



The plane of nutrition in relation to milk production
by Joseph C Shaw

A THESIS Submitted to the Graduate Committee in partial fulfillment of the requirements for the Degree of Master of Science in Animal Husbandry
Montana State University
© Copyright by Joseph C Shaw (1933)

Abstract:

A pertinent problem in dairy cattle nutrition in the Western states is the selection or formulating of a practical method of feeding dairy cows whereby they may be fed more closely to theoretical requirements. The nutrients required can be estimated with a fair degree of accuracy by referring to the feeding standards which have been prepared by various investigators. These standards agree rather closely, and for all practical purposes they may be relied upon.

The usual method of apportioning grain is to feed each cow 1 pound of grain to each 3 or 4 pounds of milk produced, depending upon the richness, regardless of the quantity or quality of roughage consumed. This method of feeding is at fault, especially under Western conditions, because cows will get enough nutrients from good roughage alone to provide for the maintenance of their bodies as well as for the production of a certain amount of milk, and because 1 pound of grain does not provide enough nutrients for as much as 3 pounds of milk.

Western dairy husbandmen have attempted to work out a method of feeding that would be more satisfactory under their conditions. Since alfalfa hay is usually the cheapest dairy cattle feed that can be produced in large quantities in many Western states, the methods suggested have been based upon the assumption that the majority of dairymen feed alfalfa hay in large quantities as the sole roughage. In making up these feeding rules an attempt is made to determine the amount of nutrients in the form of alfalfa hay that dairy cows will consume, in excess of their maintenance requirements. Acting upon the accepted principle that the nutrients consumed by dairy cows in excess of their maintenance requirements are converted into milk, providing the cow does not make more than a slight gain in body weight, the number of pounds of milk that can be produced on this excess of nutrients is determined. Concentrates are then fed in sufficient amounts to provide the nutrients required, according to a certain feeding standard, for each pound of milk produced above this amount.

The object of this thesis, "The Plane of nutrition in Relation to Milk Production", is to give a summary of the present available information which may be of value, in working out a more satisfactory method of apportioning concentrates to dairy cows in Montana, or in the revision of the present method. A brief review is given of certain phases of dairy nutrition which deals more or less indirectly with the subject.

A more detailed review is given of the literature more directly applied to the subject, together with a discussion of an experiment conducted by the author under the direction of the Animal Husbandry Department of the Montana Experiment Station.

For the convenience of the reader, this thesis is divided into five parts; Part I gives in condensed form a review of the important daily cattle feeding stuff* in Montana.

Part II presents a review of the literature in regard to feeding methods, and experimental work dealing with the important problems involved in the feeding of alfalfa hay to dairy cows as the sole roughage.

Part III reviews very briefly the more important findings regarding the protein, energy, and vitamin requirements of dairy cows.

Part II presents in detail the methods of procedure and the results of an experiment which the author conducted under the direction of the Staff of the Animal Husbandry Department of the Montana Experiment Station.

Part I presents the general conclusions of the review of the literature and the results of the experiment.

THE PLANE OF NUTRITION IN RELATION TO MILK PRODUCTION

by

JOSEPH C. SHAW

A THESIS

Submitted to the Graduate Committee in partial fulfillment
of the requirements for the Degree of Master
of Science in Animal Husbandry
at Montana State College

Approved:

Louis Vinke

In Charge of Major Work

Louis Vinke

Chairman Examining Committee

F. B. Oster

Chairman Graduate Committee

Bozeman, Montana
June, 1933

MONTANA
STATE COLLEGE LIBRARY
BOZEMAN, MONTANA

N378
Sh 26 p
~~RESTRICTED~~
Cop. 2

N378
Sh 268

CONTENTS

	Page
Introduction	v
Part I - Feeds Available for Dairy Cattle Feeding in Montana . .	1
Roughages	1
Dried Legume Roughages	1
Dried Non-Legume Roughages	2
Concentrates	3
Nitrogenous Concentrates	5
Part II- Methods of Feeding-Dairy Cattle Experiments with	
Alfalfa Hay.	7
Methods of Feeding Advocated by Prominent Dairymen . . .	7
Woodward's Method versus the Usual Method	10
Amount of Alfalfa Hay that Dairy Cows will Consume. . .	21
Effect of Grain in Ration on Efficiency of Production .	25
Part III-Nutritive Requirements of Dairy Cows-Nutritive Energy-	
Vitamins and Minerals	28
Protein Requirements	28
The Supplementary Relations Among the Proteins of	
Feeds	33
Energy Requirements	35
Mineral and Vitamin Requirements	40
Part IV- Results of Experiment at Montana Station	47
A Comparison of Two Methods of Apportioning Grain to	
Cows in Milk	47
Objects of the Experiment	49
Methods of Experimentation	50
Average Production of the Two Groups	56
Comparison of the two Groups with Respect to the	
Nutrients Consumed and the Nutrients Required	56
Comparison of the Gain or Loss in weight of the two	
Groups	62
Comparison of the two Groups with Respect to Decline	
in Milk Yield	62
Average Daily Consumption of Alfalfa Hay	65
Conclusions	66
Part V- General Conclusions	68

	Page
Acknowledgements	70
Literature Cited	71



WELLS BOND

THE PLANE OF NUTRITION IN RELATION TO MILK PRODUCTIONIntroduction

A pertinent problem in dairy cattle nutrition in the Western states is the selection or formulating of a practical method of feeding dairy cows whereby they may be fed more closely to theoretical requirements. The nutrients required can be estimated with a fair degree of accuracy by referring to the feeding standards which have been prepared by various investigators. These standards agree rather closely, and for all practical purposes they may be relied upon.

The usual method of apportioning grain is to feed each cow 1 pound of grain to each 3 or 4 pounds of milk produced, depending upon the richness, regardless of the quantity or quality of roughage consumed. This method of feeding is at fault, especially under Western conditions, because cows will get enough nutrients from good roughage alone to provide for the maintenance of their bodies as well as for the production of a certain amount of milk, and because 1 pound of grain does not provide enough nutrients for as much as 3 pounds of milk.

Western dairy husbandmen have attempted to work out a method of feeding that would be more satisfactory under their conditions. Since alfalfa hay is usually the cheapest dairy cattle feed that can be produced in large quantities in many Western states, the methods suggested have been based upon the assumption that the majority of dairymen feed

alfalfa hay in large quantities as the sole roughage. In making up these feeding rules an attempt is made to determine the amount of nutrients in the form of alfalfa hay that dairy cows will consume, in excess of their maintenance requirements. Acting upon the accepted principle that the nutrients consumed by dairy cows in excess of their maintenance requirements are converted into milk, providing the cow does not make more than a slight gain in body weight, the number of pounds of milk that can be produced on this excess of nutrients is determined. Concentrates are then fed in sufficient amounts to provide the nutrients required, according to a certain feeding standard, for each pound of milk produced above this amount.

The object of this thesis, "The Plane of Nutrition in Relation to Milk Production", is to give a summary of the present available information which may be of value, in working out a more satisfactory method of apportioning concentrates to dairy cows in Montana, or in the revision of the present method. A brief review is given of certain phases of dairy nutrition which deals more or less indirectly with the subject. A more detailed review is given of the literature more directly applied to the subject, together with a discussion of an experiment conducted by the author under the direction of the Animal Husbandry Department of the Montana Experiment Station.

For the convenience of the reader, this thesis is divided into five parts:

Part I gives in condensed form a review of the important dairy cattle feeding stuffs in Montana.

Part II presents a review of the literature in regard to feeding methods, and experimental work dealing with the important problems involved in the feeding of alfalfa hay to dairy cows as the sole roughage.

Part III reviews very briefly the more important findings regarding the protein, energy, and vitamin requirements of dairy cows.

Part IV presents in detail the methods of procedure and the results of an experiment which the author conducted under the direction of the Staff of the Animal Husbandry Department of the Montana Experiment Station.

Part V presents the general conclusions of the review of the literature and the results of the experiment.

