smallest consumption of meal and coarse foods was shown by Group II. with 18.8 and 67.8 pounds, respectively. In butter production Groups VI., IV., and III. made 3.535, 3.430, and 3.415 pounds per day, and Group I. 2.507 pounds. In daily net profit Groups VI., III., and IV. excelled, with 48.1, 46.7, and 41.2 cents, Group II. making the smallest return with 25.7 cents.

In Period IV. the extremes in meal and coarse substance eaten were represented by Groups IV. and II., with 31 and 15.2 pounds of the former, and 151.5 and 73 of the latter. In butter yields Groups III., VI., and IV. followed in the order named with a profit of 52.1, 43.4, and 36.6 cents, respectively. Group I. was last in yield with 2.647 pounds, and Group II. last in profit, with 26.4 cents.

In average production and profit from butter during the whole experiment the following rating prevailed:

Rating.	Group.	Butter per day, lbs.	Profit per day, cents.
1	III.	3.373	47.4
2	VI.	3.348	45.8
3	IV.	3.276	40.6
4—lowest of all	I.	2.502	32.4

In any successful business enterprise it is necessary to know the cost of turning out the finished article, and as milk and butter are generally sold on the basis of 100 pounds and 1 pound, the data concerning the several cows and Groups has been arrangd in Table XVI., so as to show the estimated cost of the above mentioned quantities in this experiment.

In Period I., 405 made the cheapest 100 pounds of milk, at an outlay of 36.9 cents. In the case of 653, 220, and 406 it cost 37.3, 38.1, and 39.1 cents per 100 pounds. The greatest outlay required for 100 pounds of milk was with B and 545, with 63.8 and 65.1 cents, respectively. 653 made a pound of butter at a food cost of 7.8 cents, and 405, 691, 442, 406, and 220 for 9, 9.2, 9.3, 9.3, and 10 cents, in the order named. The dearest pound of butter was made by 545 and 191, for 14.7 and 13.2 cents.

In Period II., 406, 691, 442, and 220, all made 100 pounds of milk for less than 49 cents, while the maximum expenditure for 100 pounds ranged between 72 and 89 cents. The dearest and cheapest pound of butter was yielded by 438 and 406, at a respective outlay of 17.7 and 8.8 cents.

In Period III., 405, 406, 317, and 691 made 100 pounds of milk at a cost of 42.2, 43.3, 45.9, and 46.2 cents, respectively. The highest cost of 100 pounds of milk is shown by B and 210, namely, 84.6 and 81.3 cents.

A pound of butter from 406, 442, 405, cost 9.3, 9.7, and 9.8 cents, while the cost of a pound of butter from 438 and 323 was 17 and 16.2 cents.

In Period IV., the lowest cost of 100 pounds of milk was 40.0, 41.9, 47.1, and 48.4 cents, for 405, 317, 191, and 406, while the dearest 100 pounds was produced by B and 323, at a cost of 90.9 and 84.6 cents.

Regarding the cost of one pound of butter, 405, 317, and 191 proved the most economical in this respect, while the opposite extreme was represented by 438 and B. In the first instance the butter cost 8 to 10 cents per pound, in the latter 16 to 17 cents per pound.

In average minimum cost of 100 pounds of milk, for the entire experimental period, 405 led, with 42.3 cents, followed by 406, with 43.3 cents, and 317, with 46.6 cents. In average maximum cost, B, 210, and 323 followed in the order named, with 82.8, 74.0, and 73.9 cents outlay per 100 pounds of milk yielded.

The minimum cost of making a pound of butter, as the average of the four periods, is shown in the cases of 405, 442, 406, and 691, to have been 9.6, 9.7, and 10.1 cents, respectively.

The maximum cost under similar conditions is seen in the cases of 438, B, and 323, with 15.8, 15.5, and 14.9 cents per pound, respectively.

TABLE XVI.—*Cost of 100 Pounds of Milk and of 1 Pound of Butter per Cow and per Group per Period.*

Ear tag No.	Group.	Period.	Ration fed per 1,000 pounds live weight per day.	Nutritive ratio.	Period I.			Period II.			Period III.			Period IV.			Average cost for experiment of		Rating.			
					Cost of keep.	Cost of 100 lbs. of milk.	Cost of 1 lb. of Butter.	Cost of keep.	Cost of 100 lbs. of Milk.	Cost of 1 lb. of Butter.	Cost of keep.	Cost of 100 lbs. of milk.	Cost of 1 lb. of Butter.	Cost of keep.	Cost of 100 lbs. of milk.	Cost of 1 lb. of Butter.	100 lbs. milk.	1 lb. of butter.	Per cow.		Per group.	
																			Milk.	Butter.	Milk.	Butter.
317....	I.	I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.....	1:4.5	$1 54	$0.499	$0.131	$1 56	$0.489	$0.112	$1 49	$0.459	$0.106	$1 38	$0.419	$0.096	$0.466	$0.111	3	5		
545....		II.	10 lbs. C.S.M.; 20 lbs. C.S.H.....	1:3.12	1 52	.651	.147	1 51	.714	.141	1 42	.704	.144	1 29	.601	.123	.666	.139	15	11		
191....		III.	8 lbs. C.S.M.; 25 lbs. C.S.H.....	1:4.07	1 37	.575	.132	1 38	.601	.125	1 25	.517	.109	1 18	.471	.097	.539	.113	10	7	IV.	III.
		IV.	6 lbs. C.S.M.; 25 lbs. C.S.H.....	1:5.05	Totals..4 43	1.745	.410	4 45	1.804	.378	4 16	1.680	.359	3 85	1.491	.316	1.671	.363				
				Averages	1 48	.582	.136	1 48	.601	.126	1 38	.560	.110	1 28	.497	.105	.557	.121				
B	II.	I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.....	1:4.5	1 36	.638	.114	2 27	.887	.170	2 08	.864	.169	2 11	.900	.162	.828	.155	18	15		
438....		II.	10 lbs. C.S.M.; 20 lbs. S.H.....	1:3.8	1 33	.461	.110	2 14	.703	.177	2 09	.635	.170	2 05	.625	.173	.609	.158	12	16	VI.	VI.
653....		III.	8 lbs. C.S.M.; 30 lbs. S.H.....	1:5.51	1 15	.373	.078	1 59	.622	.116	1 59	.595	.118	1 52	.598	.120	.540	.108	11	4		
		IV.	6 lbs. C.S.M.; 30 lbs. S.H.....	1:6.64	Totals..3 84	1.472	.302	6 00	2.212	.463	5 76	2.094	.457	5 78	2.123	.455	1.977	.421				
				Averages	1 28	.491	.101	2 00	.737	.154	1 92	.698	.152	1 92	.708	.152	.659	.140				
405 ..	III.	I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.....	1:4.5	1 43	.369	.090	2 00	.502	.106	1 90	.422	.098	1 77	.400	.089	.423	.096	1	1		
356 ..		II.	10 lbs. C.S.M.; 16 lbs. C.S.H.; 33 lbs. S.....	1:3.75	1 36	.569	.106	1 73	.723	.123	1 69	.679	.124	1 63	.613	.105	.644	.111	14	6	II.	I.
Gracie		III.	8 lbs. C.S.M.; 18 lbs. C.S.H; 35 lbs. S.....	1:4.66	1 48	.417	.106	1 93	.554	.125	1 91	.515	.128	1 90	.517	.125	.501	.121	7	8		
		IV.	6 lbs. C.S.M.; 18 lbs. C.S.H.; 35 lbs. S.....	1:5.78	Totals..4 27	1.355	.302	5 66	1.779	.354	5 50	1.616	.350	5 30	1.530	.319	1.578	.328				
				Averages	1 42	.452	.101	1 88	.593	.118	1 84	.538	.117	1 76	.510	.106	.526	.109				
210 ..	IV.	I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.....	1:4.5	1 31	.571	.111	1 71	.762	.146	1 83	.846	.163	1 89	.804	.153	.740	.143	17	12		
182 ...		II.	6 lbs. C.S.M.; 4 lbs. B.; 16 lbs. C.S.H.; 33 lbs. S.	1:5.03	1 34	.498	.107	1 76	.674	.134	1 81	.583	.118	1 91	.730	.144	.619	.126	13	9	V.	V.
220....		III.	4 lbs. C.S.M.; 6 lbs. B.; 18 lbs. C.S.H.; 35 lbs. S.	1:6.63	1 79	.381	.100	2 43	.487	.112	2 58	.498	.119	2 83	.545	.132	.480	.117	5	7		
		IV.	2 lbs. C.S.M.; 8 lbs. B.; 18 lbs. C.S.H.; 35 lbs. S.	1:8.90	Totals..4 44	1.450	3.18	5 90	1.923	.392	6 22	1.927	.400	6 63	2.079	.429	1.839	.386				
				Averages	1 48	.483	.106	1 96	.641	.131	2 07	.642	.133	2 21	.693	.143	.613	.129				
691 ...	V.	I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.....	1:4.5	1 09	.442	.092	1 31	.477	.096	1 47	.462	.100	1 51	.507	.113	.473	.101	4	3		
115 ..		II.	6 lbs. C.S.M.; 4 lbs. C.M.; 16 lbs. C.S.H.; 33 lbs. S.	1:5.78	1 27	.459	.115	1 62	.588	.130	1 71	.534	.136	1 74	.551	.135	.534	.127	8	10	I.	IV
347...		III.	4 lbs. C.S.M.; 6 lbs. C.M.; 18 lbs. C.S.H.; 35 lbs. S.	1:8.1	1 56	.430	.114	2 09	.570	.151	2 17	.539	.147	2 41	.605	.162	.537	.144	9	13		
		IV.	2 lbs. C.S.M.; 8 lbs. C.M.; 18 lbs. C.S.H.; 35 lbs. S.	1:11.7	Totals..3 92	1.331	.321	5 02	1.635	.377	5 35	1.535	.383	5 66	1.663	.410	1.544	.372				
				Averages	1 31	.444	.107	1 67	.545	.126	1 78	.512	.128	1 88	.554	.137	.515	.124				
442....	VI.	I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.....	1:4.5	1 06	.436	.093	1 35	.482	.096	1 38	.469	.097	1 66	.564	.110	.490	.096	6	1		
406....		II.	6 lbs. C.S.M.; 4 lbs. O.; 16 lbs. C.S.H.; 33 lbs. S.	1:5.78	1 47	.391	.093	1 84	.417	.088	2 01	.433	.093	2 22	.484	.112	.433	.097	2	2	III.	II.
323....		III.	4 lbs. C.S.M.; 6 lbs. O.; 18 lbs. C.S.H.; 35 lbs. S.	1:8.1	1 47	.568	.121	2 13	.719	.146	2 22	.813	.162	2 39	.846	.163	.739	.149	16	14		
		IV.	2 lbs. C.S.M.; 8 lbs. O.; 18 lbs. C.S.H.; 35 lbs. S.	1:9.96	Totals..4 00	1.395	.307	5 32	1.618	.330	5 61	1.715	.352	6 27	1.894	.385	1.662	.342				
				Averages	1 33	.465	.102	1 77	.539	.110	1 87	.572	.117	2 09	.631	.128	.554	.114				

TABLE XVII.—*Total Computed Digestible Nutrients Consumed per Group per Period.*

Group.	Period.	Ration fed per 1000 pounds live weight per day.	Nutritive ratio.	Total dry matter consumed, lbs.	Total digestible matter consumed.				Names of meals fed.	Dry matter consumed from meals, lbs.	Total digestible matter consumed from meals.				Names of coarse fodders.	Dry matter consumed from coarse fodders, lbs.	Total digestible matter consumed from coarse fodders.				Total milk yield per period.				Total butter yield per period.			
					Organic matter, lbs.	Protein, lbs.	Carbohydrates, lbs.	Fat, lbs			Organic matter, lbs.	Protein, lbs.	Carbohydrates, lbs.	Fats, lbs.			Organic matter, lbs.	Protein, lbs.	Carbohydrates, lbs.	Fats, lbs.	Milk, lbs.	Cost.	Value.	Profit.	Butter, lbs.	Cost.	Value.	Profit.
1	I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.	1:4.5	973.70	495.14	102 68	343 76	48 70	C.S.M.	234 82	169.11	94.67	42 26	32 18	C.S.H.+S.	738 88	326 03	8 01	301.50	16 52	780 20	$4 43	$19 50	$15 07	32.38	$4 43	$8 10	$3 67
2		7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.	1:4.5	836 85	449.73	112.57	295.00	42 16	C.S.M.	204.16	147 03	82.31	35.74	27.98	C.S.H.+S.	632 69	302 70	30.26	258 26	14.18	809 15	3 84	20 23	16 39	38 44	3 84	9 61	5 77
3		7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.	1:4.5	926 19	472 81	97 59	328 87	46.35	C.S.M.	222.71	160 39	89 79	40 08	30 52	C.S.H.+S.	703 48	312 42	7 80	288 79	15.83	980 50	4 27	24 51	20 24	42 66	4 27	10 66	6 39
4		7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.	1:4.5	967.71	494.29	101.90	343 98	48.41	C.S.M.	232.44	167.39	93.71	41.83	31.85	C.S.H.+S.	735 27	326.90	8 19	302.15	16 55	938 15	4 44	24 20	19 76	42.13	4 44	10 52	6 08
5		7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.	1:4.5	846.65	434.12	89.60	302 05	42.52	C.S.M.	204.16	147 03	82.31	33.74	27.98	C.S.H.+S.	541 49	287.09	7.29	265 31	14.54	887 05	3 92	22 18	18 26	36.50	3 92	9 14	5 22
6		7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.	1:4.5	869.08	442.89	90.69	308.97	43.23	C.S.M.	206.73	148.88	83.35	37 20	28.33	C.S.H.+S.	662.35	294 01	7.34	271.77	14.90	877 20	4 00	21 93	17 93	39.33	4 00	9 82	5 82
1	II.	10 lbs. C.S.M.; 20 lbs. C.S.H.	1:3.12	1149.10	550 55	146.40	340.55	63.60	C.S.M.	353.80	254.79	142.64	63 67	48.48	C.S.H.	795 30	295.76	3 76	276 88	15.12	760 20	4 45	19 01	14 56	35.65	4 45	8 91	4 46
2		10 lbs. C.S.M.; 20 lbs. S.H.	1:3.8	1099.78	686.28	144.69	468.69	72.90	C.S.M.	305 33	219.89	123.10	54.95	41.84	S. H.	794.45	466 39	21.59	413.74	31.03	814.00	6 00	20 35	14 35	39.06	6 00	9 76	3 76
3		10 lbs. C.S.M.; 16 lbs. C.S.H.; 33 lbs. S.	1:3.75	1143.57	607.00	150.22	390.79	65.99	C.S.M.	350.49	252.30	141.20	63.07	48.03	C.S.H.+S.	793 08	316.52	9 02	327 72	17 96	986 00	5 66	24 66	19 00	48 14	5 66	12 03	6 37
4		6 lbs. C.S.M.; 4 lbs. B.; 16 lbs. C.S.H.; 33 lbs. S.	1:5.03	1183.28	614.17	114 37	447.19	52.61	C.S.M.+B.	352.13	241.62	104.84	103 04	33.74	C.S.H.+S.	831.15	372.55	9.53	344 15	18.87	984.20	5 90	24 61	18 71	46 41	5 90	11 59	5 69
5		6 lbs. C.S.M.; 4 lbs. C.M.; 16 lbs. C.S.H.; 33 lbs. S.	1:5.78	1007.07	517.03	99.74	371.82	45.47	C.S.M.+C.M.	306.63	210.47	91.48	89.54	29.45	C.S.H.+S.	700 44	305 56	8.26	282.28	16 02	915 35	5 02	22 88	17 86	39.87	5 02	9 96	4 94
6		6 lbs. C.S.M.; 4 lbs. O.; 16 lbs. C.S.H.; 33 lbs. S.	1:5.35	1027.61	515.01	97.57	396.39	48.05	C.S.M.+O.	311.25	221.01	89.37	99.85	31.79	C.S.H.+S.	716.36	294.00	8.20	296.54	16.26	1017.65	5 32	25 44	20 12	49.40	5 32	12 34	7 02
1	III.	8 lbs. C.S.M.; 25 lbs. C.S.H.	1:4 .07	1185.17	542 25	121.76	363.56	56.93	C.S.M.	291.55	209 95	117.54	52.46	39 95	C.S.H.	893 62	332 30	4.22	311 10	16.98	767.85	4 16	19 20	15 04	35.11	4 16	8 77	4 61
2		8 lbs. C.S.M.; 30 lbs. S.H.	1:5 .51	1109.70	684.18	121.02	496.07	67.09	C.S.M.	241.61	174.00	97.41	43.48	33 11	S.H.	868 09	510 18	23 61	452 59	33 98	836 50	5 76	20 91	15 15	38.07	5 76	9 50	3 74
3		8 lbs. C.S.M.; 18 lbs. C.S.H.; 35 lbs. S.	1:4 .66	1180.19	606.06	125.20	421.48	59.38	C.S.M.	285.31	195 45	115.02	51.34	39.09	C.S.H.+S.	894 88	400 61	10 18	370 14	20.29	1069.55	5 50	26 74	21 24	47.82	5 50	11 95	6 45
4		4 lbs. C.S.M.; 6 lbs. B.; 18 lbs. C.S.H.; 35 lbs. S.	1:6 .63	1275.49	648.99	98.75	502.45	47.79	C.S.M.+B.	360.89	241.53	88.50	125.87	27.16	C.S.H.+S.	914 60	407.46	10 25	376 58	20.63	1051.88	6 22	26 30	20 08	48.03	6 22	12 01	5 79
5		4 lbs. C.S.M.; 6 lbs. C.M.; 18 lbs. C.S.H.; 35 lbs. S.	1:8 .1	1113.45	610.97	76.18	492.03	42.76	C.S.M.+C.M.	310.68	254.02	67.24	162.09	24.69	C.S.H.+S.	802.77	356 95	8 94	329 94	18 07	1039 76	5 35	25 99	20 64	42 47	5 35	10 61	5 26
6		4 lbs. C.S.M.; 6 lbs. O.; 18 lbs. C.S.H.; 35 lbs. S.	1:11.7	1069.8	561.85	83.00	433.44	45.41	C.S.M.+O.	319.97	225.65	74.50	123.71	27.44	C.S.H.+S.	749.87	336.20	8.50	309.73	17.97	1030.46	5 61	25 76	20 15	49.54	5 61	12 38	6 77
1	IV.	6 lbs. C.S.M.; 25 lbs. C.S.H.	1:5.05	1202.34	530.56	100.59	379.01	50.96	C.S.M.	238.22	172.04	96.04	43.36	32.64	C.S.H.	964 12	358.52	4.55	335.65	18.32	794.00	3 85	19 85	16 00	37.06	3 85	9 26	5 41
2		6 lbs. C.S.M.; 30 lbs. S.H.	1:6.64	1118.74	682.56	103.39	516.42	62.75	C.S.M.	194.15	139.80	78.27	34.93	26.60	S.H.	924.59	542 76	25.12	481.49	36.15	816.65	5 68	20 41	14 73	37.39	5 68	9 35	3 67
3		6 lbs. C.S.M.; 18 lbs. C.S.H.; 35 lbs. S.	1:5.78	1193.00	596.78	103.19	440.41	53.18	C.S.M.	228.58	164.58	92.15	41.13	31.30	C.S.H.+S.	964.42	432 20	11.04	399.28	21.88	1076 85	5 30	26 93	21 63	50.41	5 30	12 59	7 29
4		2 lbs. C.S.M.; 8 lbs. B.; 18 lbs. C.S.H.; 35 lbs. S.	1:8 90	1451.35	716.68	84.63	587.69	44.36	C.S.M.+B.	386.57	251 77	73.43	157.60	20 74	C.S.H.+S.	1034.78	464 91	11 20	430 09	23 62	1014 65	6 63	25 37	18 74	47.00	6 63	11 75	5 12
5		2 lbs. C.S.M.; 8 lbs. C.M.; 18 lbs. C.S.H.; 35 lbs. S.	1:7.38	1182.90	658.50	58.48	561.49	38.53	C.S.M.+C.M.	326.40	278.20	48.99	209 94	19.27	C.S.H.+S.	856 50	380 30	9.49	351 55	19 26	1010 95	5 66	25 27	19 61	41.08	5 66	10 27	4 61
6		2 lbs. C.S.M.; 8 lbs. O.; 18 lbs. C.S.H.; 35 lbs. S.	1:9.86	1255.81	635.59	63.51	528.87	42.21	C.S.M.+O.	328.73	229.94	54.76	153.54	21.64	C.S.H.+S.	927.08	405.65	9.75	375.33	20.57	1035.10	6 27	25 88	19 61	49.41	6 27	12 35	6 08

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A consideration of the cost of 100 *pounds of milk and one pound of butter,* by Groups per Period, now follows:

In Period I., Group V. yielded the cheapest 100 pounds of milk, at a cost of 44.4 cents. It was followed closely by Groups III. and VI., who produced a similar amount, at an outlay of 45.2 and 46.5 cents. The dearest 100 pounds of milk cost 58.2 cents, and was yielded by Group I. In economy of butter production, Groups II. and III. tied, with 10.1 cents per pound, while with Groups VI. and IV. the cost was 10.2 and 10.6 cents. The dearest pound of butter was made by Group I., costing 13.6 cents.

In Period II., the average cost of 100 pounds of milk was 53.9 cents, in the case of Group VI. Groups V. and III. came next in order, with 54.5 and 59.3 cents, while Group II. represented the highest cost of 100 pounds of milk in this period, with 73.7 cents.

Groups VI., III., and IV. yielded a pound of butter for 11.0, 11.8, and 12.6 cents, respectively, while Group II. represented the dearest pound of butter, at an outlay of 15.4 cents per pound.

In Period III., Groups V., III., I., and VI. produced 100 pounds of milk at an average cost of 51.2, 53.8, 56.0, and 57.2 cents. Group II. averaged 69.8 cents per 100 pounds of milk, and also represented the highest cost of the same in this period.

In butter yield, Groups I., III., and VI. exhibited the minimum cost per pound, with 11.0 and 11.7 cents, while Group II. again presented the maximum cost in this period for a pound of butter, namely, 15.2 cents.

In Period IV., Group I. led in economy of milk production, with 49.7 cents per 100 pounds. Groups III. and V. followed, with 51.0 and 55.4 cents, respectively. The dearest cost of 100 pounds of milk was shown by Group II., namely, 70.8 cents. With regard to butter yield, Group I. made a pound at an average of 10.5 cents in this period; and Groups III. and VI. at 10.6 and 12.8 cents, respectively. The highest average cost of a pound of butter was in the case of Group II., namely, 15.2 cents.

In the general averages for the four periods combined, Group V. led in economy of milk production, with an outlay of 51.5 cents per 100 pounds, followed closely by Groups III. and VI., with 52.6 and 55.4 cents, for a similar amount. The cost of 100 pounds in the case of Groups IV. and II. was 61.3 and 65.9 cents.

In minimum cost of production per one pound of butter, Group III. led, with 10.9 cents, Group VI. and I. followed, with 11.4 and 12.1 cents, while Groups IV. and II. represented the maximum cost per pound, namely, 12.4 and 14.0 cents.

A perusal of Table XVII. will reveal the computed digestible nutrients disposed of per group per period, and also the proportion furnished by the meals and roughage. It further displays the yields of milk and butter, and the profit derived from the same per group per period. Thus a clear idea of the influence of varying the amounts of dry matter and the several digestible nutrients on the economy of milk and butter production, may also be gained from this table.

It will be noted that the smallest amounts of dry matter, organic matter, carbohydrates, and fats were consumed in Period I. Very considerable variations were apparent in the consumption of these several constituents during the remaining periods. The largest quantities of dry

matter and organic matter were eaten by all the Groups in Periods III. and IV. The protein consumption reached its maximum in Period II., and its minimum in Period IV.; the fat in Period II. decreasing to Period IV., while the carbohydrates were most freely fed in Periods III. and IV.

The yields of milk were smallest in Period I. for all the Groups except I. and II. The maximum production of milk was reached in Periods III. and IV., honors being pretty evenly divided between these two Periods. The least profit was secured in Period I., and the greatest in Periods III. and IV.

The production of butter was least in Period I., and greatest in Periods III. and IV. The profits were least in Period I., and largest in Periods III. and IV.

As the yields of milk and butter and the profits derived from the same were least in Period I. and greatest in Periods III. and IV., and the consumption of dry matter, organic matter, and carbohydrates was greatest, and of protein and fat smallest in these periods, it is evident that the increase in the former and the decrease in the latter, was necessary to increased yields. It is also manifest, that the periods in which the protein (Periods I. and II.) and the fat (Period II.) consumption were very high, were not those of premium yields. This shows that a preponderance of certain ingredients in the ration will not take the place of a liberal supply of dry and organic matter, and that large quantities of food elements essential in metabolism and assimilation may be wasted, as the following example will testify:

Group.	Period	Dry matter, lbs.	Protein, lbs.	Milk per period, lbs.	Profit on milk per period.	Butter per period, lbs.	Profit on milk per period.
I.	I.	973.70	102.68	780.20	$15.07	32.38	$3.67
	II.	1149.10	146.40	760.20	14.56	35.65	4.46
	III.	1185.17	121.76	767.85	15.04	35.11	4.61
	IV.	1202.34	100.59	794.00	16.00	37.06	5.41
VI.	I.	869.08	90.69	877.20	17.93	39.33	5.82
	II.	1027.61	97.57	1017.65	20.12	49.40	7.02
	III.	1069.80	83.00	1030.46	20.15	49.54	6.77
	IV.	1225.81	63.51	1035.10	19.61	49.41	6.08

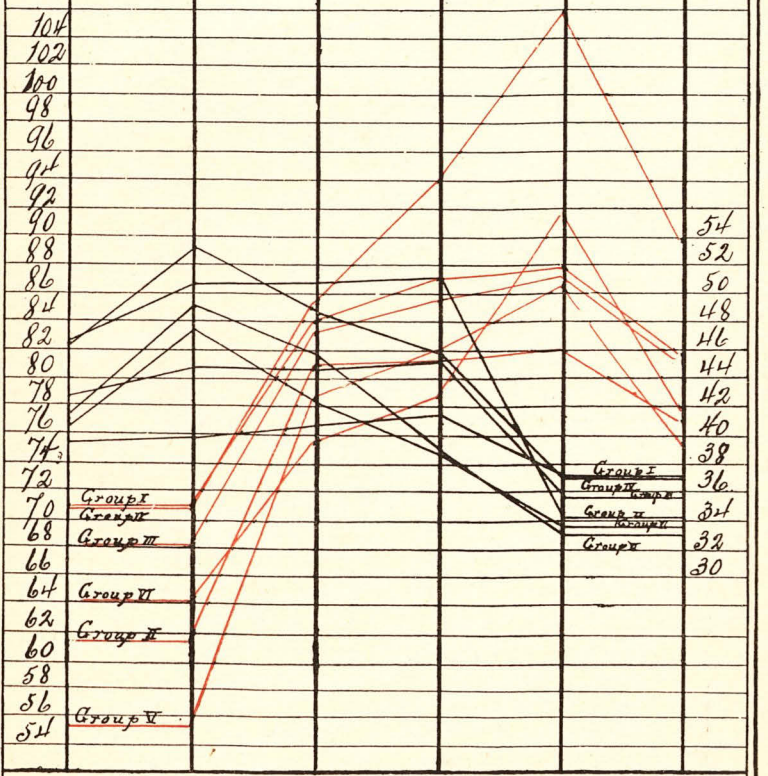
In the case of Group I., the yields of milk and the profits derived were greatest in Periods I. and IV., and the same is true of the butter in Period IV. This shows that 100 pounds of digestible protein was as efficient as a larger amount; hence, in Periods II. and III., 46 and 21 pounds of protein might have been saved. The increase of the dry matter was also out of proportion to the results obtained. It will be noted that with Group VI. the largest milk yield, and practically as large a yield of butter as is shown at any time, was obtained from the use of 64.51 pounds of protein, as compared with 97.57 pounds of protein for a smaller milk yield and an equal yield of butter. It is plain that the increase in dry matter beyond 1027.61 pounds was not profitable. This serves to illustrate how large percentages of certain food elements may be wasted.

The character and quantities of the substances fed exerted an important bearing on the distribution of the several digestible materials in the

Diagramatic Chart E Showing

The Average Consumption per Group per Period of

Dry Matter Lbs per day	Group	Period I Milk Lbs.	Period I Butter Lbs	Period II Milk Lbs	Period II Butter Lbs	Period III Milk Lbs	Period III Butter Lbs	Period IV Milk Lbs	Period IV Butter Lbs	Average for all Periods Milk Lbs	Average for all Periods Butter Lbs	Organic Matter Lbs per day
	I	780.20	32.38	760.20	35.65	767.85	37.06	794.00	35.11	775.56	35.05	
	II	809.15	38.55	814.00	37.50	826.50	37.41	816.65	37.99	819.07	37.86	
	III	980.50	42.66	986.00	48.14	1069.55	50.41	1076.85	47.82	1028.22	47.51	
	IV	968.15	42.13	984.20	46.41	1051.88	47.00	1014.65	48.03	1004.72	45.89	
	V	887.05	35.18	915.35	39.87	1037.76	41.08	1010.95	42.38	963.23	39.65	
	VI	877.20	39.33	1017.65	49.40	1030.46	49.38	1035.10	49.54	990.10	46.91	



Legend { —— Dry matter consumed per day per Group
* —— Organic matter consumed per day per Group.

* Reads towards the left

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TABLE XVIII.—*Amount of Computed Digestible Matter Consumed per Cow per Day and per Group in 56 Consecutive Days.*

Group.	Period.	Substances eaten per group in the four periods.	Dry matter consumed in the four periods.	Digestible matter consumed.				Food eaten per cow per group and per day.	Dry matter consumed per day.	Digestible matter consumed per day in meals.				Dry matter consumed per day.	Dry matter consumed per day in fodders.				Averages per day per cow and group per period.				Averages per day per cow and group per period.			
				Organic matter.	Protein.	Carbo-hydrates.	Fat.			Organic matter.	Protein.	Carbo-hydrates.	Fat.		Organic matter.	Protein.	Carbo-hydrates.	Fat.	Milk.	Cost.	Value.	Profit.	Butter.	Cost.	Value.	Profit.
			Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*								
I.	All four.	Cotton seed meal 1218.3	1118.40		450.89	201.26	153.26		19.96		8.05	3.59	2.74						22.87	$0.107	$0.572	$0.465	0.962	$0.107	$0.240	$0.133
		Cotton seed hulls 3584.5	3186.63		15.05	1109.40	60.58							56.90		.270	19.81	1.080	15.38	.102	.384	.282	.737	.102	.184	.082
		Silage 980.6	204.95		5.49	115.61	6.37							3.66		.098	2.06	.112	17.13	.092	.428	.336	.803	.092	.201	.109
Totals for 56 days			4509.98	2117.93	471.44	1426.28	220.21	Group...	19.96	14.38	8.05	3.59	2.74	60.56	23.44	.378	21.87	1.192	55.38	.301	1.384	1.083	2.502	.301	.625	.324
Average consumption for 56 days			80.53	37.82	8.42	25.47	3.93	Cow. ...	6.65	4.79	2.68	1.19	.91	20.18	7.81	.126	7.29	.397	18.46	.100	.461	.361	.834	.100	.208	.108
II.	All four.	Cotton seed meal 1031.1	945.25		381.09	170.10	129.79		16.88		6.81	3.04	2.32						16.86	.139	.421	.282	.900	.139	.225	.086
		Cotton seed hulls 511.6	454.81		21.49	158.34	8.65							8.12		.38	2.83	.154	22.31	.136	.558	.422	.860	.136	.215	.079
		Sorghum hay 2848.6	2587.13		70.32	1347.82	100.84							46.19		1.250	24.07	1.800	19.33	.104	.483	.379	.970	.104	.243	.139
		Silage 851.1	177.88		8.77	99.92	5.53							3.17		.156	1.78	.099								
Totals for 56 days			4165.07	2502.66	481.67	1776.18	244.81	Group...	16.88	12.17	6.81	3.04	2.32	57.48	32.519	1.786	28.68	2.053	58.50	.379	1.462	1.083	2.730	.379	.683	.304
Average consumption for 56 days			74.37	44.69	8.60	31.72	4.37	Cow.....	5.63	4.06	2.27	1.01	.77	19.16	10.84	.595	8.96	.684	19.50	.126	.472	.361	.910	.126	.228	.101
III.	All four.	Cotton seed meal 1180.2	1087.09		438.16	194.97	148.47		19.41		7.82	3.48	2.65						29.97	.127	.750	.623	1.318	.127	.330	.203
		Cotton seed hulls 2641.5	2348.28		11.09	817.54	44.64							41.93		.198	14.59	.797	17.76	.114	.444	.330	.996	.114	.249	.135
		Silage 4821.7	1007.58		27.03	568.48	31.34							17.99		.482	10.15	.560	25.71	.129	.643	.514	1.059	.129	.265	.136
Totals for 56 days			4442.95	2281.64	476.20	1580.99	224.45	Group...	19.41	13.95	7.82	3.48	2.65	59.92	26.78	.680	24.74	1.357	73.44	.370	1.837	1.467	3.373	.370	.844	.474
Average consumption for 56 days			79.34	40.74	8.50	28.23	4.01	Cow. ...	6.47	4.65	2.61	1.16	.88	19.97	8.93	.227	8.25	.452	24.48	.123	.612	.489	1.124	.123	.281	.158
IV.	All four.	Cotton seed meal 732.1	672.06		270.95	120.93	92.09		12.00		4.84	2.16	1.64						16.27	.120	.407	.287	.839	.120	.210	.090
		Bran 745.6	659.87		89.55	321.67	21.40		11.78		1.59	5.74	.38						19.67	.122	.492	.370	.966	.122	.242	.120
		Cotton seed hulls 2745.8	2529.70		11.53	750.90	48.08							45.17		.205	13.41	.858	35.82	.172	.895	.723	1.471	.172	.368	.196
		Silage 4861.8	1016.10		27.23	687.81	31.60							18.14		.486	12.28	.564								
Totals for 56 days			4877.73	2473.73	399.26	1881.31	193.17	Group...	23.78	16.31	6.43	7.90	2.02	63.61	27.80	.691	25.69	1.422	71.76	.414	1.794	1.380	3.276	.414	.820	.406
Average consumption for 56 days			87.10	44.18	7.13	33.59	3.45	Cow. ...	7.93	5.45	2.14	2.63	.67	21.10	9.26	.230	8.56	.474	23.92	.138	.598	.460	1.092	.138	.273	.135
V.	All four.	Cotton seed meal 641.9	589.26		237.56	106.03	80.75		10.52		4.24	1.89	1.44						20.28	.096	.507	.411	.950	.096	.234	.138
		Corn meal 651.6	558.61		52.46	392.28	21.18		9.97		.93	7.00	.38						21.19	.113	.530	.417	.888	.113	.222	.109
		Cotton seed hulls 2367.3	2104.51		10.11	722.68	40.01							37.58		.180	12.91	.718	27.33	.147	.683	.536	1.019	.147	.255	.108
		Silage 4295.2	897.69		24.05	506.40	27.92							16.03		.430	9.04	.498								
Totals for 56 days			4150.07	2221.43	324.18	1727.39	169.86	Group...	20.49	15.88	5.17	8.89	1.82	53.61	23.78	.610	21.95	1.216	68.80	.356	1.720	1.364	2.857	.356	.711	.355
Average consumption for 56 days			74.10	39.66	5.78	30.85	3.03	Cow....	6.83	5.28	1.72	2.96	.61	17.87	7.93	.203	7.32	.405	22.93	.119	.573	.455	.952	.119	.237	.118
VI.	All four.	Cotton seed meal 658.0	604.04		243.53	108.70	82.78		10.78		4.35	1.94	1.48						19.83	.097	.496	.399	.977	.097	.244	.147
		Oats 632.2	562.66		58.48	305.61	26.43		10.05		1.05	5.45	.47						31.07	.135	.777	.642	1.393	.135	.348	.213
		Cotton seed hulls 2449.9	2177.96		10.29	758.24	41.40							38.89		.183	13.54	.740	19.81	.147	.495	.348	.978	.147	.245	.098
		Silage 4189.5	875.61		23.46	493.94	27.23							15.64		.419	8.82	.486								
Totals for 56 days			4222.27	2182.09	335.76	1666.49	177.84	Group...	20.83	14.73	5.40	7.39	1.95	54.53	24.19	.602	22.36	1.226	70.71	.379	1.768	1.389	3.348	.379	.837	.458
Average consumption for 56 days			75.39	38.95	5.99	29.76	3.18	Cow. ...	6.94	4.91	1.80	2.46	.65	18.18	8.06	.201	7.45	.409	23.57	.126	.589	.463	1.116	.126	.279	.153

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meals and roughage. When cotton seed meal formed the sole meal portion of the ration for Groups I., II., and III. in all the periods and for Groups IV., V. and VI. in Period I., the protein was chiefly supplied in the meal. When cotton seed meal, bran, corn meal and oats in different combinations formed the rations of meal in Periods II., III. and IV. for Groups IV., V., and VI., with the bran, corn meal and oats increasing and the cotton seed meal decreasing, the protein is seen to diminish in quantity and the proportion furnished by the roughage to increase. Similarly the fat decreased as the cotton seed meal decreased, while the carbohydrates increased in the meal portion of the ration as the amounts of bran, corn meal, and oats increased.

While the dry matter and organic matter furnished by the meals is seen to be as high on several occasions when cotton seed meal alone formed the meal portion of the ration, this apparent anomaly is due to the high per cent of protein furnished by this meal. The quantity of dry matter and organic matter furnished by the bran, corn meal, and oats, was brought up by the high per cent. of carbohydrates contained in these meals.

Naturally, the greater portion of dry matter, organic matter, and carbohydrates was furnished by the roughage, and the rise or fall in consumption of these ingredients was due to the fluctuation in the amounts fed and the caprices of animal individuality.

It will be observed that the largest and least quantities of dry matter and organic matter were consumed in the meals in Periods II. and I. and in roughage in IV. and I., respectively. The largest and least amounts of protein were consumed in meals in Periods II. and IV., and in roughage in Periods III. and IV. The carbohydrates furnished by the meals were most freely eaten in Period IV. and least so in Period I. and in the coarse foods in Periods III. or IV. The fats furnished by the meals were most freely eaten in Period II. and least so in Period IV., and in the coarse foods in Periods I. and IV. For the production of milk and butter, profits, etc., refer to the previous portion of this discussion.

IN CONCLUSION.

I. The Periods in which large quantities of protein and fat were consumed from the meals were not those of highest production or profit.

II. When the proportion of the protein and fats furnished in the meals was least and the proportion of carbohydrates greatest the yields and profits derived were the largest.

III. As a rule the yields and profits increased when the proportions of dry matter and organic matter furnished in the meals were lowest.

Under this table is incorporated the total amounts and source of supply of the computed digestible nutrients consumed during the entire experimental period of 56 days, together with the average consumption of the same per Group per Period. The distribution of the several ingredients in meals and fodders and the average consumption per day per Group and per cow for the whole experiment is also shown. In order that a comparison of the influence of variations in the quantity and constitution of the daily rations on the daily yields of milk and butter and the profits derived from the same might be conveniently made, this data is found attached to the table:

Group.	Digestible matter eaten per day.			Rating of groups in milk and butter production.
		Largest amount, lbs.	Least amount, lbs.	
IV.	Dry matter	87.10		III.
V.	Dry matter		74.10	IV.
II.	Organic matter	44.69		VI.
I.	Organic matter		37.82	V.
II.	Protein	8.60		VI.
V.	Protein		5.78	IV.
IV.	Carbohydrates	33.59		III.
I.	Carbohydrates		25.47	V.
II.	Fat	4.37		VI.
V.	Fat		3.03	IV.

As may be gathered from this table, the quantity of protein, dry matter, organic matter, etc., did not furnish any standard by which the relative value of a ration could be judged.

Group III. leading in milk and butter yields, received 8.50 pounds of protein in its daily ration; Group VI., a very strong rival, used only 5.99 pounds, and further, Groups I. and II., rated V. and VI., received 8.42 and 8.60 pounds of protein per day in their rations. A difference of 1300 pounds of dry matter existed between the quantities eaten per day by Groups IV. and V., and yet they were rated III. and IV., while Groups II. and VI., receiving 74.37 and 75.39 pounds of dry matter in their respective daily rations, were rated VI. and II. for milk and butter production. What is true of the dry matter applies equally to the organic matter, carbohydrates and fat. Thus no definite conclusion can be reached regarding the relative influence of increase or decrease of the various nutrients on the cost of production. The character and amount of the food, individuality, and the weight and age of the animals, are factors bearing on this question.

Consumption and Production per Cow per Group per Day.

Group.	Dry matter in meals, lbs.	Digestible matter furnished in meals.				Dry matter in roughage, lbs.	Digestible matter in roughage.				utritive ratio.	ilk per day, lbs.	Profit per day, cts.	Butter per day, lbs.	Profit per day, cts.
		Organic matter, lbs.	Protein, lbs.	Carbohydrates, lbs.	Fat, lbs.		Organic matter, lbs.	Protein, lbs.	Carbohydrates, lbs.	Fat, lbs.					
I.	6.65	4.79	2.68	1.19	.91	20.18	7.81	.126	7.29	.397	1:3.5	18.46	36.1	.834	10.8
II.	5.63	4.06	2 27	1.01	.77	19.16	10.84	.595	8.96	.684	1:4.8	19.50	36.6	.910	10.1
III.	6.47	4.65	2.61	1.16	.88	19.97	8.93	.227	8.25	.452	1:4.4	24 47	48.9	1.124	15.8
IV.	7.93	5.45	2.14	2.63	.67	21.10	9.26	.230	8.56	.474	1:5.9	23.92	46.0	1.092	13.5
V.	6.83	5 28	1.72	2.96	.61	17.87	7.93	.203	7.32	.405	1:6.7	22.93	45.5	.952	11.8
VI.	6.94	4.91	1.81	2.46	.65	18.18	8.06	.201	7.45	.409	1:6.3	23.57	46.3	1.116	15.3

Showing the Total Digestible Nutrients Consumed per Cow per Day and the Proportion Furnished by Meals and Roughage.

Group.	Dry matter, lbs.	Digestible matter.				Per cent of ration furnished by meals.	Per cent of ration furnished by roughage.	Nutritive ratio.	Milk per day, lbs.	Cost per day, cts.	Butter per day, lbs.	Cost per day, cts.	Rating of groups and rations.
		Organic matter, lbs.	Protein, lbs.	Carbohydrates, lbs.	Fats, lbs.								
I.	26.83	12.60	2.806	8.48	1.107	38.0	62.0	1:3.5	18.46	10.0	.834	10.0	V.
II.	24.79	14.90	2.865	9.97	1.454	27.2	72.8	1:4.8	19.50	12.6	.910	12.6	V .
III.	26.44	13.58	2.837	9.41	1.332	34.2	65.8	1:4.4	24.48	12.3	1.124	12.3	.
IV.	29.03	14.71	2.370	11.19	1.144	36.9	63.1	1:5.9	23.92	13.8	1.092	13.8	III.
V.	24.70	13.21	1.923	10.28	1.015	40.0	60.0	1:6.7	22.93	11.9	.952	11.9	IV.
VI.	25.12	12.97	2.001	9.91	1.059	37.9	62.1	1:6.3	23.57	12.6	1.116	12.6	II.

The above tables present a concise summary of the average proportions of dry matter and digestible nutrients consumed in meals and roughage per cow per day for the entire experiment, as well as the total digestible substances eaten per cow per day, with the percentages of organic matter furnished by the meals and roughage. The nutritive ratio, the average production of milk and butter, and the average cost and profit per cow per day, together with the rating of the Groups in economy of production, is also shown. According to the so-called standard rations (page 1049), Groups I., III., IV., and VI. were high in dry matter, all the Groups were low in organic matter, V. and VI. were low in protein and the others high, while all were low in carbohydrates, and high in fats. Further none of the ratios could be classed as wide. The digestible nutrients present above represent the amounts actually used (average of 3) per cow per Group, and not according to the 1000 pounds of live weight. (See Table XVIII.) As all the groups averaged considerably under 1000 pounds, it is plain that the rations used were ample, and when fed at the rate of 1000 pounds of live weight they would be still more at variance with the so-called standard rations.

The percentage of the organic matter furnished by the meals varied from 27.2 with Group IV. to 40.0 with Group V. These Groups were rated VI. and IV. in yields, while Group III., who led in economy of yields, received 34.2 per cent of its ration from the meals. The per cent of organic matter secured in the roughage ran from 60.0 with Group IV. to 72.8 with Group II. Group III. and VI. standing first and second in economic yields of milk and butter, received 65.8 and 62.1 per cent. of their rations from the roughage. While the percentage of organic matter received from the meals and from the roughage shows no positive influence on economy of yields, yet the most favorable results were apparent when about one-third of the rations was supplied by the former and two-thirds by the latter, and in practice we believe this division will prove satisfactory.

With regard to the nutritive ratios Group I. received a very narrow one, or about 1:3.5, and Group V., representing the other extreme, a moderately wide one, or 1:6.7. These Groups were V. and IV. in economic yields, while the ratios of Groups III., VI., and II., who were

rated I., II., and VI., were 1:4.4, 1:6.2, and 1:4.8, respectively. Thus, so far as we can judge from these experiments, the narrow rations exerted the most favorable influence on economic production. The absence of certain nutrients in a ration (see p. 1047) will adversely influence the physiological functions of the body, but if they are supplied in reasonable quantities together with succulent forms of food, the cost of the food, individuality of the cows, palatability and combination of the foods will have as important a bearing on the economy of milk and butter yields as the use of a so-called standard ration.

TABLE XIX.—*Amounts of the Several Digestible Nutrients Consumed per Group in the Production of 100 Pounds of Milk and 1 Pound of Butter.*

Group.	Periods.	dry matter consumed per group, lbs.	Total digestible matter consumed per group.				matter, lbs.	Digestible matter consumed in producing 100 lbs. of milk.					Dry matter, lbs.	Lbs. of digestible matter consumed in producing 1 lb. of butter.				
			Organic matter, lbs.		Carbohydrates, lbs.	Fat, lbs.		Organic matter, lbs.	Protein, lbs.	Carbohydrates, lbs.	Fat, lbs.	Cost of 100 lbs. of milk, cts.		Organic matter, lbs.	Protein, lbs.	Carbohydrates, lbs.	Fats, lbs.	Cost of 1 lb. of butter, cts.
I.	All four	4509.98	2117.93	471.44	1426.28	220.21	145.3	68.3	15.2	45.9	7.1	55.7	32.2	15.1	3.3	10.2	1.6	12.1
II.	All four	4165.07	2502.66	481.67	1776.18	244.81	127.1	76.4	14.6	54.2	7.4	65.8	27.2	16.3	3.1	11.6	1.6	14.0
III.	All four	4422.95	2281.64	476.20	1580.99	224.45	107.1	55.4	11.5	38.4	5.4	52.6	23.2	12.0	2.5	8.3	1.2	10.9
IV.	All four	4877.73	2473.73	399.25	1881.31	193.17	121.3	61.3	9.9	46.8	4.8	61.3	26.3	12.1	2.2	10.2	1.0	12.9
V.	All four	4150.07	2241.23	324.18	1727 39	169.86	107.7	58.1	8.4	44.9	4.4	51.5	25.9	13.9	2.0	10.7	1.0	12.4
VI.	All four	4222.27	2182.09	335.76	1666.49	177.84	106.6	55.1	8.5	42.2	4.5	55.4	22.5	11.1	1.2	8.7	0.9	11.4

An interesting study of the quantities of dry matter and organic matter and the relation of the several digestible nutrients to each other in the production and cost of 100 pounds of milk and one pound of butter may be made by means of the data presented in Table XIX. The character of the foods constituting the several rations fed and the ever present influence of animal individuality, no doubt exerted some effect on the results indicated, as even a casual glance at the table reveals some remarkable differences in the amount and constitution of the digestible nutrients eaten in the manufacture of 100 pounds of milk or one pound of butter by the several groups under test.

In these experiments the dry matter consumed in the production of 100 pounds of milk varied from 106.6 to 145.3 pounds, in the cases of Groups VI. and I. Group V. led in economy of manufacturing 100 pounds of milk, at a cost of 51.5 cents, and consuming 107.7 pounds of dry matter, while Group II., disposing of 127.1 pounds of dry matter, proved the most expensive, the cost of 100 pounds of milk being 65.8 cents. The former group ate 20.00 pounds less food and yielded 100 pounds of milk for 14.3 cents less than Group II.; while Group I., consuming 37.1 pounds more food than V., manufactured 100 pounds of milk for 55.7 cents or 4.2 cents more than Group V.

Group II. ate the most organic matter, namely 76.4 pounds, while Group VI. ate the least, or 55.1 pounds, in the production of 100 pounds of milk. Groups II. and VI. stood sixth (last) and third in economy of production, while Groups V. and III., standing first and second in this respect, disposed of 58.1 and 55.4 pounds of organic matter in the manufacture of 100 pounds of milk. Again, wide discrepancies are apparent between the quantity of organic matter eaten by the several groups. We attribute these results to one of three things. 1. Unsuitable nature of the food. 2. The influence of individuality. 3. The cost of the food, of which the first and third seems to be at fault in the case of Group VI.

The protein consumption varied between 8.5 and 15.2 pounds in the production of 100 pounds of milk in the cases of Groups VI. and I., which stood third and fourth in economy of production, while Groups V. and III., standing first and second, used 8.4 and 11.5 pounds. It is apparent that either large quantities of protein were wasted or else its presence aided in the performance of certain essential physiological effects in the animal body, but of this more will be said at another time.

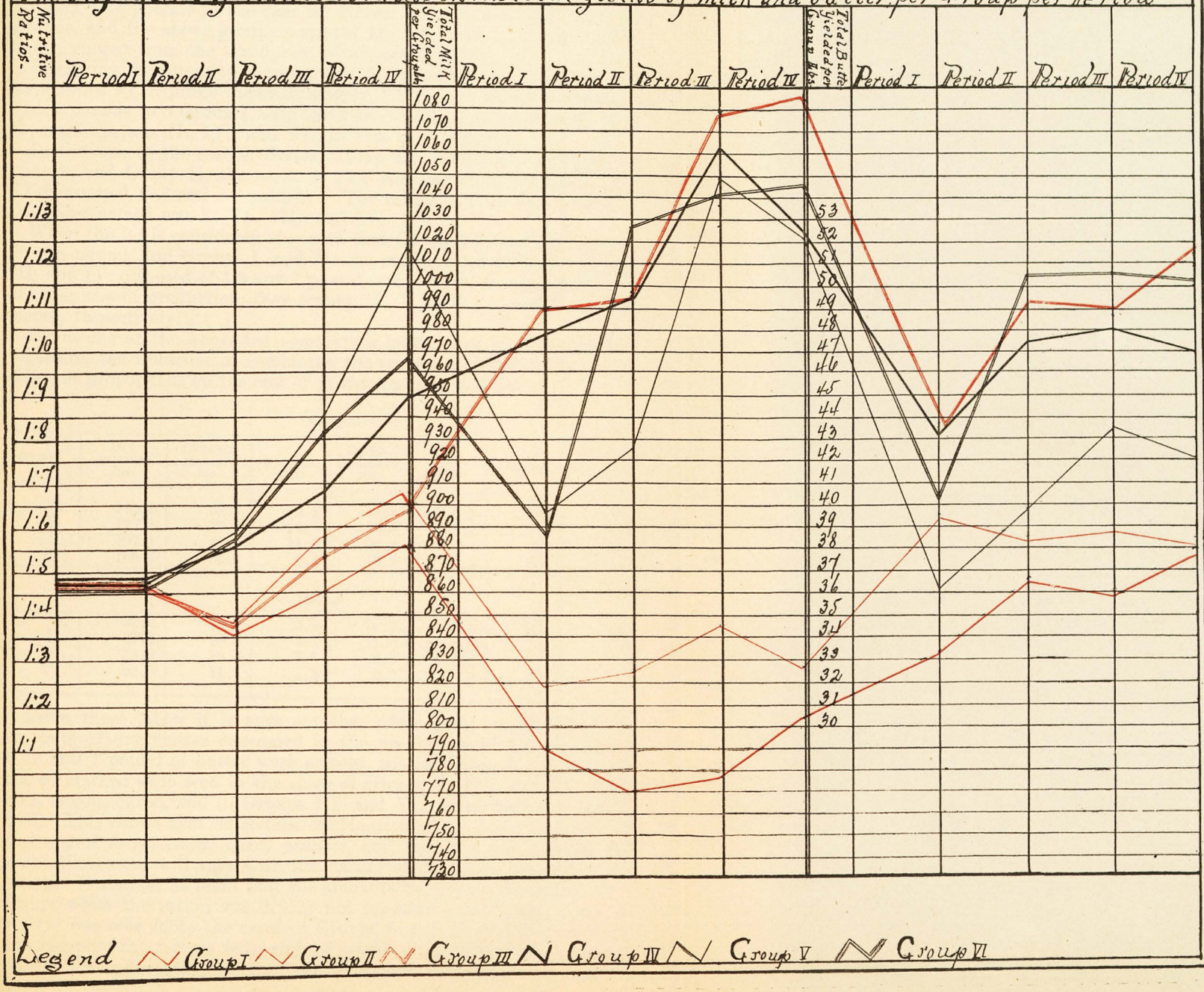
The carbohydrates eaten in the manufacture of 100 pounds of milk ranged from 38.4 to 54.2 pounds in the cases of Groups III. and II., respectively. These Groups were also I. and II. in economy of production. Groups V. and VI., which stood third and fourth in production, disposed of 44.9 and 42.2 pounds of carbohydrates per 100 pounds of milk yielded.

With regard to the consumption of fat per 100 pounds of milk, Group V., which stood first in cheapness of production, used the least, namely, 4.4 pounds, and Group II., the most, namely, 7.4 pounds. Groups VI. and III. used 4.5 and 5.4 pounds of fat and occupied second and third places in economy of yields.

From the remaining portion of the table the pounds of the several digestible nutrients used in the manufacture of 1 pound of butter may be ascertained. * * * * *

Diagramatic Chart F Showing

The influence of nutritive ratios on the total yields of milk and butter per Group per Period



Legend ~ Group I ~ Group II ~ Group III ~ Group IV ~ Group V ~ Group VI

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The pounds of dry matter used varied from 22.5 in Group VI. to 32.2 pounds in Group I., and were 23.2 pounds in Group III. These Groups were II., V. and I., in economic yields of butter.

The organic matter ranged between 11.1 pounds in the case of Group VI. and 16.3 pounds in the case of Group II. Group III. used 12 pounds, and the above groups occupied II., VI., and I. places, respectively, viewed from the standpoint of economic yields.

Regarding the quantity of protein used in making one pound of butter, Groups VI. required the least, namely, 1.2 pounds, Group V. followed with 2 pounds, and Group I. used the most, or 3.3 pounds. The rating of these groups was II., IV., and VI., in cost of production.

In the case of the carbohydrates, Group III. used the least, with 8.3 pounds, and Group II. the most, or 11.6 pounds, while Groups II. and VI. consumed 10.7 and 8.7 pounds. The rating of these four groups in the order named was I., VI., III., and IV.

When the fat is considered it is seen that Group VI. used the least, or .9 of a pound, and Groups I. and II. the most, or 1.6 pounds. Groups III. and IV. disposed of 1.2 and 1 pound each, and when ranged in order of cheapness of production, they occupy II., V., and VI., and I. and IV. places, respectively.

By means of the appended summary a better idea may be gathered regarding the influence of combining the several digestible nutrients in different proportions on the cost of producing milk and butter.

Milk.

Group.	Dry matter, lbs.	Organic matter, lbs.	Protein, lbs.	Carbohydrates, lbs.	Fat, lbs.	Rating.	Cost of 100 lbs, cts.
I.	145.3	68.3	15.2	45.9	7.1	IV.	55.7
II.	127.1	76.4	14.6	54.2	7.4	VI.	65.8
III.	107.1	55.4	11.5	38.4	5.4	II.	52.6
VI.	106.6	55.1	8.5	42.2	4.5	III.	55.4

Butter.

I.	32.2	15.1	3.3	10.2	1.6	III.	12.1
II.	27.2	16.3	3.1	11.6	1.6	VI.	14.0
III.	23.2	12.0	2.5	8.3	1.2	I.	10.9
VI.	22.5	11.1	1.2	8.7	.9	II.	11.4

From these tables it is apparent that while great variations in the amounts of dry matter consumed in the production of 100 pounds of milk and 1 pound of butter were present, the influence on the cost was not so marked as is seen in the cases of Groups I., III., and VI., when milk is considered, and in Groups III. and VI., when butter is considered. This shows that *no certain combination of the digestible nutrients is essential to successful dairy practice,* and that the combination and proportions used will vary with the nature of the foods composing the ration. It also seems plain that the amounts required were considerably higher when the ration was dry or not succulent, and lower when the reverse was true (note the cases of Groups I. and II. and III. and IV., and compare the rations fed), and, of course, this influenced the cost of production. Furthermore, the cost of a food determines whether we

can afford to feed more of a certain nutrient than is apparently necessary, for this experiment indicates that either a large amount of the several nutrients were wasted (as in the case of portein used by Groups I. and VI., for both milk and butter), or else through destructive metabolism, or some other physiological function of the animal body, it was converted into useful and constructive compounds, that took the place of some other substance essential, but deficient, in the ration fed. The source of supply influences the amount of a nutrient that may be fed. For example, protein is so abundant and cheap, in cotton seed meal, that we can afford to feed an excess over that required in production.

TABLE XX.—*Fertilizing Constituents Consumed in Food Factors Fed by Each Group in the Four Periods.*

Group.	Periods.	Corn meal, lbs.	Fertiliz'g value.	Bran, lbs.	Fertiliz'g value.	Oats, lbs.	Fertiliz'g value.	Cotton seed meal, lbs.	Fertiliz'g value.	Cotton seed hulls, lbs.	Fertiliz'g value.	Silage, lbs.	Fertiliz'g value.	Sorghum hay, lbs.	Fertiliz'g value.	Total pounds of food consumed.	Total fertilizing value.	20 per cent retained in animal body and lost.	Total cost of milk and butter production.	Net cost of milk and butter production.
I.	All four	.....	.....	.....	.....	.....	.....	1218.3	$12 10	3534.5	$5 41	980.6	55	.....	.....	5783.4	$18 06	$14 45	$16 89	$2 44
II.	All four	.....	.....	.....	.....	.....	.....	1029.7	10 22	511 6	0 77	851.1	48	2848.6	$5 70	5241.0	17 17	13 74	21 28	7 54
III.	All four	.....	.....	.....	.....	.....	.....	1184.2	11 76	2641 5	3 99	4821.0	$2 70	.....	.....	8646.7	18 45	14 76	20 73	5 97
IV.	All four	.....	.....	745.6	$3 85	.....	.....	732.1	7 27	2745.8	4 15	4861.8	2 72	.....	.....	9085.3	17 99	14 39	23 19	8 80
V	All four	651.6	$1 53	.....	.....	.....	.....	641.9	6 37	2367.3	3 57	4295.2	2 41	.....	.....	7956 0	13 88	11 10	19 95	8 85
VI.	All four	.....	.....	.....	.....	632.2	$1 97	658 0	6 53	2449 9	3 70	4199.6	2 35	.....	.....	7939.7	14 55	11 64	21 20	9 56
Totals....		651.6	$1 53	745.6	$3 85	632 2	$1 97	5464.2	$54 25	14,300 6	$21 59	20,009 3	$11 21	2848.6	$5.70	44,652.1	$100 10	$80 08	$123 24	$43 16

The fertilizing constituents contained in the several foods are exhibited in this table. Of the meals used, cotton seed meal was incomparably the most valuable in this respect, when similar quantities of the other meals fed are considered.

For example, 651.6 pounds of corn meal contained fertilizing elements worth $1.53, while 641.9 pounds of cotton seed meal showed a value of $6.37 for this purpose, a difference of $4.84 in its favor. The fertility contained in 745.6 pounds of bran aggregated $3.85, whereas 732.1 pounds of cotton seed meal is seen to be worth $7.27. A difference of $3.42 is here apparent, in favor of the latter meal. Again, 632.2 pounds of oats were worth $1.97, from the standpoint of the fertility they contained, when 658.0 pounds of cotton seed meal was valued at $6.53 for a similar purpose. Thus when similar amounts of cotton seed meal and oats are compared the former is seen to have two and one half times the fertilizing value of the latter.

While the meals that may be fed are by far the richest in fertilizing materials, owing to the much larger quantities of coarse foods disposed of in the daily ration, the value of this portion of the food has a greater significance than may at first be supposed. If we consider the total amount of the several food stuffs consumed during the experiment, it will be observed that—

7,493.6 pounds of meals had a fertilizing value of	$61	60
14,300.0 pounds of cotton seed hulls had a fertilizing value of	21	59
20,009.3 pounds of silage had a fertilizing value of	11	21
2,848.6 pounds of sorghum hay had a fertilizing value of	5	70

Thus the quantities of cotton seed hulls, silage and sorghum hay consumed aggregated 37,158.5 pounds, and had a fertilizing value of $38.50, while the 7493.6 pounds of meals were worth $61.60, or a difference of $23.10 in favor of the latter. It is worthy of note that none of the coarse foods used were rich in fertilizing elements, when compared, for example, with clover, hays, etc. A great difference in the respective fertilizing values of the several coarse foods is also apparent. For instance, while 5709.3 pounds more of silage were fed than cotton seed hulls, the latter were worth $10.38 more than the former, from the standpoint of fertility; and if a quantity of sorghum hay, equalling in amount the quantities of cotton seed hulls and silage actually fed, be considered, the difference between it and the former would be, in round numbers, $19.01, and between it and the latter $28.91, when the fertilizing elements are alone kept in view.

Therefore, in farming, where the purchase of food may be necessary, the above facts should be carefully considered. For, if foods have to be bought, the farmer should secure the food best adapted to his purpose in feeding and furnishing the highest percentage of valuable fertilizing materials at the same time. By this means the fertility of the farm may be properly conserved and enlarged.

The figures presented in this table show the total cash outlay for the food fed to amount to $123.24, and the fertilizing value of this same food is seen to be $100.10; so that the net cash outlay in this instance is represented by $23.14. This is the most formidable argument that can be advanced to show the necessity of preserving the dejecta from the live stock fed on the farm. Of course, all the fertilizing material of the food

TABLE XXI.—*Summary of Results.*

Ear tag No.	Group.	Period.	Ration fed per 1000 pounds live weight per day.	Nutritive ratio.	Final weight, lbs.	Meal eaten in 56 days, lbs.	Coarse food eaten in 56 days, lbs.	Dry matter consumed per day, lbs.	Digestible matter consumed per day per group.				Cost of food per period.	Milk produced per period, lbs.	Milk produced per day, lbs.	Cost of 100 pounds of milk.*	Value of milk at 2½ cents per pound.	Butter produced, lbs.	Value of butter at 25 cents per pound.	Cost of a pound of butter.*	Profit from selling milk.	Profit from selling butter.
									Organic matter, lbs.	Protein, lbs.	Carbohydrates, lbs.	Fat, lbs.										
317....		I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.....	1:4.5	994.5	225.8	1581.2	69.55	35.37	7.33	24.55	3.48	$4 43	780.20	55.73	$0.567	$19 50	32.38	$8 10	$0.137	$15 07	$3 67
545....	I.	II.	10 lbs. C.S.M.; 20 lbs. C.S.H.....	1:3.12	997 5	385.4	894.6	82.08	39.32	10.46	24 32	4.54	4 45	760.20	54.28	.585	19 01	35.65	8 91	.125	14 56	4 46
191....		III.	8 lbs. C.S.M.; 25 lbs. C.S.H.....	1:4.07	877.5	317.6	1005.2	84.65	38.73	8.70	25.97	4.07	4 16	767.85	54 85	.543	19 20	35.11	8 77	.118	15 04	4 61
		IV.	6 lbs. C.S.M.; 25 lbs. C.S.H.....	1:5.05	... .	259.5	1084.5	85.88	37.90	7.18	27.07	3.64	3 85	794.00	56.71	.485	19 85	37.06	9 26	.104	16 00	5 41
	Averages per Group.....				956.5	297.1	1141.4	80.54	37.83	8.42	25.48	3.93	4 22	775.56	55.38	.545	19 39	35.05	8 76	.121	15 17	4 54
B.		I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.....	1:4.5	835.0	222 4	1362.7	59.78	32.12	8.04	21.07	3.01	3 84	809.15	57.79	.474	20 23	38.44	9 61	.099	16 39	5 77
438....	II.	II.	10 lbs. C.S.M.; 20 lbs. S.H.....	1:3.8	845.0	332 6	877.5	78 56	49.02	10.33	33.48	5.21	6 00	814 00	58.14	.749	20 35	39.06	9 76	.160	14 35	3 76
653....		III.	8 lbs. C.S.M.; 30 lbs. S.H.....	1:5.51	602.5	263.2	959 9	79.26	48 87	8.64	35 43	4.79	5 76	836.50	59.74	.688	20 91	38.07	9 52	.152	15 15	3 76
		IV.	6 lbs. C.S.M.; 30 lbs. S.H.....	1:6.64	.....	211.5	1021.2	79.91	48.75	7.38	36.89	4.48	5 68	816.65	58.32	.695	20 41	37 39	9 35	.152	14 73	3 67
	Averages per Group				760.8	257.4	1055.3	74.37	44.69	8.59	31.72	4.37	5 32	819.07	58.50	.652	20 47	38.24	9 56	.141	15 15	4 24
405 ...		I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.....	1:4.5	930.0	242.6	1534.8	66.16	33.77	6.97	23.49	3.31	4 27	980.50	70.03	.435	24 51	42.66	10 66	.100	20 24	6 39
356 ..	III.	II.	10 lbs. C.S.M.; 16 lbs. C.S.H.; 33 lbs. S.....	1:3.75	877.5	381.8	1766.7	81.68	43 36	10.73	27.91	4.71	5 66	986.00	70.43	.573	24 66	48.14	12 03	.117	19 00	6 37
Gracie.		III.	8 lbs. C.S.M.; 18 lbs. C.S.H.; 35 lbs. S.....	1:4.66	993.0	310.8	1999.7	84 30	43.29	8.94	30.11	4.24	5 50	1069.55	76.40	.515	26 74	47.82	11 95	.115	21 24	6 45
		IV.	6 lbs. C.S.M.; 18 lbs. C.S.H.; 35 lbs. S.....	1:5 78	.....	249.0	2161.3	85.21	42.63	7.37	31.46	3.80	5 30	1076.85	76.91	.493	26 93	50.41	12 59	.105	21 63	7 29
[illegible]	Averages per Group				933.5	296.1	1865.6	79.34	40.76	8.50	28.24	4.01	5 18	1028.22	73.44	.504	25.71	47.51	11 81	.109	20 53	6 62
210 ..		I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.....	1:4.5	825.0	253.2	1608 5	69 12	35.31	7.28	24.57	3.46	4 44	968.15	69.14	.459	24 20	42 13	10 52	.106	19 76	6 08
182 ...	IV.	II.	6 lbs. C.S.M.; 4 lbs. B.; 16 lbs. C.S.H.; 33 lbs. S.	1:5.03	852.5	389.2	1863.3	84.52	43.87	8.17	31.94	3 76	5 90	984 20	70 29	.598	24 61	46.41	11 59	.127	18 71	5 69
220 ...		III.	4 lbs. C.S.M.; 6 lbs. B.; 18 lbs. C.S.H.; 35 lbs. S.	1:6.63	1250.0	401.8	1994.7	91.11	46.36	7.05	35.89	3.41	6 22	1051 88	75.11	.591	26 30	48.03	12 01	.129	20 08	5 79
		IV.	2 lbs. C.S.M.; 8 lbs. B.; 18 lbs. C.S.H.; 35 lbs. S.	1:8.90	... .	433.5	2221.1	103.67	51.19	6.05	41.98	3.17	6 63	1014.65	72 47	.653	25 37	47.00	11 75	.141	18 74	5 12
	Averages per Group				975.8	369.4	1921.9	87.10	44.18	7.14	33.59	3.45	5 40	1004.72	71.76	.575	25 12	45.89	11 47	.123	19 32	5 67
691 ...		I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.....	1:4.5	667.5	222.4	1428 1	60 47	31.01	6 40	21 59	3 04	3 92	887.05	63 35	.442	22 18	35.58	9 14	.112	18 26	5 22
115....	V.	II.	6 lbs. C.S.M.; 4 lbs. C.M.; 16 lbs. C.S.H.; 33 lbs. S.	1:5.78	800.0	338.9	1608 5	71.93	36.93	7.12	26 56	3.25	5 02	915.35	65 38	.548	22 88	39 87	9 96	.125	17 86	4 94
347 ..		III.	4 lbs. C.S.M.; 6 lbs. C.M.; 18 lbs. C.S.H.; 35 lbs. S.	1:8.1	1060.0	354 2	1758 1	79 53	43.64	5.44	35 14	3 05	5 35	1039.76	74 23	.514	25 99	42 47	10 61	.125	20 64	5 26
		IV.	2 lbs. C.S.M.; 8 lbs. C.M.; 18 lbs. C.S.H.; 35 lbs. S.	1:4.7	.....	378.0	1867.8	84.49	47.04	4.18	40.10	2.75	5 66	1010.95	72.20	.559	25 27	41 08	10 27	.137	19 61	4 61
	Averages per Group				842 5	323.4	1665.6	74.10	39.66	5.78	30 85	3.03	4 99	963.28	68 80	.515	24 08	40 00	9 99	.125	19 09	5 01
442....		I.	7 lbs. C.S.M.; 16 lbs. C.S.H.; 28 lbs. S.....	1:4.5	615 0	225 2	1442 8	62 08	31 58	6 48	22 06	3 09	4 00	877.20	62 65	.456	21 93	39 33	9 82	.102	17 93	5 82
406 ..	VI.	II.	6 lbs. C.S.M.; 4 lbs. O.; 16 lbs. C.S.H.; 33 lbs. S.	1:5.35	900.0	343 2	1604.6	73.40	38 71	6.97	28 31	3 43	5 32	1017.65	72.68	.522	25 44	49 40	12 34	.108	20 12	7 02
323 ..		III.	4 lbs. C.S.M.; 6 lbs. O.; 18 lbs. C.S.H.; 35 lbs. S.	1:7 38	1030.0	354 8	1688.3	76 41	40 13	5.93	30 96	3 24	5 61	1030.46	73 60	.544	25 76	49 54	12 38	.113	20 15	6 77
		IV.	2 lbs. C.S.M.; 8 lbs. O.; 18 lbs. C.S.H.; 35 lbs. S.	1:9.86	.....	367.0	1933.8	89.70	45.40	4 53	37.76	3 02	6 27	1035.10	73.94	.605	25 88	49 41	12 35	.127	19 61	6 08
	Averages per Group				848.3	322.5	1667.4	75.39	38.95	5.99	29.77	3.19	5 30	990 10	70.79	.532	24 78	46.92	11 72	.112	19 45	6 42

* The average cost of 100 pounds of milk and one pound of butter as given in this and Table XXIII. does not correspond exactly with that given in Table XVI. At most the differences are slight, and the apparent discrepancy is explained by the fact that in one case the average cost is first determined per cow, per period and per group by the addition of the three results obtained, while in the other instance it is obtained directly per groups.

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does not pass through the alimentary canal into the excrements; some is retained to aid in the formation of flesh, bone and milk. In the case of average milk cows this is estimated at 20 per cent. Allowing for this loss the fertilizing value of the foods used in this experiment is still $80.08, making the net food cost $43.16. If the excrements from the cows are carefully preserved, so as not to be readily fermented by undue exposure to the air, or leaching by heavy rains, by far the largest per cent of the fertilizing constituents can be successfully returned to the soil.

Supposing, however, that only 50 per cent is returned to the farm, we still have a fertilizing value in these foods of $50.05, and then the net cash outlay for the foods consumed would only rise to $73.19. Thus, in determining the cost of milk and butter production, the fertilizing value of the food stuffs must be carefully considered. By many it is held that the fertilizing material secured to the farm through stock husbandry covers the cost of care and feeding, whether beef or milk forms the object.

With the above data before us, this proposition seems fair and reasonable, and certainly points out the fact that this feature, so long neglected in our domestic economy, should receive careful attention.

On the other hand we must not lose sight of the fact that a high fertilizing value, or vice versa, may or may not be combined in the same meal with high productivity. Further, a meal or fodder may be poor in fertilizing elements and still so excel in ability as a productive factor as to make the former consideration insignificant. The appended data will aid in a better understanding regarding this matter.

Group	Total food consumed, lbs.	Total (less 20 per cent.) fertilizing value.	Total cost of milk and butter production.	Net cost of milk and butter production.
I	5783.4	$14 45	$16 89	$2 44
II	5241.0	13 74	21 28	7 54
III	8646.7	14 76	20 73	5 97
IV	9085.3	14 39	23 19	8 80
V	7956.0	11 10	19 95	8 85
VI	7939.7	11 64	21 20	9 56

This shows that the quantities of food consumed in Groups III., IV., V., and VI., were much the largest, but notwithstanding the great discrepancy in the amounts of food consumed by the several groups the fertilizing value was practically equal for Groups I., II., III., and IV., while a considerable decrease was shown by Groups V. and VI. It is plain that the first cost of the foods had a very decided influence on the net cost, as the character of the food had on the fertilizing value.

This table contains a summary of the performance of the several Groups by feeding periods, and also the average results shown by each Group for the entire experimental period. It is noteworthy that the quantity of dry matter and organic matter was low in the ration fed to all the Groups in Period I. The only instance when this ration proved the most profitable one fed was with Group II., and then it was only due to the added cost of the rations fed in the remaining Periods. In

nearly every other Period and Group the increase in the consumption of dry matter resulted in a material gain of milk, and in a number of cases of butter also. With Groups III., IV., V., and VI. the largest milk and butter yields were obtained, when 85.21, 91.11, 79.53, and 76.41 pounds of dry matter were disposed of per day. When 103.67 pounds of dry matter was used by Group IV. per day and 84.49 pounds with Group V., there was a decrease in the milk yield of 37.23 and 28.81 pounds for the periods when these amounts of dry matter were used. Thus an increase of 12.56 and 4.96 pounds of dry matter per day in the food of Groups IV. and V. was attended with a considerable loss in milk yields. This does not mean that the larger amount of dry matter eaten exerted any detrimental influence on the milk flow but that the optimum production was secured with smaller amounts and therefore the above food was wasted. This goes to show that cows will consume far more food than they can use advantageously in milk yields, and this refers us to a previous statement made concerning this matter, and the important bearing it has on profitable dairy yields (see p. 1086). Similarly it may be shown that large quantities of other food materials were wasted. An examination of the table will reveal the fact that decidedly larger yields of butter were secured with Groups III., IV., V., and VI. in Period II., as compared with Period I. It will also be observed that the quantity of dry matter and organic matter eaten in Period II. was largely in excess of that received in Period I. For example:

Group.	Dry matter, Period I., lbs.	Butter, Period I., lbs.	Dry matter, Period II., lbs.	Butter, Period II., lbs.
III	66.16	42.66	81.68	48.14
IV	69.12	42 13	84.52	46.41
V	60.47	36.58	71 93	39.87
VI	62.08	39.33	73.40	49.40

This data goes to prove that great injustice may be done the cows by a failure to give a liberal and properly constituted ration; and further, that much food may be wasted when no adequate returns in milk and butter are secured. This is one of the most important problems for consideration in the feeding of dairy cows, and, as is very evident, is one requiring most careful study so that a proper adjustment may be had, or the difference between profit and loss will be increased or decreased accordingly. The dairy man must therefore acquaint himself thoroughly with his cows and study their individual peculiarities, next investigate the character and composition of the food stuffs at his command and then by the use of a number of trial rations ascertain when a proper adjustment of the ration has been gained, so that he may obtain the optimum yields of milk and butter at the least cost. This reduces the hap-hazard method of feeding now practiced to something of a certainty, and places the dairy industry on a substantial business basis—the only possible basis for success.

Attention is here called to the fact that there were increased milk and butter yields obtained as the amount of cotton seed meal was reduced in the case of Groups I. and III., while with Groups IV., V., and VI., a reduction of the cotton seed meal to 4 pounds and the addition of 6

pounds of bran, corn meal, and oats, generally speaking, resulted in an increased yield of milk and butter. From this as well as the table it is evident that the production and cost of milk and butter was not more favorably affected by cotton seed meal than the other mixtures fed.

Period.	Group.	Nutritive ratio (when fed per 1000 pounds of live weight).	Dry matter, lbs.	Organic matter, lbs.	Protein, lbs.	Carbohydrates, lbs.	Fat, lbs.	Yields of milk, lbs.	Yields of butter, lbs.
IV.	I.	1:5.05	85.88	37.90	7.18	27.07	3.64	794.00	37.06
III.	II.	1:5.51	79.26	48.87	8.64	35.43	4.79	836.50	38.07
II.	IV.	1:5.03	84.52	43.87	8.17	31.94	3.76	984.20	46.41
II.	VI.	1:5.35	73.40	38.71	6.97	28.31	3.43	1017.65	49.40

The above table represents the digestible nutrients eaten by Groups I., II., IV. and VI, in Periods IV., III., II., and the yields of milk and butter secured from the same. The nutritive ratios of these four very divergent rations are practically the same. While it is true that these four rations were fed to separate groups of cows, it goes to show how easily the feeder may be misled by the use of a so-called standard ration, or one having a certain nutritive ratio. Here are four rations having similar ratios, but they differ materially as to the amounts of the several digestible nutrients they contain as widely as they differed in their productive capacities when fed to the four Groups shown above. These rations were compounded from different food stuffs, and the point is this: The average feeder has been led to believe that all that is needed is a certain ratio, whereas an indefinite number of rations may be secured having similar ratios, but as they come from different foods and are fed to different cows the results do not turn out as expected in actual practice, for the reasons shown above.

TABLE XXII.—*Comparison of Holstein and Jersey Grades in Production.*

HOLSTEIN GRADES.

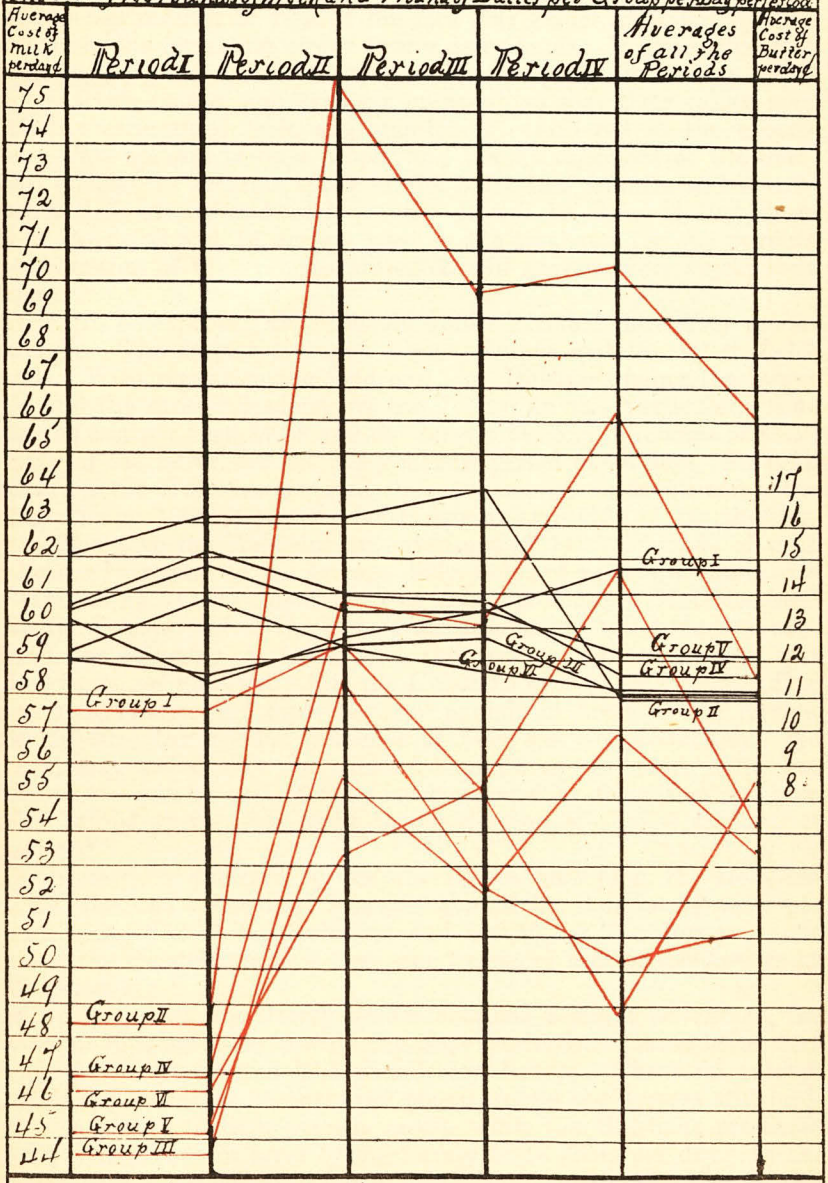
Ear tag number.	Final weight, lbs.	Cost of food.	Milk produced, lbs.	Milk per day, lbs.	Cost of 100 lbs. of milk.	Value of milk at 2½ cents per pound.	Butter produced, lbs.	Value of butter at 25 cents per pound.	Cost of a pound of butter.	Profit from selling milk.	Profit from selling butter.	Profit when milk is sold at 3 cts. per quart.	Profit when butter is sold at 20 cents per lb.	Rating of cows for milk.	Rating of cows for butter.
317.....	994.5	$5 97	1281.05	22.87	$0.466	$32 03	53.9	$13 47	$0.111	$26 06	$7 51	$13 25	$4 81	6	9
545.....	997.5	5 94	861.60	15.38	.666	21 54	41.3	10 32	.139	15 80	4 57	6 98	3 32	17	17
B	835.0	7 82	944.20	16.86	.828	23 61	50.5	12 62	.155	15 79	4 80	6 34	1 98	18	16
438.....	845.0	7 61	1249.60	22.31	.609	31 24	48.1	12 03	.158	23 63	4 42	11 13	2 03	7	18
Gracie	993.0	7 22	1439.85	25.71	.501	36 00	59.3	14 83	.121	28 78	7 61	14 38	4 64	5	7
220.....	1250.0	9 63	2006.18	35.82	.480	50 15	82.4	20 60	.117	40 52	10 96	20 46	6 85	1	3
347.....	1060.0	8 23	1530.60	27.33	.537	38 26	57.1	14 27	.144	30 03	6 04	14 73	2 91	4	13
323.....	1030.0	8 21	1109.65	19.81	.739	27 74	54.9	13 72	.149	19 53	5 51	8 43	2 75	13	14
Averages..	1000.6	$7 58	1302.84	23.26	.603	32 57	55.9	13 98	.137	25 02	6 43	11 96	3 66	...	...

JERSEY GRADES.

191.....	877.5	5 18	959.60	17.13	.539	23 99	45.0	11 25	.113	18 81	6 17	9 21	3 82	14	11
653.....	602.5	5 85	1082.50	19.33	.540	27 06	54.3	13 57	.108	21 21	7 72	10 39	5 01	11	6
405.....	930.0	7 10	1678.55	29.99	.423	41 97	73.8	18 45	.096	34 87	11 34	18 08	7 66	3	2
356.....	877.5	6 41	994.50	17.76	.644	24 87	55.8	13 95	.111	18 46	7 54	8 51	4 75	15	8
210.....	825.0	6 74	911.05	16.27	.740	22 77	47.0	11 75	.143	16 03	5 10	6 93	2 66	16	15
182.....	852.5	6 82	1101.65	19.67	.619	27 54	54.1	13 52	.126	20 72	6 69	9 71	3 98	12	10
691.....	667.5	5 38	1135.86	20.28	.473	28 40	53.2	13 30	.101	23 02	7 89	11 66	5 26	9	5
115.....	800.0	6 34	1186.65	21.19	.534	29 66	49.7	12 43	.127	23 32	6 09	11 46	3 60	8	12
442.....	615.0	5 45	1110.65	19.83	.490	27 77	54.7	13 68	.096	22 32	8 22	11 21	5 49	10	4
406.....	900.0	7 54	1740.11	31.07	.433	43 50	78.0	19 50	.097	35 96	11 96	18 56	8 06	2	1
Averages..	794.7	$6 28	1190.11	21.25	$.543	$29 75	56.5	$14 14	$0.112	$23 47	$7 87	$11 57	$5 03	.....	....

Diagramatic Chart G Showing

The Cost of 100 Pounds of Milk and 1 Pound of Butter per Group per Day per Period



* Reads towards the left

In profit from milk production, the Holsteins led. They averaged $25.02 per cow, while the Jerseys made $23.47 per cow, or $1.55 per head less than the Holsteins. In profit from selling butter, the advantage again reverted to the Jerseys, the individual profit derived in their case being $7.87, while the Holsteins showed $6.43, or $1.44 per head less than the Jerseys. Again is the importance of food cost displayed on the rating of cows whose productive capacities are similar, as in some instances observed in this table.

If the fertilizing value of the foods eaten had been disregarded, and the milk sold at 1½ cents per pound (i. e., allowing a cent per pound for the cost of milking and delivery), and the butter at 20 cents per pound (allowing 5 cents for the cost of manufacturing and delivery), the relative positions of the Holsteins and Jerseys would have been seriously affected, though the profit secured would still have proved gratifying, especially when we remember that this is the result of two months' feeding, and an average lactation period of 10 months would enable the results obtained to be multiplied by five. Supposing the prices indicated above to have been attached to the pound of milk and butter, the Holsteins would have yielded an average profit of $10.46 per head for milk and $3.66 for butter, while the Jerseys would show $11.57 for the former and $5.03 for the latter. This would have thrown the Jerseys into first place for both purposes, with an average advantage per head of $1.11 for milk and $1.37 for butter, and after all it is the respective food cost that would be responsible for these results.

Generally speaking, the data presented warrants the statement that for milk production the dairy farmer should choose Holstein grades (quality of the milk not considered), and Jersey grades where butter making is the object sought. We do not favor any particular breed. Equally good animals may be secured for dairy purposes among herds of mixed breeding and from any one of half a dozen pure breeds. We do advocate the use of the best sires obtainable for any specific purpose in breeding, but pedigree and performance must go hand in hand. In any form of comparison of different breeds, or their grades, there are some apparent weaknesses always present, so that the results attained can only serve as guides in a general way. Individuality and food cost play a very important part in such tests, as well as the breeding. For instance, the sires of the several cows used in the test differed materially in essential characteristics and predisposing tendencies; furthermore, the purity of the blood of the several cows varied, they being in some instances the result of a first cross or of a third or fourth cross upon the native stock; so that these, and many other factors, have a decided influence in determining the value of a cow, and make a fair comparison of this nature difficult.

In order that a clearer comparison might be made of the results obtained from feeding rations of cotton seed meal and cotton seed hulls and cotton seed meal and sorghum hay against different proportions of cotton seed meal and bran, cotton seed meal and corn meal, and cotton seed meal and oats, with cotton seed hulls and silage, the first period when all groups were fed the same ration has been omitted, and the last three periods averaged together. Groups I. and II. were always behind, though by ref-

TABLE XXIII.—*Summary of the Results of Feeding Coarse Foods and Cotton Seed Meal Against Silage, Cotton Seed Hulls, and a Variety of Meals.*

Ear tag number.	Group.	Period.	Ration fed per 1000 pounds live weight per day.	Nutritive ratio.	Final weight, lbs.	Meal eaten in 42 days, lbs.	Coarse foods eaten in 42 days, lbs.	Dry matter consumed per day, lbs.	Digestible matter consumed per day.				Cost of food.	Milk produced, lbs.	Milk per day, lbs.	Cost of 100 lbs. of milk.	Value of milk at 2½ cents per lb.	Butter produced, lbs.	Value of butter at 25 cents per lb.	Cost of a pound of butter.	Profit from selling milk.	Profit from selling butter.
									Organic matter, lbs.	Protein, lbs.	Carbohydrates, lbs.	Fat, lbs.										
317....		II.	10 lbs. C.S.M.; 20 lbs. C.S.H.	1:3.12	994.5	385.4	894.6	82.08	39.32	10.46	24.32	4.54	$4 45	760.20	54.28	$0.585	$19 01	35.65	$8 91	$0.125	$14 56	$4 46
545....	I.	III.	8 lbs. C.S.M.; 25 lbs. C.S.H.	1:4.07	997.5	317.6	1005.2	84.65	38.73	8.70	25.97	4.07	4 16	767.85	54.85	.543	19 20	35.11	8 78	.118	15 04	4 61
191....		IV.	6 lbs. C.S.M.; 25 lbs. C.S.H.	1:5.05	877.5	259.5	1084.5	85.88	39.70	7.18	27.07	3.64	3 85	794.00	56.71	.485	19 85	37.06	9 26	.104	16 00	5 41
Totals for three Periods					2869.5	962.5	2984.3	252.61	117.75	26.34	77.36	12.25	12 46	2322.05	165.84	1.613	58 16	107.82	26 95	.347	45 60	14 48
Averages for three Periods					956.5	320.8	994.8	84.20	39.25	8.78	25.78	4.08	4 15	774.02	55.28	.538	19 38	35.94	8 98	.115	15 20	4 83
B		II.	10 lbs. C.S.M.; 20 lbs. S.H.	1:3.8	835.0	332.6	877.5	78.56	49.02	10.33	33.48	5.21	6 00	814.00	58.14	.749	20 35	39.06	9 76	.160	14 35	3 76
438....	II.	III.	8 lbs. C.S.M.; 30 lbs. S.H.	1:5.51	845 0	263.2	959.9	79.26	48.87	8.64	35.43	4.79	5 76	836.50	59.74	.688	20 91	38 07	9 52	.152	15 15	3 76
653....		IV.	6 lbs. C.S.M.; 30 lbs. S.H.	1:6.64	602.5	211.5	1021.2	79.91	48.75	7.38	36.89	4.48	5 68	816.65	58.32	.695	20 41	37.39	9 35	.152	14 73	3 67
Totals for three Periods					2282.5	807.3	2858.6	237.73	146.64	26.35	105.80	14.48	17 44	2467.15	176.20	2.132	61 67	114.52	28 63	.464	44 23	11 19
Averages for three Periods					760.8	269.1	952.8	79.24	48.88	8.78	35.26	4.83	5 81	822.38	58.73	.711	20 56	38.17	9 54	.155	14 74	3 73
405....		II.	10 lbs. C.S.M.; 16 lbs. C.S.H.; 33 lbs. S.	1:3.75	930 0	381.8	1766.7	81.68	43.36	10.73	27.91	4.71	5 66	986.00	70.43	.573	24 66	48.14	12 03	.117	19 00	6 37
356....	III.	III.	8 lbs. C.S.M.; 18 lbs. C.S.H.; 35 lbs. S.	1:4.66	877.5	310 8	1999.7	84.30	43 29	8.94	30.11	4.24	5 50	1069.55	76 40	.515	26 74	47 82	11 95	.115	21 24	6 45
Gracie		IV.	6 lbs. C.S.M.; 18 lbs. C.S.H.; 35 lbs. S.	1:5.78	993.0	249.0	2161.3	85.21	42.63	7.37	31.46	3.80	5 30	1076.85	76.91	.493	26 93	50.41	12 59	.105	21 63	7 29
Totals for three Periods					2800.5	941.6	5925.7	251.19	129.28	27.04	89.48	12.75	16 46	3132.40	223.74	1.581	78 33	146.37	36 57	.337	61 87	20 11
Averages for three Periods					933.5	313.8	1975.2	83.73	43.09	9.01	29.83	4.25	5 49	1044 13	74.58	.527	26 11	48.79	12 19	.112	20 62	6 70
210....		II.	6 lbs. C.S.M.; 4 lbs. B.; 16 lbs. C.S.H.; 33 lbs. S.	1:5.03	825.0	389.2	1863.3	84.52	43.87	8.17	31.94	3.76	5 90	984.20	70.29	.598	24 61	46.41	11 59	.127	18 71	5 69
182....	IV	III.	4 lbs. C.S.M.; 6 lbs. B.; 18 lbs. C.S.H.; 35 lbs. S.	1:6.63	852.5	401.8	1994.7	91.11	46 36	7.05	35 89	3.41	6 22	1051.88	75.11	.591	26 30	48 03	12 01	.129	20 08	5 79
220....		IV.	2 lbs. C.S.M.; 8 lbs. B.; 18 lbs. C.S.H.; 35 lbs. S.	1:8.90	1250.0	433.5	2221.1	103.67	51.19	6.05	41.98	3.17	6 63	1014.65	72.47	.653	25 37	47.00	11 75	.141	18 74	5 12
Totals for three Periods					2927.5	1224.5	6079.1	279.30	141.42	21.27	109.81	10.34	18 75	3050.73	217.87	1.842	76 28	141.44	35 35	.397	57 53	16 60
Averages for three Periods					975.8	408.2	2026.3	93.10	47.14	7.09	36.60	3.45	6 25	1016.91	72.62	.614	25 43	47.15	11 78	.132	19 18	5 53
691....		II.	6 lbs. C.S.M.; 4 lbs. C.M.; 16 lbs. C.S.H.; 33 lbs. S.	1:5 .78	667.5	338.9	1608.5	71.93	36.93	7.12	26.56	3.25	5 02	915.35	65.38	.548	22 88	39.87	9 96	.125	17 86	4 94
115....	V.	III.	4 lbs. C.S.M.; 6 lbs. C.M.; 18 lbs. C.S.H.; 35 lbs. S.	1:8 .1	800.0	354.2	1758.1	79.53	43.64	5.44	35 14	3.05	5 35	1039.76	74.26	.514	25 99	42.47	10 61	.125	20 64	5 26
347....		IV.	2 lbs. C.S.M.; 8 lbs. C.M.; 18 lbs. C.S.H; 35 lbs. S.	1:11.7	1060.0	378.0	1867.8	84.49	47.04	4.18	40.10	2.75	5 66	1010.95	72.20	.559	25 27	41.08	10 27	.137	19.61	4 61
Totals for three Periods					2527.5	1071.1	5234.4	245.95	127.61	16.74	101.80	9.05	16 03	2966.06	211.84	1.621	74 14	123.42	30 84	.387	58.11	14.81
Averages for three Periods					842.5	357.0	1744.8	81.98	42.53	5.58	33.93	3.02	5 34	988.69	70.61	.540	24 71	41.14	10 28	.129	19 37	4.93
442....		II.	6 lbs. C.S.M.; 4 lbs. O.; 16 lbs. C.S.H.; 33 lbs. S.	1:5.35	615.0	343.2	1604.6	73.40	38 71	6.97	28.31	3.43	5 32	1017.65	72.68	.522	25 44	49.40	12 35	.108	20 12	7 02
406....	VI.	III.	4 lbs. C.S.M.; 6 lbs. O.; 18 lbs. C.S.H.; 35 lbs. S.	1:7.38	900.0	354.8	1688.3	76.41	40.13	5.93	30.96	3.24	5 61	1030.46	73.60	.544	25 76	49.50	12 38	.113	20 15	6 77
323		IV.	2 lbs. C.S.M.; 8 lbs. O.; 18 lbs. C.S.H.; 35 lbs. S.	1:9.86	1030.0	367.0	1933.8	89.70	45.40	4.53	37.76	3.02	6 27	1035.10	73.94	.605	25 88	49.41	12 35	.127	19 61	6 08
Totals for three Periods					2545.0	1065.0	5226.7	239.51	124.24	17.43	97.03	9.69	17 20	3083.21	220.22	1.671	77 08	148.28	37 08	.348	59 88	19 87
Averages for three Periods					848.3	355.0	1742.2	79.84	41.41	5.81	32.34	3.23	5 73	1027.74	73.41	.557	25 69	49.43	12 36	.116	19 96	6 62

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erence to Period I. in Table XVII. it will be seen that they compared very favorably with the other groups in milk and butter production, and especially will this be found true when the cases of Groups II., V., and VI. are compared. While it is true that Groups I. and II. made some increased yields of milk and butter in Periods II., III., and IV., they were insignificant and not at all in accord with what would be expected from their favorable comparison with the other groups in Period I. Evidently, then, their failure to give increased yields must be attributed to some other cause than lack of productive capacity, and it would seem that that other factor must be the nature of the food, and this is borne out by the fact that in the case of Groups I. and II. the ration might be termed a dry ration, and in the case of the remaining group a succulent one. A glance at the averages and the differences represented by them between the several groups will aid in giving a clearer idea concerning this matter.

Group.	Av. milk per day, lbs.	Av. cost of 100 lbs. milk.	Av. butter produced per Period, lbs.	Av. cost of a pound of butter.
I	55.28	53.8	35.94	11.5
II	58.73	71.1	38.17	15.5
III	74.58	52.7	48.79	11.2
IV	72.62	61.4	47.15	13.2
V	70.61	54.0	41.14	12.9
VI	73.41	55.7	49.43	11.6

The digestible nutrients fed the different Groups compared very favorably. Groups I. and II. received the most protein and fat, though somewhat less of carbohydrates and organic and dry matter than some of the groups. Thus, so far as the amounts are concerned, there was little cause for complaint, especially as Groups I. and II. had an abundant supply of protein, so long considered a desideratum; but in the matter of variety the last four Groups had decidedly the advantage. The best results were obtained when the digestible nutrients were supplied from several sources, and this was probably due to the well known favorable action of the constituents of one food on that of another, and also to the increased palatability thus secured.

Three different rations were fed each Group is as many Periods, and the influence of these on the milk and butter yields and economy of production will, therefore, be studied with interest. With Group I. little gain was secured from the changed rations. The one giving the largest increase, and making the cheapest milk and butter, was 6 pounds of cotton seed meal and 25 pounds of cotton seed hulls. Thus, 6 pounds of cotton seed meal proved more effective than 10 pounds. With Group II., 8 pounds of cotton seed meal and 30 pounds of sorghum hay proved more effective than 10 pounds of cotton seed meal and 20 pounds of

sorghum hay, and as effective as 6 pounds of cotton seed meal and 30 pounds of sorghum hay. In Group III., 6 pounds of cotton seed meal, 18 pounds of cotton seed hulls, and 35 pounds of silage was the cheapest and most effective ration used. When more than 6 pounds of cotton seed meal was used, it not only made the ration too expensive, but failed to yield large enough returns to make its use permissible.

With Group IV., the highest milk and butter yield and the cheapest milk was made when 4 pounds of cotton seed meal, 6 pounds of bran, 18 pounds of cotton seed hulls, and 35 pounds of silage constituted the ration.

In the case of Group V., 4 pounds of cotton seed meal, 6 pounds of bran, 18 pounds of cotton seed hulls, and 35 pounds of silage produced the cheapest milk and butter.

With Group VI., the most effective ration, from the standpoint of economic yields, was 4 pounds of cotton seed meal, 6 pounds of oats, 18 pounds of cotton seed hulls, and 35 pounds of silage.

It thus appears that in the mixed meal rations the use of 4 or 6 pounds of cotton seed meal, combined with 6 or 4 pounds of bran, corn meal, and oats, respectively, yielded the best returns. In practice, we would recommend the use of 4 pounds of cotton seed meal and 6 pounds of the others mentioned for cows in full flow. Less than four pounds of cotton seed meal does not seem effective.

By means of the appended data the influence of cotton seed meal, as compared with other meals in combination with it, on the increase of butter fat, may be obtained:

		Group I. Butter, lbs.	Group II. Butter, lbs.	Group III. Butter, lbs.	Group V. Butter, lbs.	Group VI. Butter, lbs.
Period	II	35.65	39.06	48.14	39.87	49.40
	III	35.11	38.07	47.82	42.47	49.50
	IV	37.06	37.39	50.41	41.08	49.41

In Periods II., III., and IV., when 10, 8, and 6 pounds of cotton seed meal constituted that portion of the ration for Groups I., II., and III., no increased yields of butter beyond slight variations were observed, and just as great variations were observed with Groups V. and VI., who received a mixed meal ration. From this data we must conclude, therefore, that cotton seed meal has no ability to increase the yield of butter fat above that of other meals used.

Diagramatic Chart H Showing

Averag cost and Profit on Milk and Butter per Group per Day per Period

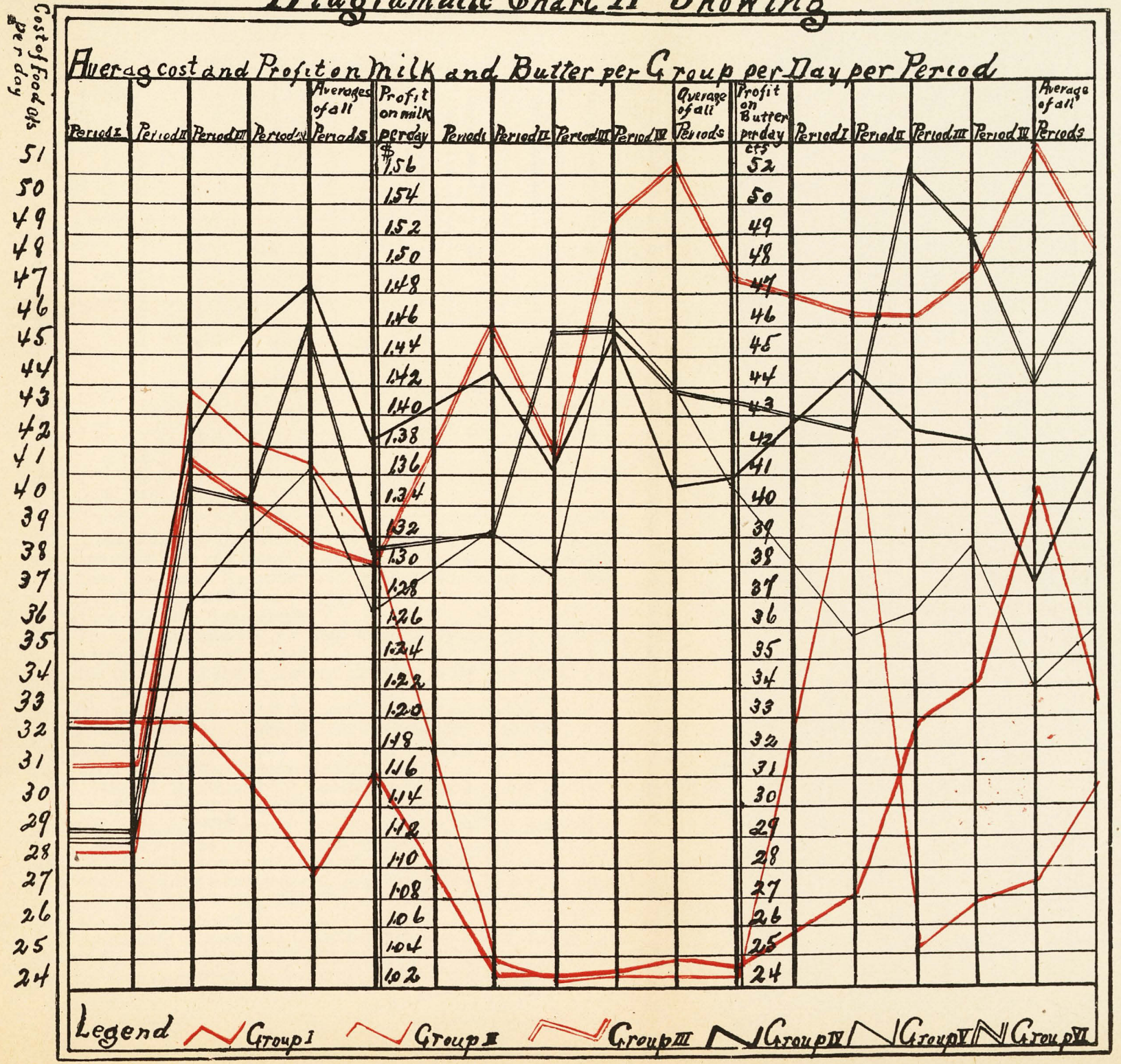

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TABLE XXIV.—*Rating of the Cows and Groups.*

Ear Tag No.	In milk production.	In butter production.	In value for milk.	In value for butter.	Group.	In milk production.	In butter production.	In value for milk.	In value for butter.
317.....	6	11	6	9					
545.....	18	18	17	17	I.	VI.	VI.	V.	V.
191.....	15	17	14	11					
B	16	13	18	16					
438.....	7	15	7	18	II.	V.	V.	VI.	VI.
653.....	13	9	11	6					
405.....	3	3	3	2					
356.....	14	6	15	8	III.	I.	I.	I.	I.
Gracie .	5	4	5	7					
210.....	17	16	16	15					
182.....	12	10	12	10	IV.	II.	III.	III.	III.
220.....	1	1	1	3					
691.....	9	12	9	5					
115.....	8	14	8	12	V.	IV.	IV.	IV.	IV.
347.....	4	5	4	13					
442.....	10	8	10	4					
406.....	2	2	2	1	VI.	III.	II.	II.	II.
323.....	11	7	13	14					

This table contains the rating of the cows and groups according to the quantity of milk and butter produced and the respective profits derived from the same. No better proof of the individuality of the cow is needed than is here afforded.

Further, it clearly demonstrates:

1. The different values a cow may have for special lines of dairy husbandry.

2. The influence of cost of food and character of the food on the cost of production.

3. It aids in the detection of the cows of little or small value.

220 stood first in three instances, but the cost of the food forced her into third place for profit under butter, while it raised 406 to first place and 405 to second place in this particular.

317, 545, 191, B, 438, and 653 were either poor cows or the character of the food was at fault. In the case of these two groups, the food was doubtless to blame. While every other group contained one cow making a poor showing (note 356, 210, 182, 691, 115, and 323), it will be seen by reference to previous tables (XXI.), that in Period I., when all cows received the same character of ration, these particular Groups made a much better showing than they ultimately possessed at the conclusion of the experiment.

The variability of some cows is strikingly developed in this table. As an example, take the case of 323, who occupied the 11th, 7th, 13th, and 14th positions respectively, while 191 occupied the 15th, 17th, 14th, and

11th, and 356, the 14th, 6th, 15th, and 8th. An example of the value of cows for milk and butter dairying is shown by 356, whose rating was 14 and 15 in milk values and 6 and 8 for butter.

With regard to the Groups, the rating being similar to that for individual performance, the positions held were rendered more uniform from the fact that good and bad cows were blended in the several Groups so as to give a fairly uniform average. The Groups receiving the greatest variety in the ration (both of meals and roughage), when the roughage consisted partly of silage, easily led. The position of Group III. was maintained because of the cheapness of its ration, and while Group IV. nearly equalled Group III. in production, the greater cost of its ration forced it down, and the same is true of Group V. and Group VI.

It is apparent from the data presented in this table that individual ability is of as much importance as good measurements. It will be noted that as a rule the cows possessed of large development in the respiratory, digestive, and pelvic regions were the best producers. Owing to the limited number of measurements presented here, no very definite conclusions can be drawn. Much has been said and written regarding the conformation of the dairy cow. To us the following requisites appear desirable, in harmony with natural laws, and in accord with the best results secured in practice.

Cows should be sought weighing more or less than 1000 pounds, possessed of well developed wedges and indications of great nervous energy. A clean cut contour, with a well fleshed body—not fat, not skin and bones. A wide, deep chest, and narrow withers, with great breadth and depth through the pelvic region. Tremendous digestive and udder capacity, and every indication of a great circulation of blood, as shown by external appearances, as the skin and milk veins, etc. Individual performance and hereditary influences are of more importance than any certain type in conformation. It is unreasonable to expect a mass of skin and bones to yield unlimited supplies of milk and butter. Such emaciation as has been advocated as essential in the conformation of the dairy cow may be disproved by the citation of dozens of instances when well fleshed cows were *record cows* in the dairy world. A sleek, smooth, well rounded out cow will give just as much, if not more, milk and butter, as a mass of skin and bones. Such a cow will be more vigorous, less subject to diseases and abortion, and retain her productive powers unimpaired for a longer time, for the reason that her stamina is better.

The extreme of the skin and bone theory has been reached, and we firmly believe it has been detrimental, in many instances, to the welfare of dairy herds. *It is time for a reaction, not to rush to the opposite extreme, but consisting of a practice based on the use of foods that will increase both the quantity and circulation of the blood, maintain the animal system in a state of equilibrium, and keep it in a healthy and vigorous condition at all times.*

TABLE XXV.—*Measurements of the Cows in Feet and Inches.*

Ear tag No.	Width of forehead.	Girth at chest.	Girth at flank.	Girth at navel.	Length from full rib to hook point.	Length of hind quarter.	Length of body.	Width at hook points.	Width at rumps.	Height at shoulders.	Height at hook points.	Depth from hooks to flank.	Circumference of udder.	Length of udder from front to rear.	Weight in pounds of cow.	Milk yielded, lbs.	Butter yielded, lbs.	Rating for milk.	Rating for butter.	REMARKS ON APPEARANCE.
317....	7 in.	6 ft. 3 in.	6 ft. 7 in.	7 ft. 3 in.	11 in.	1 ft. 5 in.	7 ft. 0 in.	1 ft. 8 in.	1 ft. 1 in.	4 ft. 2 in.	4 ft. 2 in	1 ft. 7 in.	3 ft. 3 in.	1 ft. 10 in.	994.5	1281.05	53.9	6	11	Only fair wedge, rather beefy, udder well formed, lethargic.
545....	6½ in.	6 ft. 0 in.	6 ft. 5 in.	6 ft. 7 in.	13 in.	1 ft. 5 in	6 ft. 3 in.	1 ft. 6 in.	1 ft. 1 in.	4 ft. 3 in.	4 ft. 0 in.	1 ft. 5½ in.	2 ft. 10 in.	1 ft 9 in.	997.5	861.60	41.3	18	18	Beefy type, nervous, udder well formed, head, neck, and shoulders coarse.
191....	8 in.	5 ft. 8 in.	6 ft. 4 in.	7 ft. 0 in.	1 ft. 2 in	1 ft. 6 in.	6 ft. 10 in.	1 ft. 4 in.	11 in.	4 ft. 0 in.	4 ft. 1 in	1 ft. 8 in.	2 ft. 9 in.	1 ft. 9 in.	877.5	959.60	45.0	15	17	Fair wedges, head and tail coarse, udder funnel shaped.
13....	7½ in.	5 ft. 11 in.	6 ft. 0 in.	6 ft. 10 in.	1 ft. 2 in	1 ft. 5½ in.	6 ft. 11 in	1 ft. 4 in.	10½ in.	4 ft. 3 in.	4 ft. 1 in	1 ft. 8 in.	.....	.....	835.0	944.20	49 0	16	14	Fair wedges, poorly formed udder, good barrel, quiet disposition.
438....	6½ in.	5 ft. 10 in.	6 ft. 1 in.	6 ft. 11 in.	1 ft. 2 in	1 ft. 4 in.	6 ft. 2 in.	1 ft. 6 in.	1 ft. 0 in	4 ft. 3 in.	3 ft. 10 in.	1 ft. 6 in	.....	.....	845.0	1249.60	48.2	7	15	Fair wedges, excitable, well formed udder.
653....	6 in.	5 ft. 2 in.	5 ft. 7 in.	5 ft. 9 in.	1 ft. 1½ in	1 ft. 1 in.	6 ft. 3 in.	1 ft 3 in.	10 in	4 ft. 0 in.	3 ft. 10 in.	1 ft. 6 in.	.....	.....	602 5	1082 50	54.3	13	9	Good wedges, clean cut features, gentle disposition, well formed udder.
405....	7½ in.	5 ft. 11 in.	6 ft. 4 in.	7 ft. 1 in.	11 in	1 ft. 4½ in.	6 ft. 4 in.	1 ft. 6 in.	11 in.	4 ft. 0 in.	4 ft. 0 in.	1 ft. 5 in.	3 ft. 7 in	2 ft. 0 in.	930.0	1678 55	73 8	3	3	Good dairy form, active but gentle, finely formed udder.
356....	7 in.	5 ft. 11 in	6 ft. 3 in.	7 ft. 0 in.	11 in	1 ft. 4 in.	6 ft. 1 in.	1 ft. 5 in.	11 in	4 ft. 0 in	3 ft. 11 in.	1 ft. 6 in.	2 ft. 9 in.	1 ft. 8 in	877.5	944.50	55 8	14	5	Beefy type, poorly shaped udder, coarse head and shoulders.
Gracie	7 in.	5 ft. 11 in	6 ft. 8 in.	7 ft. 1 in	1 ft. 4 in.	1 ft. 6 in.	6 ft. 9 in	1 ft. 7 in.	1 ft. 0 in	4 ft. 5 in	4 ft. 4 in	1 ft. 8 in	3 ft. 5 in	2 ft. 0 in.	993.0	1439.85	59.3	5	4	Bony, angular type of cow, large but poorly shaped udder, quiet disposition.
210....	6 in.	5 ft. 10 in.	6 ft. 3 in.	7 ft. 1 in	1 ft. 1 in	1 ft. 4 in.	5 ft. 10 in.	1 ft. 3 in.	10 in.	4 ft. 0 in.	3 ft. 11 in	1 ft. 8 in.	3 ft. 1 in.	1 ft. 8 in	825.0	911.05	47.0	17	16	Bright, active animal, good dairy type, udder evenly quartered.
182....	6 in.	5 ft. 9 in.	6 ft. 2 in.	6 ft. 11 in.	1 ft. 4 in.	1 ft. 6 in.	6 ft. 3 in.	1 ft. 5 in.	11 in.	4 ft. 1 in	4 ft. 0 in.	1 ft. 7 in.	2 ft. 11 in	2 ft. 4 in.	852.5	1101.65	54.1	12	10	Nervous cow, udder funnel shaped, wedges only fair.
220....	7 in.	6 ft. 3 in.	7 ft. 5 in.	7 ft. 10 in.	1 ft. 1 in	1 ft. 6 in.	7 ft. 1 in	1 ft. 7 in	1 ft. 2 in	4 ft. 4 in.	4 ft. 4 in	1 ft. 8 in.	3 ft. 4 in	2 ft. 3 in	1250 0	2006.18	82.4	1	1	Well developed udder, fine dairy type, strong, active, plenty of nervous energy.
691....	6 in.	5 ft. 3 in.	5 ft. 9 in.	6 ft. 2 in.	1 ft. 2 in.	1 ft. 5 in.	6 ft. 3 in.	1 ft. 3 in.	9 in.	3 ft. 9 in.	3 ft. 7 in	1 ft 5 in.	1 ft. 7 in.	3 ft. 0 in.	667.5	1135.86	53.2	9	12	Conforms to dairy type, udder development good, irritable disposition.
115....	6½ in.	5 ft. 7 in.	6 ft. 4 in.	7 ft. 0 in	1 ft. 5 in.	1 ft. 8 in.	6 ft. 2 in.	1 ft. 6 in	11 in.	4 ft. 1 in	3 ft. 11 in.	1 ft. 6 in.	2 ft. 6 in.	1 ft. 11 in.	800.0	1186.65	49.7	8	13	Fair dairy type, poorly formed udder, gentle in temperament.
347....	7 in.	6 ft. 1 in.	6 ft. 8 in.	7 ft. 5 in.	1 ft. 1 in	1 ft. 7 in	6 ft. 6 in	1 ft. 7 in.	1 ft. 0 in.	4 ft. 2 in.	4 ft. 2 in	1 ft. 7 in.	.....	.....	1060.0	1530.60	55.7	4	6	Large and beefy in type, fairly formed udder, very quiet.
442....	6 in.	5 ft. 2 in.	5 ft. 6 in.	6 ft. 2 in	1 ft. 1 in.	1 ft. 4 in.	5 ft. 11 in.	1 ft. 4 in.	10 in.	4 ft. 0 in.	3 ft. 8 in	1 ft. 5 in.	.....	.....	615.0	1110.65	54.7	10	8	Under sized cow, good dairy form, well developed udder.
406....	6½ in.	6 ft. 0 in.	6 ft. 8 in.	7 ft. 0 in.	1 ft. 1 in.	1 ft. 5 in.	6 ft. 9 in.	1 ft. 4 in.	11 in.	4 ft. 6 in.	4 ft. 5 in	1 ft. 8 in	3 ft. 5 in.	2 ft. 5 in.	900 0	1740.11	78.0	2	2	Fine dairy type, plenty of nervous energy, udder funnel shaped.
323....	6½ in.	6 ft. 0 in.	6 ft. 7 in.	7 ft. 5 in.	1 ft. 2 in.	1 ft. 5 in.	6 ft. 7 in.	1 ft. 6 in.	11 in.	4 ft. 3 in	4 ft. 2 in	1 ft. 8 in	.....	.....	1030.0	1109.65	54.8	11	7	Somewhat beefy, poorly formed udder, irritable disposition.
		For the sake of comparison, the measurements of the famous "record" cow Yentje Netherland is here attached.																		
Y. N..	12 in.	7 ft. 5 in.	8 ft. 3 in.	9 ft. 3 in	1 ft. 7 in.	1 ft. 7 in.	7 ft. 8 in.	2 ft. 5 in.	1 ft. 10 in.	4 ft. 11 in.	5 ft. 0 in	2 ft. 3 in.	6 ft. 3 in	.....	1650.0	20,232	625.5			