

MANUAL OF DAIRY FARMING



W. K. CLARE



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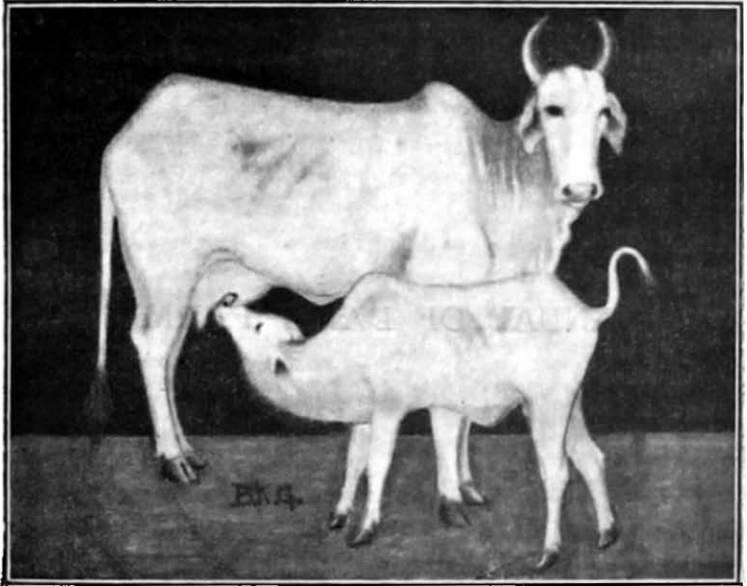
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MANUAL OF DAIRY FARMING

MILK IS VITAL TO NATIONAL HEALTH



अभिवर्धताम् पयसा

अभि राष्ट्रेण वर्धताम् ।

अथर्व वेद ६।७।२

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MANUAL OF DAIRY FARMING
FOR INDIAN STUDENTS

BY

B. K. GHARE, L.Ag. (Bom.)

LECTURER, AGRICULTURAL COLLEGE, CAWNPORE.
(Retired)

MACMILLAN AND COMPANY, LIMITED,
BOMBAY · CALCUTTA · MADRAS · LONDON

1928

First Published 1928
Transferred to Macmillan & Co., Ltd
Second Edition, Revised and Enlarged 1928.

Printed by M. N. Kulkarni, at the Karnatak Printing Press,
318 A, Thakurdwar, Bombay

and

Published by F. E. Francis, for Macmillan & Co., Ltd.,
Hornby Road, Bombay.

**IN MEMORY
OF
MY DEAR DAUGHTER
LEELAVATI**

Born 31st October, 1914.

Died 14th September, 1928.

PREFACE TO THE FIRST EDITION

LITERATURE is positively correlated to the collective thought and action of a country and hence it is taken as an index of the progress the country has made in any particular line of work. Dairy literature published in our country is very poor and this fact alone is quite sufficient to show how far our country is lagging behind other nations in the science and art of dairying. Fortunately, however, efforts are being made in several directions to improve the present deplorable condition and to add to the present literature is one of these. The publication of this little book is an humble attempt to give only the rough outlines of such a vast and vitally important subject and it does not aspire to any thing beyond this.

In our country, dairying on modern lines is at present in its infancy and hence this little book may have its own weak points ; but it is hoped that the very defects may give impetus to progress in dairy farming and if fortunately such an impetus be given, my object in publishing this book would be amply fulfilled.

I acknowledge my indebtedness to Professors R. V. Damle and M. G. Phatak of the Agricultural College, Cawnpore, and to S. T. Gadre, Esqr., Industrial Chemist to Government, U. P., for their valuable help and friendly encouragement, without which, the publication of this book would not have been possible.

AGRICULTURAL COLLEGE, }
CAWNPORE, }
10th July 1923. }

AUTHOR.

PREFACE TO THE SECOND EDITION

SINCE the publication of the first edition some progress has been made in the science and practice of Dairying and in this regard the feeding experiments taken up by our Agricultural Departments, the establishment of the Imperial Institute of Dairying and Animal Husbandry at Bangalore and the Central Cattle Bureau are worth noting.

In bringing out this second edition an attempt is made to keep pace with the progress recently made in Dairying in our country by making ample use of the latest available information.

Three new and important chapters on (1) Feeding Experiments, (2) Dairy Bacteriology and (3) Dairy Economics have been added in the present edition and it is hoped that they will not only make up the deficiency in this regard in the first edition, but also be found very useful.

In this added portion, though more technical, the same easy style of expression has been maintained as in other chapters to render the subject matter readable without overtaxing the reader. Sufficient scope and margin, however, will yet be found left for the teacher and professor of the agricultural institutions where the book will be used as a text to elucidate the subject by throwing further illuminating light on it while teaching.

The progress in the science and practice of Dairying so far made in our country is decidedly hopeful, yet it would be found to be much too little if only a glance is given at the vast area that still remains uncovered in the field of Dairy-

ing. It is, therefore, with a deep feeling of constraint that I again repeat the sentiment and hope to which I had given expression in the first edition that the very consciousness of our backwardness in Dairying may itself be helpful in giving a strong and sustained impetus to the desire of accomplishing that progress with rapid strides in the near future.

I have to acknowledge my indebtedness to Dr. Clouston, C.I.E., M.A., D.Sc., Agricultural Adviser to the Government of India, for allowing me to quote the summaries of the Feeding Experiments carried on by our Agricultural Departments and to Mr. William Smith, the Imperial Dairy Expert, for kindly sparing a portion of his valuable time to go through the manuscript and then consenting to write his weighty introduction to this edition of my humble book on the subject which he loves so dearly and in which, concerning India, he is an authority.

I have also to thank him for making some very valuable suggestions regarding the subject matter dealt with in the book and further for putting me under personal obligations by sending me photos of typical Dairy animals.

Many thanks are also due to all the Dairy and Cattle-Farm Managers who were kind enough to send their replies in response to my questionnaire for collecting correct data on Dairying.

POONA:
May, 1928.

}

AUTHOR.

CONTENTS

	Page
Introduction—	
PART I. RUDIMENTS OF AGRICULTURE.	
Chapter I.—THE SOIL	1
1. Dairying and agriculture. 2. The soil. 3. Some physical properties of the soil. 4. Soil moisture. 5. Soil aeration. 6. Plant food in the soil. 7. Nitrification in soil. 8. Soil fertility.	
Chapter II.—MANURES	14
9. Manuring. 10. Cow-dung manure. 11. Sheep and goat-dung manure. 12. Night soil manures. 13. Green manure. 14. Saline manures.	
Chapter III.—CULTIVATION	22
15. Land for fodder and preliminary work. 16. Farm buildings, cattle and implements. 17. Preparation of seed bed. 18. The seed and sowing. 19. Irrigation. 20. Crop Harvesting and threshing. 21. Arrangement for foddere.	
PART II. CATTLE MANAGEMENT.	
Chapter IV.—HOUSING OF CATTLE	35
22. Cattle sheds. 23. Site for cattle sheds. 24. Types of cattle sheds. 25. Floor of cattle shed. 26. Walls and roof. 27. Food troughs. 28. Air space. 29. Other buildings.	

	Page.
Chapter V.—FEEDING OF CATTLE	43
30. Feeding. 31. Foods and fodders. 32. Constituents of foods and fodders. 33. Functions of food constituents. 34. Digestion of food constituents. 35. Comparative feeding value of food stuffs. 36. Balanced ration. 37. Concentrated foods. 38. Jowar. 39. Maize. 40. Bajra. 41. Rice straw. 42. Guinea grass. 43. Oat and barley green fodders. 44. Bhusa of oats, wheat and barley. 45. Grass hay. 46. Lucerne and clovers. 47. Carrots. 48. Pulse crop fodders. 49. Pulse seeds and their bye products. 50. Cotton seed. 51. Linseed. 52. Rape and mustard. 53. Other oil cakes. 54. Condiments and food adjuncts. 55. Silage. 56. Nagpur silage experiments.	
Chapter VI.—GENERAL MANAGEMENT OF CATTLE.	75
57. Tying of cattle. 58. Feeding, watering and grazing. 59. Grooming and exercise. 60. Bathing. 61. Care of pregnant animals. 62. Care at delivery time. 63. Weaning. 64. Care of calves. 65. Dehorning. 66. Care of sick animals.	
Chapter VII.—FEEDING EXPERIMENTS	84
67. Feeding experiments. 68. Lyallpur digestibility trials. 69. Experiment with bhusa and gram. 70. Experiment with bhusa-maize, and bhusa-shisham. 71. Second series of Lyallpur digestibility trials. 72. Bangalore maintenance experiment. 73. Estimation of	

net energy values. 74. Physiological effects.
 75. Growth production experiment. 76.
 Bangalore milk production experiments. 77.
 Summary of milk production experiment.

PART III. MILK AND ITS PRODUCTS.

Chapter VIII.—MILK 118

78. Udder. 79. Formation of milk. 80. Constituents of milk. 81. Properties of milk. 82. Variation in the quantity and quality of milk. 83. Species. 84. Breed. 85. Food and fodder. 86. Individuality. 87. Lactation. 88. Time of milking. 89. Age. 90. Portions of a milking. 91. Season. 92. Part of udder. 93. Other factors. 94. Limits of variation of milk constituents.

Chapter IX.—MILK PRODUCTS 136

95. Milking of cattle. 96. Care after milking. 97. Purification of milk by cream separator. 98. Refrigeration of milk. 99. Pasteurization of milk. 100. Sterilization of milk. 101. Distribution. 102. Cream. 103. Setting process. 104. Cream separator. 105. Preparation by separator. 106. Standardizing cream. 107. Pearson's formula. 108. Separated milk. 109. Butter. 110. Butter milk. 111. Cheese. 112. Casein. 113. Preparation of dahi and butter. 114. Ghee. 115. Khova, Khoys, or Mava. 116. Dairy room.

	Page.
Chapter X.—TESTS FOR MILK, CREAM AND BUTTER	163
117. Standard for milk. 118. Sampling for Analysis. 119. Specific gravity. 120. Total solids in milk. 121. Richmond's scale. 122. Fat percentage in milk. 123. Adulteration. 124. Fat percentage incream. 125. Water percentage in butter. 126. Amyl alcohol.	
Chapter XI.—DAIRY BACTERIOLOGY	173
127. Bacteria. 128. Effect of temperature. 129. Moisture and bacteria. 130. Food material. 131. Occurrence. 132. Bacteria and their work. 133. Bacteria and the soil. 134. Cattle food and bacteria. 135. Bacteria and the body of the cow and milker. 136. Other sources. 137. Lactic bacteria. 138. Gas-forming bacteria. 139. Bacteria acting on casein. 140. Producing a ropy consistency. 141. Pathogenic bacteria. 142. Keeping quality of milk and bacterial content. 143. Bacterial standards, and milk supply of cities.	
PART IV. CATTLE BREEDING.	
Chapter XII.—PRINCIPLES OF BREEDING... ...	194
144. Variation. 145. Causes of Variation. 146. Heredity. 147. Inheritance and variation. 148. Irregularity in transmission of characters. 149. Prepotency. 150. Heredity and diseases. 151. Heredity and sex. 152. Correlation. 153. Fecundity. 154. Oestrus. 155. Maturity. 156. Sex. 157. Nutrition. 158. Environment. 159. Average type of a breed. 160. Statistical methods.	

Page-

Chapter XIII.—BREEDING AND BREEDS OF CATTLE 220-

161. Cattle breeding and Standard of excellence.
 162. Selection. 163. Statistical methods of judging cattle. 164. Mating. 165. Crossing.
 166. Grading. 167. In-breeding. 168. Indian dairy breeds. 169. Delhi buffalo. 170. Surti buffalo. 171. Jaffrabadi buffalo. 172. Sindi cow. 173. Gir cow. 174. Mewati cow. 175. Hariana cow. 176. Montgomery cow. 177. Cross-breed.

PART V. DAIRY ECONOMICS.

Chapter XIV.—DAIRY ECONOMICS 254-

178. Preliminary considerations. 179. Land. 180. Buildings. 181. Live stock. 182. Cows vs. buffaloes. 183. Dead Stock. 184. Feeding. 185. Grazing. 186. Labour. 187. Sundries. 188. Economic life of a dairy animal. 189. Marginal cow and marginal dairy. 190. Dairy data. 191. Dairy accounts.

Appendices: A. Av. Composition of Foods & Fodders.	293
B. Co-efficients of Digestibility	295
C. Feeding Standards	297
D. Dairy Equipment	300
E. Data for Dairy Estimates	301
F. Building Material for Estimates	302

Glossary

Index

LIST OF ILLUSTRATIONS.

		Page..
Plate	1. Cowshed, partly in section	40
"	2. Silage making — spraying water ...	68
Figure	1. Internal Structure of Udder	119
"	2. Alveoli (magnified)	120
Plate	3. Herd recorder, milk cans etc.	139
"	4. Separator, Pasteurizer, and Refrigerator	142
"	5. Sterilizer, Churn, and Butter Worker ...	153
"	6. Gerber's fat test apparatus	168
"	7. Bengal Cow	210
"	8. Krishna Valley Bull	222
"	9. Amrit Mahal Pair	223
"	10. Amrit-Mahal Cow — work type ...	224
"	11. Guernsey Cow	225
"	12. Malvi Cow — Work type	226
"	13. Malvi bull — Work type	227
"	14. Hissar Cow — double purpose type ...	228
"	15. Nellore Cow — " "	230
"	16. Delhi Buffalo	241
"	17. Sindi Murra buffalo	243
"	18. Jaffrabadi buffalo bull	244
"	19. Sindi Cow	245
"	20. Sindi bull	246
"	21. Gir Cow	247
"	22. Haryana Cow	248
"	23. Haryana bull	249
"	24. Montgomery bull	250
"	25. Montgomery Cow	251
"	26. Ayr-Hissar Cow	252
"	27. Ayr-Montgomery Cow	253

INTRODUCTION

Of late years the thinking public in India have begun to take a live and ever increasing interest in such questions as public health, the raising of the standard of living of the ryot, and the progress of agriculture, and there is no specific question bearing on these subjects so important as the question of the improvement of Indian cattle. The cattle question is of course the milk question, and milk supply is one of the factors which has a very direct bearing on public health. The cattle question also directly affects every phase of agriculture and thereby the prosperity and well being of the cultivator, the real wealth earner in India. The cultivation of every crop depends to some extent on the efficiency of the ryot's working cattle. Then the cattle question in India is one which must be of extraordinary interest to the economist in that India by reason of the sentiments of her people does not, generally speaking, kill and eat her surplus cattle population, and the country is therefore called upon to maintain enormous herds of useless cattle, cattle who by reason of advanced age are unfit to work and to give milk, and cattle which were at no period of their existence good enough to be used either as workers, stud animals or milk producers.

Seeing that India does not rear cattle for the product of beef, she only demands two qualities from her cattle population; *vis.*, draught efficiency from the male and milk yielding capacity from the female. It is now generally admitted that these two qualities can be combined in any of the types required for the varying conditions of different parts of the country, and so the cattle question in India is and must be the dairy question. It naturally follows that

the country needs light and leading on a subject of such universal importance and in this the second edition of his work, Mr. Ghare makes an honest and comprehensive attempt to deal with the situation.

India is a vast country and within its bounds are found numerous types of cattle and many and varied conditions under which they live and work and breed, so much so, that I believe it is impossible for any one living person to write a detailed and accurate account of Indian Dairying as now carried on in every part of the country ; but this book, so far as I am aware, is the only modern publication which attempts to deal with the dairying problem from an all India point of view and for this reason it will meet an ever increasing demand as a text book, and reference work regarding Indian Dairying. While in the main I agree with the conclusions drawn by Mr. Ghare in the work, I do not hold myself responsible for any of his opinions nor for any of the figures, records or results he has compiled. The importance of the subject demands that we shall have reliable dairy literature dealing with Indian Dairying conditions and Mr. Ghare's work is a sound and comprehensive attempt to deal with the subject within the limits imposed by a readable text book and as such I confidently recommend it to the Indian public.

BANGALORE :
December, 1927. }

WILLIAM SMITH,

*Imperial Dairy Expert &
Secretary, Central Bureau
of Animal Husbandry.*

APPENDICES

APPENDIX A.

AV. COMPOSITION OF FOODS AND FODDERS.

(From Departmental Publications.)

Green Fodders.

Name.	Moisture %	Oil %	Proteids %	Carbo-hydrates %
Jowar ...	69'52	0'48	1'36	14'81
Oats ...	83'51	0'37	0'94	9'00
Sarson ...	86'13	0'47	2'00	4'64
Nagli ...	80'83	0'48	1'94	7'85
Barley ...	79'62	0'45	2'46	8'20
Lucerne ...	78'03	0'76	3'40	11'55
Senji ...	84'40	0'36	2'69	6'16
Guinea grass ...	67'47	0'94	2'25	16'53
Moth ...	74'70	0'89	3'20	12'00
Kangni ...	76'79	0'54	2'08	10'08
Maize Silage ...	81'87	0'21	0'77	9'44
Jowar Silage ...	60'52	0'65	1'89	21'37
Am-Sorghum ...	64'05	.. ..	1'51	15'66
Wheat green ...	82'65	0'40	1'87	7'56
Maize green ...	88'92	0'31	1'13	4'65

Straws and Bhusas.

Name.	Moisture %	Oil %	Proteids %	Carbo-hydrates %
Jowar ...	8'91	2'46	3'21	46'22
Oats ...	9'88	1'97	3'00	41'31
Rice ...	10'22	1'23	2'56	40'46
Wheat ...	8'71	0'98	3'01	37'93
Tur ...	8'81	4'40	11'01	44'67
Gram ...	8'41	2'27	3'65	45'86
Kulith ...	5'60	2'63	5'25	49'66
Wal ...	9'92	3'72	13'37	43'04
Urd ...	15'96	1'70	11'19	39'14
Mung ...	13'30	2'52	10'88	40'35
Pea ...	8'57	3'02	10'84	42'63
Grass good ...	9'77	.....	4'54	46'47
Grass poor ...	11'04	.....	1'77	45'21

Grains, Seeds and Bye-products.

Name.	Moisture %	Oil %	Proteids %	Carbo-hydrates %
<i>Grains :-</i>				
Jowar	10.71	3.69	9.71	72.38
Bajra	8.77	5.33	9.52	73.52
Oats	10.47	5.69	7.68	59.38
Barley	12.39	1.85	6.62	71.55
Maize	10.58	4.81	9.66	71.59
Wheat	13.33	1.76	9.74	70.18
Gram	9.98	4.39	18.14	57.94
Gwar	9.83	2.81	27.29	48.18
Kulith	8.82	0.80	18.18	62.29
Pea	10.56	0.93	20.12	61.34
<i>Oil Seeds :-</i>				
Cotton seed	9.82	18.65	17.31	31.15
Linseed	5.80	40.31	17.91	26.12
<i>Cakes :-</i>				
Niger seed	7.42	9.30	38.56	25.48
Til	10.23	12.51	30.56	29.75
Safflower	9.71	7.05	34.88	27.19
Ground nut	6.49	10.82	38.02	26.31
Linseed	11.72	9.69	29.57	35.02
Rape	10.38	9.53	30.06	33.77
Mustard	8.01	10.54	32.52	35.55
Cotton seed	12.06	6.23	19.78	38.89
Ground nut and niger mixed	8.38	8.63	36.00	26.97
Rape and Cotton seed mixed	9.45	7.80	24.28	40.30
Cotton seed meal	8.32	4.60	5.84	50.17
Rice bran	8.21	8.31	5.72	34.25
Wheat bran	10.02	3.67	11.75	61.47

APPENDIX B.
CO-EFFICIENTS OF DIGESTIBILITY
(KELLNER.)

Feeding Stuff.	Proteids.	Oil.	Carbo- hydrates.
<i>Green fodders :—</i>			
Pasture grass	75	66	79
American maize	65	72	73
Green Sorghum	62	85	78
Oats flowering	75	70	63
Barley flowering	70	62	73
Lucerne in flower	81	45	72
Soja beans	75	54	73
<i>Hays :—</i>			
Meadow Hay medium	57	51	64
Millet hay	63	53	59
Lucerne hay medium	68	53	62
<i>Straw, Chaff, Husks :—</i>			
Wheat straw	4	31	37
Oat straw	33	36	46
Barley straw	25	39	53
Rice straw	45	47	32
Bean straw	49	57	68
Pea straw	60	46	64
Wheat chaff	26	43	33
Oats chaff	38	48	49
Rice husks	10	67	35
Earthnut husks	36	96	39
<i>Roots and Tubers :—</i>			
Potato	51	...	90
Mangels	70	...	95
Turnips	73	...	92
Cabbage	80	84	95
<i>Grains :—</i>			
Oats	76	80	76
Barley	70	89	92
Maize	72	89	95
Field beans	87	83	91
Peas	86	65	93
Vetches	88	92	100
Soja beans	89	90	69
Linseed	91	86	55
Cotton seed	68	87	50
Locust beans	68	53	95

CO-EFFICIENTS OF DIGESTIBILITY—(Continued.)

(KELLNER.)

Feeding Stuff.	Proteids.	Oil.	Carbo- hydrates.
<i>Industrial Products :—</i>			
Wheat bran	79	71	71
Wheat flour	86	92	83
Barley bran	85	87	86
Barley meal	72	38	99
Pea husks	71	73	90
Brewer's grains fresh	73	86	62
Brewer's grains dry... ..	71	88	60
Rape cake	81	79	76
Linseed cake	86	92	78
Cotton seed meal decort.	86	94	67
Cotton seed meal undecort.	77	93	52
Earthnut cake	90	90	84
Palm nut cake	75	98	77
Coconut cake	78	97	83
Poppy cake	79	92	64
Sesame cake	90	90	56
Molasses	52	...	91
<i>Animal Product :—</i>			
Cow's milk	94	100	98

APPENDIX C.

FEEDING STANDARDS.

I.—*Wolff Lehmann Standard.*

For 1000 lbs. body wt.

	Dry M.	D. f rot.	D. Carb.	Oil D.	Alb. Ratio.
<i>Maintenance</i>	18	0·7	8·0	0·1	1 : 11·8
<i>Cow 22 lbs. milk</i>	29	2·5	13·0	0·5	1 : 5·7

II.—*Swedish "Feed-unit" Standard.*

1 lb. of standard grain feed is the unit such as corn, barley.

Food required to equal

1 feed unit.

Corn wheat, barley	...	...	1·0 lbs.	
Cotton seed meal	...	...	0·8 "	
Oil meal	...	...	0·9 "	
Wheat bran, oats	...	...	1·1 "	
Lucerne hay	...	...	2·0 "	
Oat hay, Oat and pea hay	...	...	2·5 "	
Corn stover	...	...	4·0 "	
Lucerne green	...	...	7·0 "	
Sorghum, corn, oats green	...	...	8·0 "	
Carrots	...	...	8·0 "	
Rape green	...	...	10·0 "	
		Prot.		Feed units.
Maintenance		0·65		6·60
1 lb. milk		0·045-0·05		0·33

III.—*Haecker Standard.*

		Dig. Cr. Prot.	D. Carbo.	D. Fat.
Maintenance		0·700	7·00	0·100
1 lb. milk	3 % Fat.	·047	·20	·017
"	3·5 "	·049	·22	·019
"	4·0 "	·054	·24	·021
"	4·5 "	·057	·26	·023
"	5·0 "	·060	·28	·024
"	5·5 "	·064	·30	·026
"	6·0 "	·067	·32	·028
"	6·5 "	·072	·34	·029
"	7·0 "	·074	·36	·031

IV.—Savage's Standard.

	Dig. Cr. Prot.	T. Dig. Nutri.
Maintenance	0·700	7·925
1 lb. milk of 3·0 % Fat.	0·057	0·287
" 3·5 "	0·061	0·319
" 4·0 "	0·065	0·350
" 4·5 "	0·069	0·379
" 5·0 "	0·073	0·405
" 5·5 "	0·077	0·431
" 6·0 "	0·081	0·457
" 6·5 "	0·085	0·484
" 7·0 "	0·089	0·508

V.—Eckles Standard.

	Dig. true Protein.	Net Energy Therms.
Maintenance	0·500	6·00
1 lb. milk of 3·0 % Fat.	0·050	0·26
" 3·5 "	0·052	0·28
" 4·0 "	0·055	0·30
" 4·5 "	0·058	0·33
" 5·0 "	0·062	0·36
" 5·5 "	0·066	0·40
" 6·0 "	0·070	0·45
" 6·5 "	0·075	0·50

VI.—Armsby Standard.

	Dig. true Protein.	Net Energy Therms.
Maintenance	0·500	6·000
1 lb. milk of 3·0 % Fat.	0·043	0·224
" 3·5 "	0·045	0·232
" 4·0 "	0·049	0·265
" 4·5 "	0·052	0·291
" 5·0 "	0·055	0·315
" 5·5 "	0·058	0·338
" 6·0 "	0·061	0·361
" 6·5 "	0·064	0·385
" 7·0 "	0·068	0·408

VII.—Woll-Humphrey Standard.

	Dry M.	Dig. Crude Prot.	T. Dig. Matter
Maintenance	12·5	0·70	7·9
less than 0·5 lb. fat	16·2	1·18	10·6
0·5-0·75 ..	18·7	1·49	12·3
0·75-1·00 ..	21·1	1·80	14·1
1·00-1·25 ..	23·6	2·11	15·8
1·25-1·50 ..	26·0	2·43	17·6
1·50-1·75 ..	28·5	2·74	19·3
1·75-2·00 ..	30·9	3·05	21·1

VIII.—Modified Wolff Lehmann Standard.

	Dig. Cr. Prot.	Total dig. Nutrients.
Maintenance	0·700	7·925
1 lb. milk containing		
2·5 % Fat	0·045-0·053	·256
3 % ..	·047-0·057	·286
3·5 % ..	·049-0·061	·316
4 % ..	·054-0·065	·346
4·5 % ..	·057-0·069	·376
5 % ..	·060-0·073	·402
5·5 % ..	·064-0·077	·428
6 % ..	·067-0·081	·454
6·5 % ..	·072-0·085	·482
7 % ..	·074-0·089	·505

APPENDIX D.

DAIRY EQUIPMENT.

Connected with Cattle.

Ropes, chains, pegs, baskets, brooms, brushes, towels and dusters, strings, wooden spades or rakes, buckets, sticks, stools, marking irons, needle, wooden hammer, lanterns.

Feeding of Cattle.

Chaffcutters, grain and cake crushers, baskets, rakes, steeping vats, balances with weights, sacks, buckets, carts, scythes, spanners, lubricating oil, sharpening stone.

Fodder growing.

Ploughs, cultivators, harrows, hoes, clod crushers, picks, crowbar, khurpas, water lifts, carts, baskets, sacks, seed drills, yokes, ropes, chains, measuring tape or chain, spades, balance with weights, tools for ordinary repairs.

Milk.

Herd recorder, milk cans of various sizes, milk measures, milk strainer, milking pots, buckets, muslin cloth, pasteurizer and cooler, seals and seal pincers.

Cream.

Cream vessels and vats (China or ordinary), buckets, strainer, floating thermometer, cream separator, temperature can.

Butter.

Churn, strainer and sieves, scoops and scotch hands, butter worker, butter box or ice chest, enamelled buckets, beater, butter colour, salt, butter paper and cloth, ready reckoner, balance, marble table, butter prints.

Analytical work.

Sampler, sample bottles, butyrometer with test tubes etc. complete, amyl alcohol, sulphuric acid, hydrometer, thermometer, Richmond's scale, spirit lamps, preservatives, balance.

Miscellaneous.

Towels, cloth, soap, soda, dusters, brushes, brooms, lubricating oil, lamps, Pot. permanganate, boiler, fuel, oil feeders, spanners, time piece, lamp, registers and account books, drying racks and stands, balance with weights, matches, spirit, quick lime, copper sulphate, office equipment and fly papers.

APPENDIX E.

DATA FOR DAIRY ESTIMATES.

Live Stock :—

$$(a) \frac{\text{Mds. of milk required daily} \times 40}{\text{Av. daily yearly yield in Sr. of a cow}} = \text{No. of cows required.}$$

$$(b) \frac{\text{Mds. of milk required daily} \times 40}{\text{Av. daily yield in a lactation in Sr. of a cow}} = \text{No. of milking:}$$

cows.

(c) In a herd about 60 per cent. cows remain in milk.

(d) One stud bull is required for every 30 to 40 cows.

(e) One pair of bullocks is required for every 6 to 8 acres.

Land :—

 $\frac{1}{2}$ to 1 acre for fodder growing and $\frac{1}{2}$ to 1 acre for grazing per head.

Menial Staff :—

1 boy for every 20 calves.

1 man 25 cows while grazing.

1 10-12 cows for cleaning the shed and food distribution..

1 for milking.

Food and fodder :—

(a) *Conc. food*— $\frac{3}{4}$ the milk yield for cows and 1-2 seers for bullocks and 2-4 seers for stud bulls roughly.(b) *Bulky fodder*—Dry fodder 2-10 and green 5-20 seers according to the kind and quantity of fodders available per head daily.(c) *Silage*—25 to 35 % loss in silage making.**Depreciation** :—Live stock 10 % ; dead stock 10 % ; Buildings 3 %.**Calves** :—Roughly 4 calves in 5 years.**Manure** :—60 to 100 mds. according to method of preservation and amount of water, litter etc. added per head.**Milk** :— $2\frac{1}{2}$ to $3\frac{1}{2}$ and 4 to 5 seers daily yearly average of cows and buffaloes respectively.

APPENDIX F.

BUILDING MATERIAL FOR ESTIMATES.

- (1) **Brick work, 1st class** :—Bricks 1520, size $9 \times 4\frac{1}{2} \times 2\frac{1}{2}$ " allowing 5% wastage.
Slaked lime 16 cu. ft.
Sand 24 ..
- (2) **Brick work, 2nd class** :—Bricks 1350, Slaked lime 20 cu. ft.
Sand 30 cu. ft.
- (3) **Brick and mud work** :—Bricks 1350, Mud 30 cu. ft.
- (4) **Concrete trap metal** :—Metal 103 cu. ft. Sand 46 cu. ft.
Lime slaked 23 cu. ft.
- (5) **Concrete of broken bricks** :—Broken bricks 100 cu. ft.
Sand 25 cu. ft. Lime 25 cu. ft.
- (6) **Cement concrete** :—Cement 20 cu. ft.; Sand 40 cu. ft.
Broken stone 100 cu. ft.
- (7) **Pointing masonry** :—Slaked lime and Sand $1\frac{1}{2}$ each.
- (8) **Pointing brick work** :—Slaked lime and sand 2 cu. ft. each.
- (9) **Cement pointing** :—Cement and sand $\frac{3}{8}$ cu. ft. each.
- (10) **Lime plaster** :—Lime and sand 6 cu. ft. each.
- (11) **Cement plaster** :—Cement and sharp sand 4 cu. ft. each.
- (12) **Brick floor** :—

Bricks No.	Lime cu. ft.	Sand cu. ft.	Concrete cu. ft.	Bricks.
650	6	9	50	Laid on edge.
375	4	6	50	flat.

- (13) **Roof** :—Country round tiles 2200
Bangalore tiles ($16 \times 9\frac{1}{2}$ ")—150.
- (14) **Wire fencing** :—Angle iron, $5\frac{1}{2} \times 2 \times 2\frac{1}{2}$ "—2 cwt.
Galvanized iron wire No. 4, 500 ft.
Strain hooks with nuts 7.

The quantities given above are for 100 ft. cubic, superficial or running as the case may be.

(From P.W.D. Specifications.)

GLOSSARY

Ajwain :—	Bishop's weed (<i>Carum copticum</i>) a condiment.
Arhar :—	Region pea, (<i>Cajanus indicus</i>), a pulse.
Bajra :—	Bulrush millet, (<i>Pennisetum typhoidium</i>) a cereal.
Bhusa :—	The stuff left behind after threshing and separating the grain of such crops as wheat, barley, etc.
Bhusi :—	Husk of pulse seeds.
Chappar :—	Thatch of grass, straw, etc.
Chavali :—	Cow pea, (<i>Vigna catiang</i>), a pulse.
Chuni :—	A bye product obtained in preparing Dal from pulses. It contains some husks and small broken piece of cotyledons and embryo of pulse seeds.
Chhatak :—	A weight = 1/16 of a seer = 2 ozs. roughly.
Dabi :—	Milk curdled with normal lactic fermentation.
Dal :—	Cotyledons of pulse seeds (without husk).
Ghee :—	Clarified butter.
Guari :—	Cluster bean, (<i>Cyamopsis psoralioides</i>), a pulse.
Gur :—	Raw cane-sugar
Haldi or Haldi :—	Turmeric, a condiment.
Jowar :—	Great Millet (<i>Sorghum vulgare</i>) a cereal.
Kachcha :—	In the text indicates earthen, without masonry work.
Karbi :—	Dried straw of cereals like Jowar.
Kharif :—	Rainy season (June to September).
Khowa or Khoya :—	Milk reduced to semi-solid consistency by boiling and evaporating water.
Kutthi :—	Horse gram, (<i>Dolichos biflorus</i>), a pulse.
Lota :—	A metal pot.

GLOSSARY

Maund (md) :—	A weight = 40 seers = 80 lbs. roughly.
Mawa :—	See Khowa.
Moht :—	A leather or metal sheet basket used for raising water for irrigation, a water lift.
Mung :—	Green gram, (<i>Phaseolus radiatus</i>) a pulse.
Nala :—	Small water course.
Phol :—	See Bhusi.
Pucca :—	In the text means with masonry work.
Purda :—	A curtain.
Rabi :—	Cold season (November to April).
Seer :—	A weight = 1/40 maund = 2 lbs. roughly.
Sonf :—	Fennel (<i>Foeniculum vulgare</i>), a condiment.
Soya :—	A condiment (<i>Paucidanum graveolens</i>).
Tatti :—	A structure made of grass, straw, etc., to serve the purpose of a curtain or wall.
Til :—	Sesame (<i>Sesamum indicum</i>), oil seed.
Tur :—	See Arhar.
Urd :—	A pulse (<i>Phaseolus mungo</i>).
Wai :—	A pulse (<i>Dolichos lablab</i>).
Zira :—	Caraway (<i>Cuminum cyminum</i>).

INDEX

Numbers refer to pages

Abdominal vein	113	Balanced ration	... 52
Acid, Sulphuric	169	Barley	... 61
Adulteration of milk	... 170	Bathing	... 77
Aerobic bacteria	19, 177	Bhusa, quality of	... 61
Age, influence of, on milk	... 131	Bhusi	... 64
Agriculture and dairying	... 1	Bile	... 47
Air space	... 40	Body points	... 221
Albumin, milk	... 121	Breeding, in—	... 240
Albuminoid ratio	... 49	" , line	... 241
Alveoli	118, 120	Buildings, farm	24, 42, 257
Ammonium sulphate	... 21	Butter	... 151
Amyl alcohol	169, 173	" , colour	... 152
Anaerobic bacteria	19, 177	" , fats	... 121
Annatto colour	... 152	" , milk	... 156
Array	... 219	" , ratio	... 156
Atavism	... 202	" , water % in	... 172
Average deviation	... 216	Butyrometer, Gerber's	... 167
" type	... 212		
Bacilli, tubercle	... 187	Calf shed	... 42
Bacteria	173, 177	Calorie	... 45
" , acting on casein	... 185	Calves, care of	... 80
" , aerobic	19, 177	Calves, weaning of	... 80
" , effect of temp. on	174	Canal irrigation	... 29
" , food for	... 176	Carrots	... 63
" , gas-forming	... 185	Casein	121, 158
" , in soil	... 179	Catch crops	... 13
Bacteria lactic	... 184	Cattle, efficiency of	... 43
Bacteria, moisture and	... 175	Cattle sheds	... 35
" , pathogenic	... 186	" , doors of	... 39
" , producing ropiness	186	" , drains in	... 37
" , work of	... 179	" , floor of	... 37
Bacterial content	80, 182, 188	" , site for	... 36
" nodules	... 19	" , types of	... 36
" standards	... 189	" , ventilation in	... 38
Bajra	... 60	" , walls of	... 38

Cattle, tying of	... 75	Death rate	275, 278
Character, the term	... 194	Dehorning	... 81
" causes of trans-		Delivery, care at	... 78
" mission of	... 197	Deviation, average	... 216
Cheese	... 157	" standard	... 217
Chuni	... 64	Digestibility coefficients	47, 87, 89
Clovers	... 62	Digestion	... 46
Colostrum	... 128	Disinfecting fluids	... 162
Concentrated food	... 58	Economic life of a cow	... 274
Condiments	... 66	Energy value	... 49
Cooler	... 140	Environment	... 210
Correlation	204, 235	Exercise	... 76
Cotton seed	... 65	Fallowing	... 13
Cowdung manure	... 15	Farm buildings	24, 42, 257
Cow, marginal	... 280	" cattle	24, 259
Cow & Buffalo	... 262	" implements	25, 266
Cream	... 145	Fecundity	... 205
" finding fat % in	... 171	Feeding	43, 75, 268
" ripening of	... 146	" standards	... 54
" separator	... 147	" values	... 48
" standardizing	... 150	Field operations	... 12
Crop, exhaustive	... 12	Floor, cattle shed	... 37
" restorative	... 12	" space	... 38
" rotation of	... 13	Fodder growing	1, 22, 32
Cross breeds	... 252	Food adjuncts	... 66
Crossing	... 238	Foods and Fodders	... 127
Cultivation calendar	... 33	Foods concentrated	... 58
Dahi	... 159	" " constituents of	... 44
Dairy accounts	... 283	" " functions of	... 45
Dairy animal, body points of	223	Food troughs	... 39
" " economics of the		Food units	... 49
" " life of	... 274	Garlic	... 67
Dairy data	... 281	Ghee	67, 160
Dairy, marginal	... 281	Ginger	... 67
" rooms	... 161	Gir bread	... 247
Dairies, types of	... 255	Grading	... 239
Darwin's theory	... 198		
Dead stock	... 266		

Grazing	75, 272	Mammary glands	... 118
Grooming	... 76	Manu	... 272
Growth requirements	... 105	Manuring	10, 14
Guinea grass	... 60	Marginal cow	... 280
Gur	... 67	Mating	... 237
Gypsum	... 21	Maturity	... 207
		Mava	... 160
Hariana breed	... 249	Median	... 219
Harvesting	... 30	Mewati cow	... 248
Hay	32, 62	Milk	... 118
Heat value	45, 49	.. air in	... 122
Herd recorder	... 138	.. cavity	... 119
Heredity	196, 198	.. constituents	... 121
.. and disease	... 203	.. detecting adultera-	
.. and sex	... 203	.. tion in	... 170
		.. distribution of	... 144
Implements	25, 266	.. factors affecting	... 125
In breeding	... 240	.. finding fat % in	167
Individuality	... 127	.. formation of	... 119
Irrigation	... 29	.. mineral matter in	121
		.. pasteurization of	141
Jaffrabadi breed	... 244	.. production, energy	
Jowar	... 58	.. cost of	... 115
		.. properties of	... 123
Karbi	... 32	.. purification of	... 140
Khova	... 160	.. refrigeration of	... 140
		.. sampling of	... 164
Labour	... 272	.. scale, Richmond's	166
Lactation	... 128	.. separated	... 151
Lactic bacteria	... 184	.. sp. gr. of	123, 165
Lactometer	... 165	.. standard for	... 163
Land for fodder	22, 256	.. sterilization of	... 143
Line breeding	... 241	.. sugar	... 121
Linseed	... 65	.. variation in	... 125
Live stock	... 259	.. vein	... 118
Lucerne	... 62	Milking	... 136
		.. care after	... 138
Maintenance ration	... 53	.. portions of a	... 131
Maize	... 59	Mode	219, 233

Montgomery cow	...	250	Saline manures	...	20
Murrah buffalo	...	242	Saliva	...	46
Mustard	...	65	Salt, common	...	66
Nitre	...	20	Sampling of milk	...	164
Nitrification	8, 180		Season, influence of, on milk	...	132
Nitrogen, urinary	...	113	Seed bed, preparation of	...	25
Nodules, bacterial	19, 177		" sowing	...	27
Nutrition	...	208	Selection	...	221
Oats	...	61	Sewage	...	18, 29
Oestrus	...	206	Sex	...	203, 207
Oil cakes	66, 127		Sick animals, care of	...	82
Pancreatic juice	...	47	Sickness, signs of	...	82
Pasteurizer	...	141	Silage	...	67
Pearson's formula	...	150	" experiment	...	71
Pedigree	...	224	Sindhî breed	...	245
Pepsin	...	46	Slide rule, Richmond's	...	166
Percolation	...	5	Soil, aeration in	...	6
Plant food	...	7	" capillarity	...	5
Porosity	...	3	" classification of	...	2
Potassium nitrate	...	20	" constituents of	...	2
" sulphate	...	21	" fertility	...	9
Pregnant animals, care of	...	77	" formation of	...	2
Prepotency	...	202	" moisture	...	4
Pulse crop fodders	...	63	" nitrification in	...	8
Rape	65, 127		" physical properties	...	3
Ratio, albuminoid	...	49	of	...	3
Ration, balanced	...	52	" plant food in	...	7
Refrigeration	...	140	Sonf	...	67, 127
Rennet	...	157	Sowing, methods of	...	27
Retentiveness of soil	...	4	Species, influence of, on milk	...	126
Reversion	...	202	Sp. gr. of milk	...	165
Rice straw	60, 102		Standard, bacterial	...	189
Roof, riding	...	38	" breeding	...	220
Rotation of crops	...	13	" for milk	...	163
			" rations	...	54
			Starch values	...	48
			Statistical methods	...	212, 232
			Sterilization of milk	...	143

v

Stud bull, influence of	... 202	Variability, coefficient of	... 218
	204, 221, 230	Variation	... 194
Sundries	... 273	" and inheritance	... 197
Surti Buffalo	... 243	" causes of	... 196
		" in milk	... 125
Tests, cultivation	... 23	Vegetable rennet	... 157
Threshing, crop	... 31		
Til	... 127	Water, functions of	... 46
Troughs, food	... 39	Watering	... 75
Tuberculosis	... 187	Weaning	... 80
		Weismann's Theory	... 199
Udder	... 118	Work units	45, 49
Unit values	... 52		
Urinary nitrogen	... 113	Zira	67, 127
Urine, preservation of	... 16		