

FEEDING DAIRY CALVES

Minor Subject for M. S. Degree in Animal Husbandry

R. M. Patterson, Jr.

Object:

1. To study the growth and development of dairy heifers during the winter months.
2. To determine the relative value of cottonseed meal, copra nut meal, and velvet bean meal as concentrates, fed with corn silage as the sole roughage.
3. To determine the following:
  - a. Cost per month.
  - b. Cost per 100 pounds gain.
  - c. Development of the individual calf.
  - d. Average daily gains.
4. Comparison of these results with those from other experiment stations.
5. To study the following literature:

Dairy Cattle and Milk Production, by Eckles.  
Missouri Bulletin No. 135.  
Illinois Bulletin No. 165.  
Iowa Bulletin No. 165.

Student will be required to take examination on the above literature and to present thesis in triplicate.

All feeding, care, and weighing of calves to be done by student.

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The wintering of Dairy Heifers, like all practical Agricultural problems is one in which a variety of factors are to be taken into consideration and knowledge, experience, and, above all, good judgment must all be brought to play their full weight upon the subject before best results can be obtained.

The attributes of knowledge and experience are obvious requirements and need no discussion here. But the attribute of good judgment, though readily conceded to be necessary, is perhaps deserving of a few words because it bears directly upon the very root of the whole problem which is the decision as to the kind and amount of feed to be used in order to produce the best results at the least proportionate cost.

The ration which ~~xxx~~ fulfils these requirements is the best, or optimum ration, and lies somewhere between the maximum ration possible to be fed, and which produces the greatest amount of actual gain, and the minimum ration necessary to sustain the animals through the winter.

Neither extreme is ever justifiable because they are too expensive; it is not the maximum because of the law of diminishing returns, by which there is a decreasing ratio as the amount of feed increases, between the pro-

portionate results obtained and the proportionate profit, nor is it the minimum ration, because, early growth is bone growth, and it takes bone to make size, and size to bring in the returns so that money saved in feed at this time is later lost through low production.

Since the cost of feed is by far the most important economic factor involved in wintering calves, and as the price of feeds is constantly varying due to market and local conditions, it follows that the optimum ration will vary constantly also, and, it is in this respect that the good judgment of the dairyman is put to the test.

It will be readily understood that growth must not be confused with fattening, and that whereas it is a mistake to restrict the one it is equally a mistake, and a very expensive one, to encourage the other. However, it is advisable to have a slight margin on the safe side, especially in the case of dairy heifers, because so much of their later production of milk at a relatively high sale price is dependant upon their feed at this particular time, the feed being relatively low in cost, compared to the milk obtained later on.

Due to the present high price of practically all concentrates, the quantity of these fed must be kept at a minimum, and, since protein feed is what one pays highest for, it is advisable to use legume hays for

roughage whenever obtainable. Legumes are often expensive in certain localities, or not to be had at all, in which case, as in the present instance, corn silage may be used with every promise of exceptionally good results when used in conjunction with protein concentrates.

The following experiment was performed as the fourth of a series of annual experiments in operation at the Virginia Agricultural Experiment Station in order to compare the relative value of several rations composed of different kinds of feeds.

## FEEDING EXPERIMENTS FOR THE WINTER OF 1918 - 19.

The feeding experiments were carried on this season to determine the relative value and economy of cottonseed meal, copra nut meal, and velvet bean meal. The roughage used was the same for each lot, and consisted of 30 pounds corn silage per head per day.

Care of the Animals:- All heifers ran in the same lot during the day, but at night they were separated into their respective lots and stabled in three similar pens, where the feeding was done. All animals had access to a tank of water in the lot during the day. The feed pens were of ample size, feed mangers were split up into sections so that crowding for feed was minimized and bedding of straw was applied daily.

Discussion of Heifers Used:- Pure-bred heifers of two leading dairy breeds were used namely, Holstein-Friesian and Jersey. Fifteen animals were used averaging fifteen months of age, being divided as nearly equally as possible with respect to breed and weight. There were three lots, consisting of one Jersey and four Holstein-Friesians, and the average weights per lot were 485, 485, and 491 lbs. respectively. All the animals were in thin condition at beginning of test, but all lots made satisfactory gains during the test. Lots were distinguished by means

of neck-bands, and individuals by means of ear marks.

Weighings:- Weights were taken once a week, each animal being weighed separately. The weights represented by chart were taken at the end of each two week period and is an adequate graphic illustration of the changes of weight during the test.

Rations per head per day:- The following rations were used throughout the test:-

Lot I. 30 lbs. corn silage, 2.5 lbs. Cottonseed Meal.  
 Lot II. 30 lbs. Corn Silage, 3.25 lbs. Copra nut meal.  
 Lot III. 30 lbs. Corn Silage, 4.0 lbs. Velvet bean meal.

The corn silage was made from corn that would have yielded from 35 to 40 bushels of corn per acre and was of good quality. The concentrates carried the following guaranteed analyses:

	Protein (percent)	Carbohydrates. (per cent)	Fat. (per cent)	Fiber. (per cent)
Cottonseed Meal.....	38.6	22.0	6.9	12.0
Copra nut Meal.....	20.0	50.0	6.0	12.0
Velvet bean Meal....	16.5	50.0	4.0	15.0

Table Daily Rations for Growing Heifers Weighing 490 lbs.

Lots.	Rations.	Digestible	Net Energy
		Protein.	Value.
		Pounds.	Therms.
	Armsby's Standard	1.420	7.200
I	30 lbs. Corn Silage.	.330	4.770
	2.5 lbs. Cottonseed Meal.	.925	2.336.
		<u>1.255</u>	<u>7.106</u>
II	30 lbs. Corn Silage.	.330	4.770
	3.25 lbs. Copra Nut Meal.	.610	2.613
		<u>.940</u>	<u>7.383</u>
III	30 lbs. Corn Silage.	.330	4.770
	4 lbs. Velvet bean meal.	.629	3.393
		<u>.959</u>	<u>8.163</u>

Cost of Feeds:- The following prices were paid per ton for the

feeds used:

Corn Silage	\$8.50
Cottonseed Meal.	65.60
Copra Nut Meal.	60.00
Velvet Bean Meal.	55.00

RESULTS AND DISCUSSION OF THEIR MEANING.

Table Showing Results of Feeding Tests from Jan.3rd. to Apr.25th,1919.

	Lot I.	Lot II.	Lot III.
Number of heifers per lot.	5	5	5
Rations fed, lbs.	Corn Silage. 30 Cottonseed Meal. 2.5	Corn Silage, 30 Copra Nut Meal. 3.25	Corn Silage. 30 Velvet bean Meal. 4.0
Average first weight per head in pounds.	485	485	491
Average last weight per head in pounds.	629	635	585
Total gain per head in pounds.	144	150	94
Average daily gain in pounds.	1.21	1.26	.79
Average cost per heifer for month of 28 days.	\$5.86	\$6.30	\$6.65
Average cost per heifer for feeding period of 112 days.	\$ 23.46	\$25.20	\$ 26.60

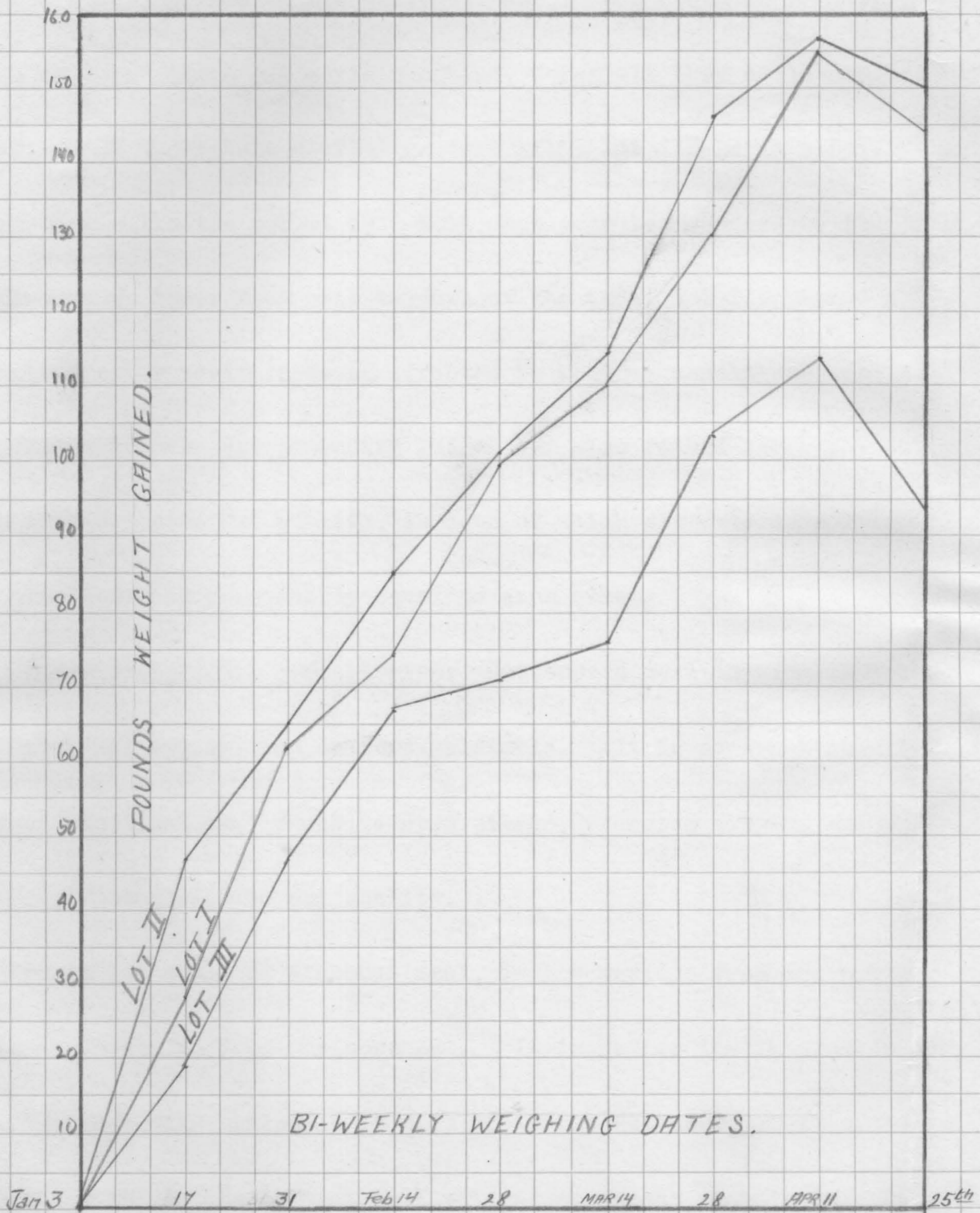
Discussion of Results:- From the standpoint of greatest gain for

least cost the concentrates used ranked in the following order: 1st, Cottonseed

Meal; 2nd. Copra nut meal; 3rd. Velvet bean Meal, the cost per one hundred <sup>lbs.</sup> gain being \$16.29, \$16.80, and \$27.20 respectively. The rations used were deficient in protein, <sup>and,</sup> excepting Lot I, a trifle in excess in carbohydrates and fat. It will be noticed that cottonseed meal, the most economical of the three rations used was not only the highest in protein content but also the lowest in therms energy, so that we may rightly charge the slightly superior gain in weight of Lot II to undesirable fat rather than growth, while Lot III though considerably higher in therms net energy value, was unable to even approximate the gains in weight of either of the other two lots. Here is a case where we pay dearly for unnecessary carbohydrates and fat. The relatively poor showing of velvet bean meal is also partly due to unpalatability. Copra nut meal is an excellent feed in every respect, and compares most favorably with cottonseed meal in cost, pounds, weight, gained, palatability, and merit as regards imparting sleek coats and quality to the animals fed.

The following chart shows average changes in weight of the heifers from week to week during the experiment.

DA. E Jan.-3 to Apr. 25 1919 SUBJECT Wintering Dairy Heifers.



Lot I	-	30	POUNDS	CORN	SILAGE	2.5	POUNDS	COTTONSEED	MEAL.
Lot II	-	30	"	"	"	3.25	"	COPRA	NUT MEAL.
Lot III	-	30	"	"	"	4.0	"	VELVET	BEAN MEAL.

For dairy heifers of the above weights it was found that thirty pounds of corn silage was ample roughage, being all they could comfortably handle. All three lots started on feed well, lot III being slightly inclined to dislike the velvet bean meal, but soon became used to it. Each lot cleaned up their feed well throughout the test. Lot III showed a somewhat greater tendency to be affected by weather conditions, and not only failed to make corresponding gains, but also ranked below the other lots, in smoothness and quality, in both of which respects lots I and II were excellent and practically equal to each other.

Discussion of the Concentrates: Cottonseed meal is rich in protein and therms net energy, and is very palatable. It is somewhat constipating. It is an excellent supplement to corn silage, promotes growth, and produces extremely fine condition and quality.

Copra nut meal, or cocoanut meal, is the residue from the process of oil - extraction from the cocoanut. It is rather low in protein compared to other oil-meals and is rich in therms net energy. It compares favorably with cottonseed meal as a silage supplement, and is distinguished by the same characteristics with regard to conditioning qualities. It is not so constipating as cottonseed meal, and is very palatable. In hot

weather it becomes rancid if kept more than a few weeks, but as a winter feed this fact is not an objection. No difficulty was experienced, in this respect, during the test.

Velvet bean meal, is rather low in protein, and fairly high in therms net energy. It is unpalatable, and proved in this experiment to be very slightly more than one-half as valuable as cottonseed meal as a weight producer, and about one-sixth more expensive.

Development of Individual Calves: Under this heading it may be stated that the amount of roughage fed, thirty pounds, is ample for six hundred pound animals, and excessive for animals under four hundred pounds, yet every individual rapidly attained capacity to handle this amount, and there was a minimum of waste throughout. The heifers showed variable characteristics with regard to rapidity of growth, and number of pounds gained.

This variability was due to difference of age, those of lighter weight making relatively speedier progress and greater gain.

Decidedly more individuality was shown with respect to holding up under temporary adverse conditions, such as rain, or fall in temperature, the heavier animals being less affected.

The Holsteins were superior to the Jerseys in this respect.

But from the standpoint of averages within lots over the full time on test very little breed-difference or "personal equation", was noticeable.

Comparison of results with those of other experiments: These results compare favorably with those of other experiments and the statements made regarding calf-feeding, and the conclusions drawn are supported by them especially in the following respects:

1. Corn silage is an excellent roughage for growing calves when supplemented by high-protein concentrates. It may be fed as the sole roughage without fear of unsatisfactory results.

References: Virginia Agricultural Experiment Station bulletin number 219.  
Purdue Agricultural Experiment Station Bulletin #1.  
Farmers' Bulletin - # 578.

2. It is economically sensible to push dairy calves for growth during their first and second winters because of the larger size, and consequently greater production obtained, always assuming animals of hopeful dairy qualities are used.

References: F. W. Wall, Proceedings, Soc. for Promotion of Agricultural Science, 1912.  
 Research bulletin No. 2, Missouri Agricultural Experiment Station.  
 Bulletin No. 135 of the same station.

3. Growth must not be confused with fat, and the latter must be avoided because of actual expense, and effect upon milking qualities of dairy animals.

References: Missouri Agricultural Experiment Sta. Bul. # 135.  
 "Feeds and Feeding", Henry & Morrison, 16 edition,  
 page 426, paragraph 704.

4. Because they are easily handled, it has become a common error to neglect the ration for growing stock after they have passed six months of age. Whereas experiments show that dairy heifers should be fed so as to gain at least one pound a day during the first and second winters.

References: Virginia Agricultural Experiment Sta. Bul. # 219.  
 "Feeds and Feeding", Henry & Morrison, 16 edition,  
 page 426 - Section IV.  
 "Farm Management" - Warren.

5. Protein concentrates especially oil or bean adequately supplement corn silage, and take the place of a legume roughage in rations for growing stock, comparing favorably as regards growth, gain, and cost, as indicated by Virginia Agricultural Experiment Station bulletin No. 219, winter 1915 - 1916. Also valuing clover hay at thirty dollars a ton, a ration of ten pounds corn silage and ten pounds hay for the same feeding period this winter would have cost \$21.56, which is only \$1.99 less than the Cottonseed lot, and not very much less than the copra nut meal and velvet bean lots, And what would the gains have been? Certainly no more, undoubtedly less, as this ration is sub-maintenance in both protein and net energy requirements; being .87 pounds protein and 1.74 therms N.E.V. from the standpoint given in Table \_\_\_\_\_.

And the condition and "handling" qualities of the animals would undoubtedly be greatly inferior to any of the concentrate-fed lots.

6. The concentrates used should be of narrow nutritive ratio. Compare lot III with Lot I and observe that growth, gain and economy were in direct proportion to protein, though Lot I was actually below the standard in therms net energy, while Lot III was in excess. Also compare Lot II

and III, and observe that Lot II though lower than Lot III in protein content, was a narrower nutritive ratio, and made double the gain. The nutritive ratios for cottonseed meal, copra nut meal, and velvet bean meal are 1:1.1,- 1:3.2,- and 1:4.0 respectively. (See paragraph 134 - Henry & Morrison, "Feeds and Feeding, 16 edition, P.91.)

7. From the above comparisons the conclusion is indicated that, while it is true that we pay more money for protein the expense lies rather in feeding rations carrying unnecessary and undesirable carbohydrates and fat. Which corroborates paragraph No. 1 and 5, and drives home the already known fact that it takes protein to make growth, and confirms the statement that we can afford to pay for it.

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